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QGroundControl User Guide

QGroundControl provides full flight control and vehicle setup for PX4 or ArduPilot powered vehicles. It provides easy and straightforward usage for beginners, while still delivering high end feature support for experienced users.

Key Features:

- Full setup/configuration of ArduPilot and PX4 Pro powered vehicles.
- Flight support for vehicles running PX4 and ArduPilot (or any other autopilot that communicates using the MAVLink protocol).
- Mission planning for autonomous flight.
- Flight map display showing vehicle position, flight track, waypoints and vehicle instruments.
- Video streaming with instrument display overlays.
- Support for managing multiple vehicles.
- QGC runs on Windows, OS X, Linux platforms, iOS and Android devices.

> This guide is an active work in progress. The information provided should be correct, but you may find missing information or incomplete pages.

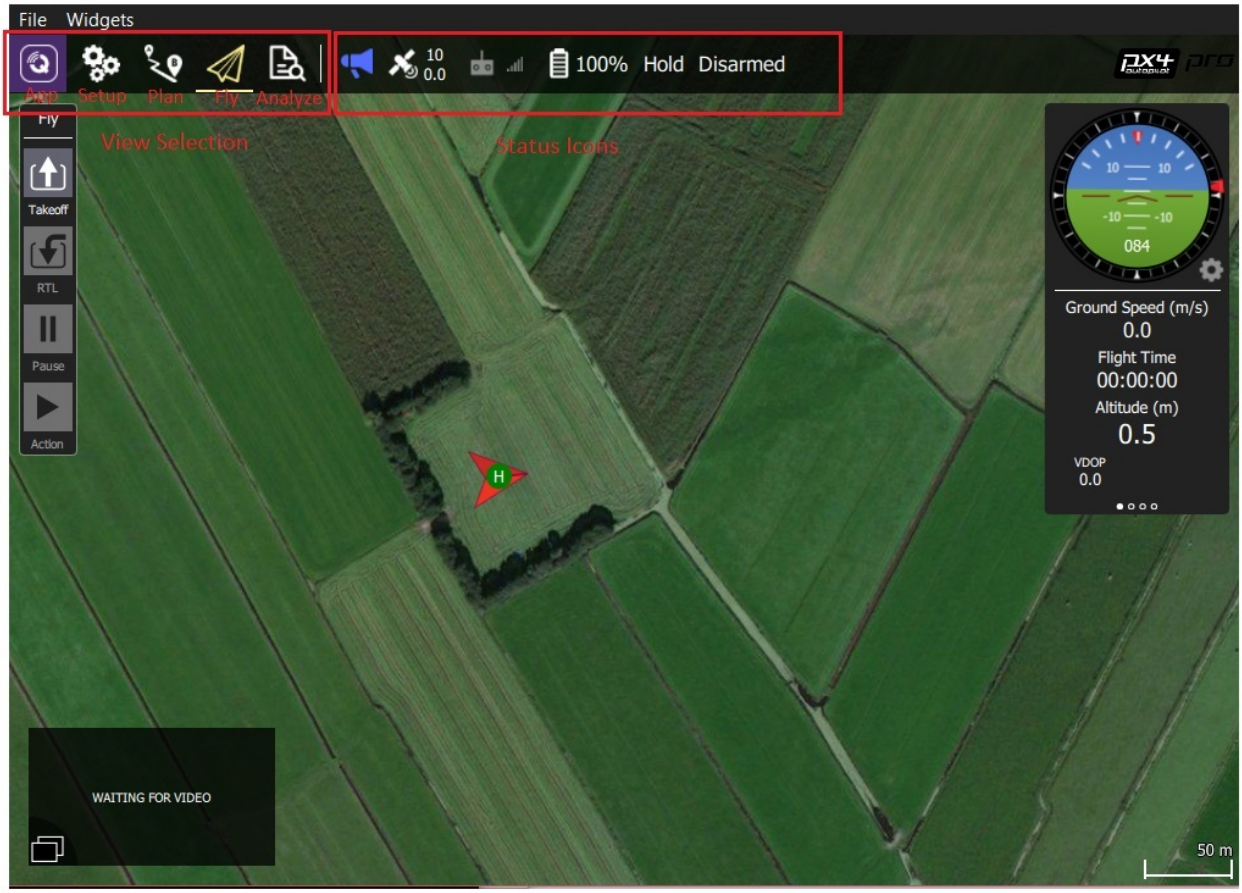
> Information about QGroundControl architecture and development can be found in the Developers Guide.

QGroundControl Quick Start

Getting *QGroundControl* up and running is quick and easy:

1. Download and install the application.
2. Start *QGroundControl*.
3. Attach your vehicle to the ground station device via USB, through a telemetry radio, or over WiFi. *QGroundControl* should detect your vehicle and connect to it automatically.

That's it! If the vehicle is ready to fly, *QGroundControl* should display Fly View as shown below (otherwise it will open Setup View).



A good way to become familiar with *QGroundControl* is to start experimenting:

- Use the toolbar to switch between the main views:
  - Settings: Configure the *QGroundControl* application.
  - Setup: Configure and tune your vehicle.
  - Plan: Create autonomous missions.
  - Fly: Monitor you vehicle(s) while flying, including streaming video.
- Click the *Status icons* on the toolbar to find out the status of the connected vehicle.

While the UI is fairly intuitive, this documentation can also be referenced to find out more.

Download and Install

The sections below can be used download the current stable release of *QGroundControl* for each platform.

Windows

Install *QGroundControl* for Windows Vista or later:

1. Download QGroundControl-installer.exe.
2. Double click the executable to launch the installer.

Mac OS X

Install *QGroundControl* for Mac OS X 10.8 or later:

1. Download QGroundControl.dmg.
2. Double-click the .dmg file to mount it, then drag the QGroundControl application to your Application folder.

Ubuntu Linux

Install *QGroundControl* for Ubuntu Linux 14.04 LTS or later. You can either install the AppImage **or** the compressed archive.

AppImage

1. Download QGroundControl.AppImage.
2. Install using the terminal commands:

```
chmod +x ./QGroundControl.AppImage
./QGroundControl.AppImage  (or double click)
```

Compressed Archive

1. Download QGroundControl.tar.bz2.
2. Extract the archive using the terminal command:

```
tar jxf QGroundControl.tar.bz2
cd qgroundcontrol
./qgroundcontrol-start.sh
```

3. Install additional packages as specified in the github README. You do not need to install Qt.

Android

Install *QGroundControl* for Android 5.1 or later:

1. Open the Google Play Store QGroundControl link.
2. Follow the installation instructions.

iOS

> *QGroundControl* for iOS is in beta. It can only be installed as a daily build.

Install *QGroundControl* for iOS 8.0 or later:

1. Follow the instructions for Installing iOS Daily Beta using Test Flight.

Old Stable Releases

Old stable releases can be found on GitHub.

Daily Builds

Daily builds can be downloaded from here.

Toolbar

The main menu/tool bar provides access to the different application views, and high level status information for connected vehicles. The menu is the same in all views except for "PlanView" (which has a single icon to take you back to "Fly" view).

View-select icons

The following icons are used to switch between the main *Views*. These are displayed even if no vehicle is connected.

 **Settings**
Configure the *QGroundControl* application.

 **Setup**
Configure and tune your vehicle.

 **Plan**
Create autonomous missions.

 **Fly**
Monitor you vehicle(s) while flying, including streaming video.

 **Analyse**
Download logs, geotag images from a survey mission, access the mavlink console.

Status icons

Status icons are displayed when *QGroundControl* is connected to a vehicle. These show the high level status of the vehicle, and can be clicked to see more detailed information.

 **Vehicle Messages**
Click to show a dropdown of messages from the vehicle. This will change to a Yield sign if there are critical messages.

GPS Status
Shows you satellite count and curent hdop.

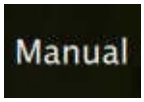
 **RC RSSI**
RS signal strength information.

Telemetry RSSI

Telemetry signals strength information.

Battery

Remaining battery percent.



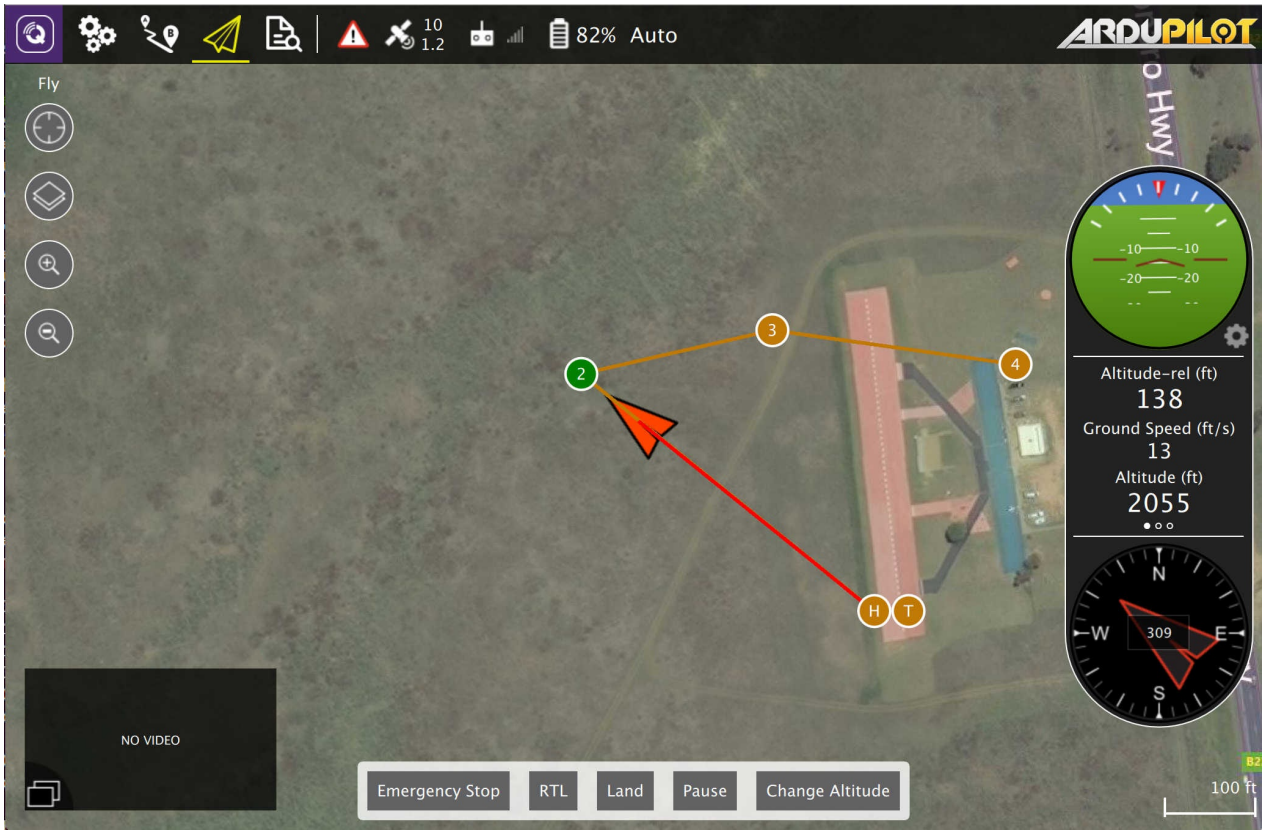
Flight Mode

Current flight mode. Click to change flight mode.

RTK GPS Survey-In Status

Shows you progress of RTK GPS Survey-In process.

Fly View



The Fly View is the main view you will use while flying your vehicle. You can switch between a map view and a video view (if available).

Map

The map will show you the positions of all the vehicles you are connected to. It will also show you the mission for the current vehicle.

Fly Tools

On the left edge of the screen you will see the Fly Tools. The order of tools from top to bottom is:

- Center map
- Map Type
- Zoom In/Out

Center Map

The Center Map tool allow you to center the map around various points such as home position, vehicle and so forth.

Map Type

This tool allows you to change the current map type between Street, Satellite and Hybrid (Street+Satellite). The default map provider is Bing since it seems to provide better Hybrid maps. You can change the map provider from the General page of Settings.

Video

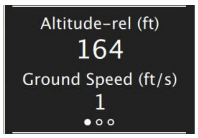
At the lower left of the display you will see video output. QGroundControl supports RTP and RTSP video streaming over your vehicles UDP connection. It also support directly connected UVC device support. More details on QGC Video support can be found on the Video README.

By clicking on the video you can make it be the main display for the Fly view.

Instrument Panel

To the right is an instrument panel showing you current information on your vehicle. The center section of the panel has multiple pages. You can switch between pages by clicking on the center section.

Telemetry page

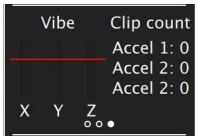


The values shown within the telemetry page can be configured by clicking on the small gear icon.

Vehicle Health page

This page shows you the health of the systems within your Vehicle. If any of the systems switchs from healthy to unhealthy this page will automatically be switched to.

Vibration Clipping page



This page show you current vibration values and clip counts.

Guided Bar

At the bottom of the view is the Guided Bar. The guided bar allows to to interact with your vehicle directly from the QGroundControl application. Options available vary by Vehicle and current Vehicle state.

Some of the possible options are:

- Arm, Disarm, Emergency Stop
- Takeoff
- Change altitiude
- Go to location
- RTL
- Pause

Plan View

The Plan View is used to plan autonomous missions for you Vehicle. Once the mission is planned and sent to the vehicle, you switch to the Fly View to fly the mission.

If your Vehicle supports a GeoFence or Rally Points you can also set those up from the Plan View.

The image above shows a simple mission which starts with a takeoff, flies through two waypoints and then lands.

The steps to creating a missions are:

1. Change to Plan View
2. Add commands to the mission and edit as needed
3. Send the mission to the vehicle
4. Change to Fly View and fly your mission

Plan Tools

On the left edge of the screen you will see the Plan Tools. The order of tools from top to bottom is:

- Add Commands
- Survey
- Sync
- Center map
- Map Type
- Zoom In/Out

Add Commands

Click to activate the Add Commands tool. While active, clicking in the map will add new mission commands at the clicked location. The tool will stay active until you click it again.

Sync

The Sync tools allows you to move Missions back and forth to your Vehicle or a file. *Before you fly a mission you must be sure to send your Mission to your vehicle.* The tool will change to have an "!" within it to indicate that you have changes to your Mission which you have not sent to your vehicle.

The Sync tool provides the following functionality:

- Send to Vehicle
- Load from Vehicle
- Save to File
- Load from File
- Remove All

Survey

Survey allows you to fly a grid pattern over a polygonal area.

Mission Command List

On the right edge of the display is the list of mission commands for this mission. You can click on one of these to edit the values for the item. Above are a set of options to switch between editing the Mission, GeoFence and Rally Points.

Mission Command Editors

Click on a mission command to show its editor which allows you to specify the values for the command. You can also change the type of the command by clicking on the command name, "Waypoint" in this example. This allows you to pick from the set up available commands to build your mission. To the right of the command name is a menu you can open by clicking. This menu provides you access to additional options such as Insert and Delete.

Planned Home Position

A mission always has a "Planned Home Position" associated with it. This is used to simulate the home position of the vehicle such that waypoint lines can be drawn correctly to the first actual waypoint. Keep in mind that the actual home position for a mission is set by the vehicle and may differ from the "planned" home position if you don't begin your mission with the vehicle in the same location as "planned".

Mission Display

In the center of the map you will see a visualization of your current mission. You can click on the indicators to select then and then you can also drag them around to move them.

Mission Height Display

At the bottom of the map you will see a representation of the height differences between your mission commands. To the left of that is information for the currently selected command relative to the previous command. For example: Distance from previous waypoint.

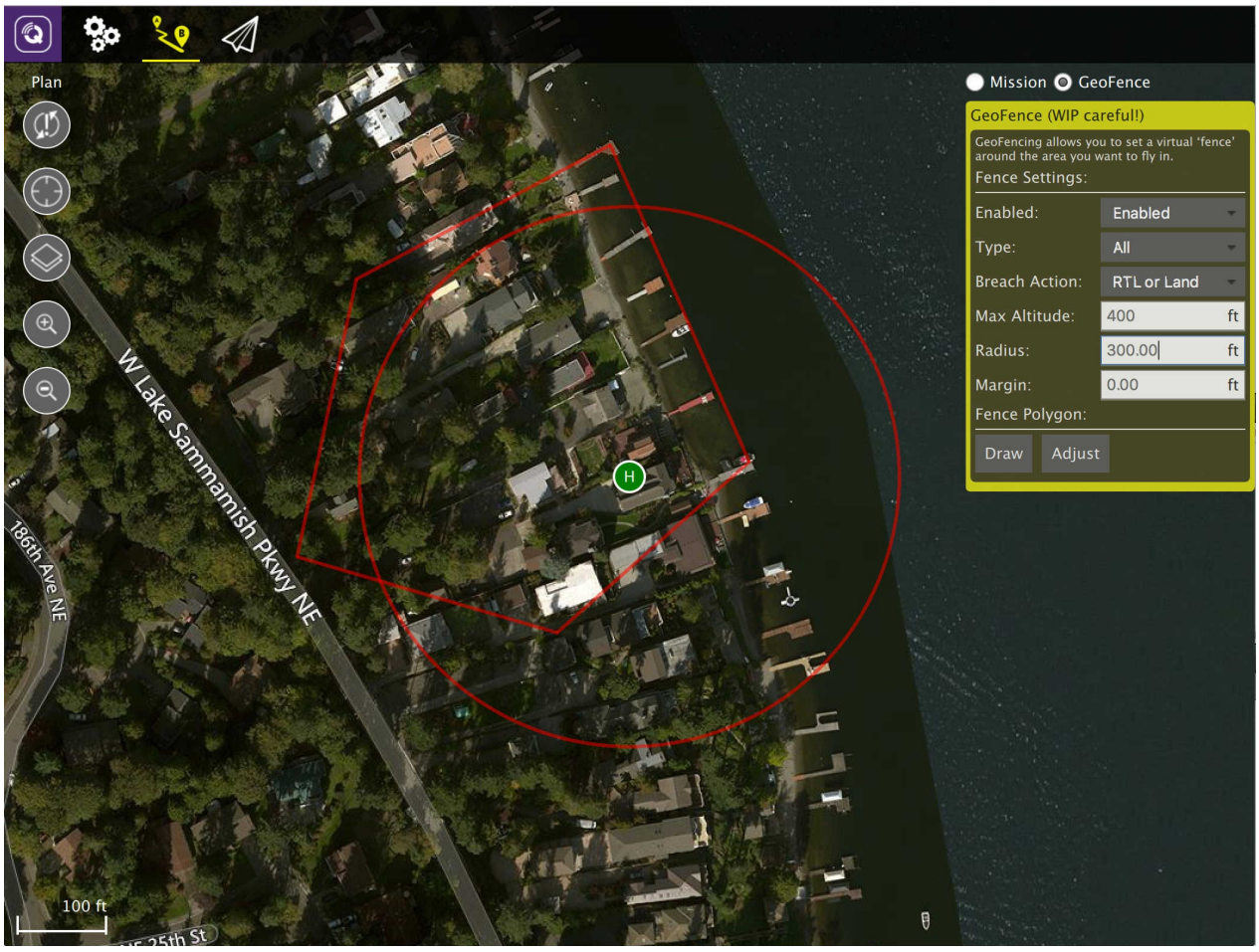
Plan View - GeoFence

A GeoFence allows you to create a virtual fence around the area you want to fly in. If you then fly outside that area you can configure a specific action to be taken.

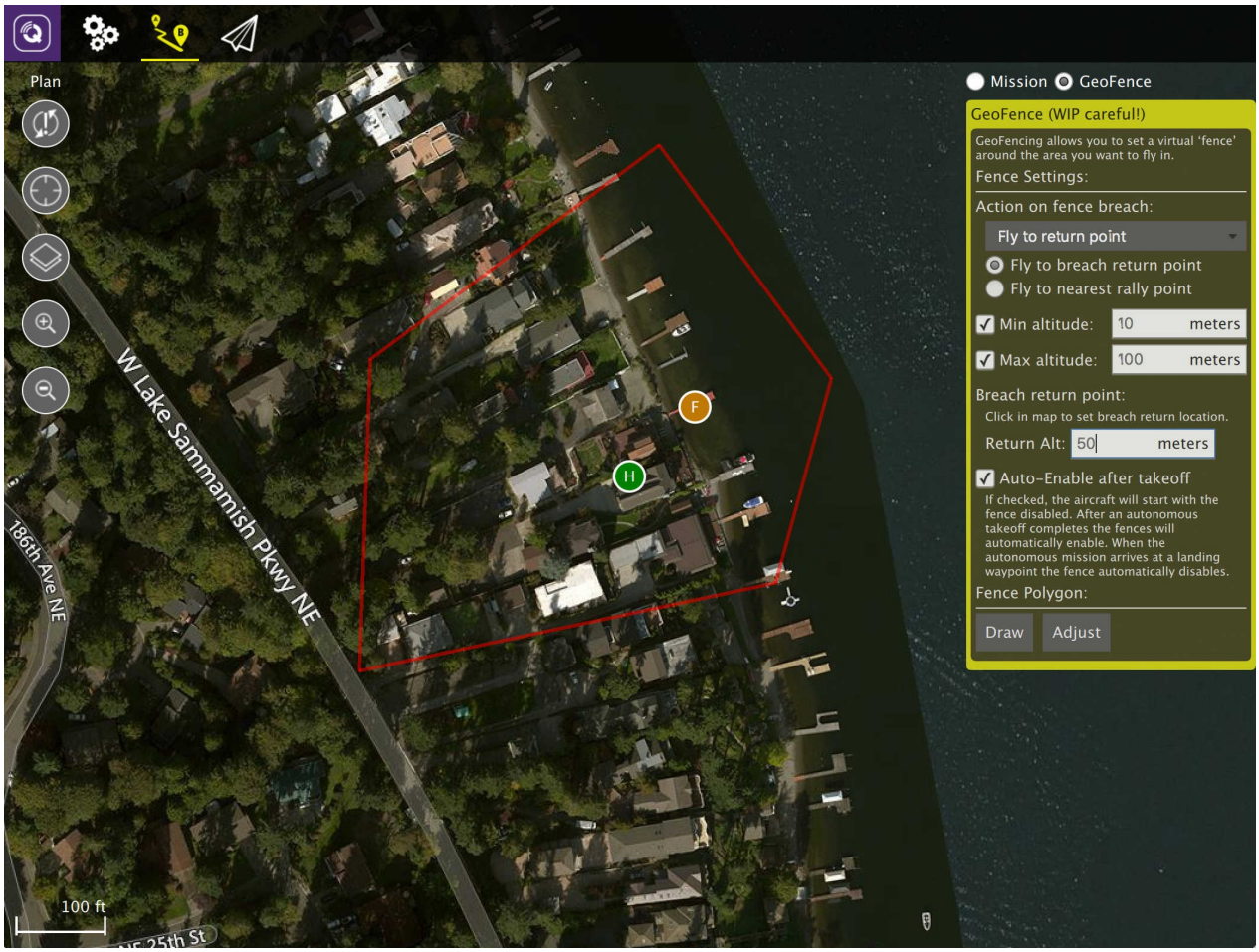
Not all vehicle firmwares support GeoFence and if supported the GeoFence capabilities vary.

Example Visuals

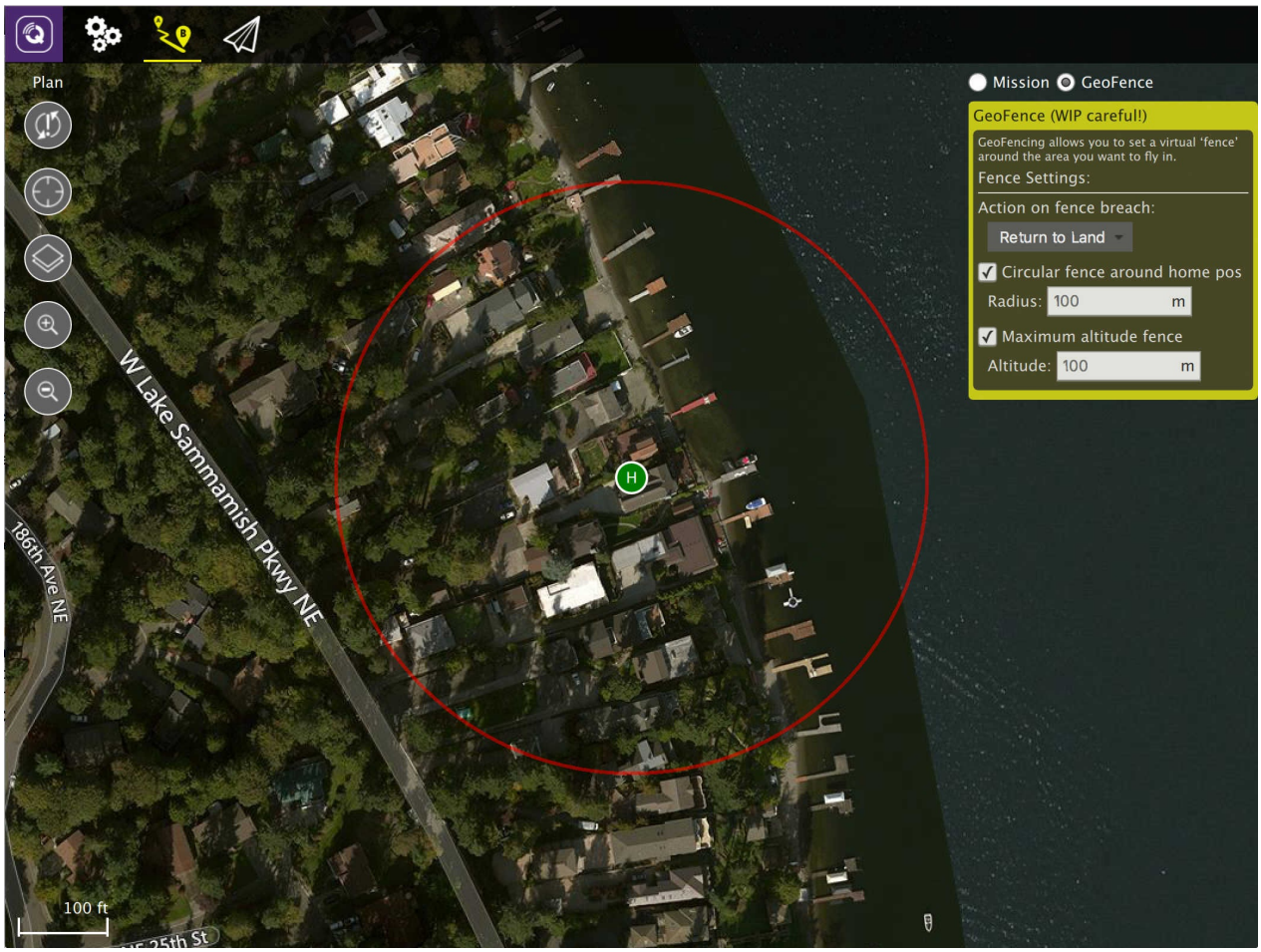
ArduCopter visual:



ArduPlane visual:



PX4 Pro visual:



GeoFence Setup

The steps to creating a GeoFence are:

1. Change to Plan View
2. Select the GeoFence radio button (top right of view)
3. Specify fence settings in the editor panel
4. Add a fence polygon (if supported)
5. Send the GeoFence to the Vehicle (or save to file)

Drawing a GeoFence Polygon

If your vehicle supports polygon fences, at the bottom of the editor panel you will see the "Fence Polygon" section. Click the Draw button to draw a polygon on the map by clicking to add points to the polygon.

Once you have created a fence polygon you can adjust it by clicking the Adjust button which will allow you to move the polygon corners. You can also click Draw again to redraw a completely new fence polygon.

GeoFence Tools

On the left edge of the screen you will see the Plan Tools. The order of tools from top to bottom is:

- Sync
- Center map
- Map Type
- Zoom In/Out

Sync

The Sync tools allows you to move GeoFences back and forth to your Vehicle or a file. *Before you fly you must be sure to send your GeoFence to your vehicle.* The tool will change to have an "!" within it to indicate that you have changes to your GeoFence which you have not sent to your vehicle.

The Sync tool provides the following functionality:

- Send to Vehicle
- Load from Vehicle
- Save to File
- Load from File
- Remove All

When you save a GeoFence to a file all settings will be saved, not just the fence polygon.

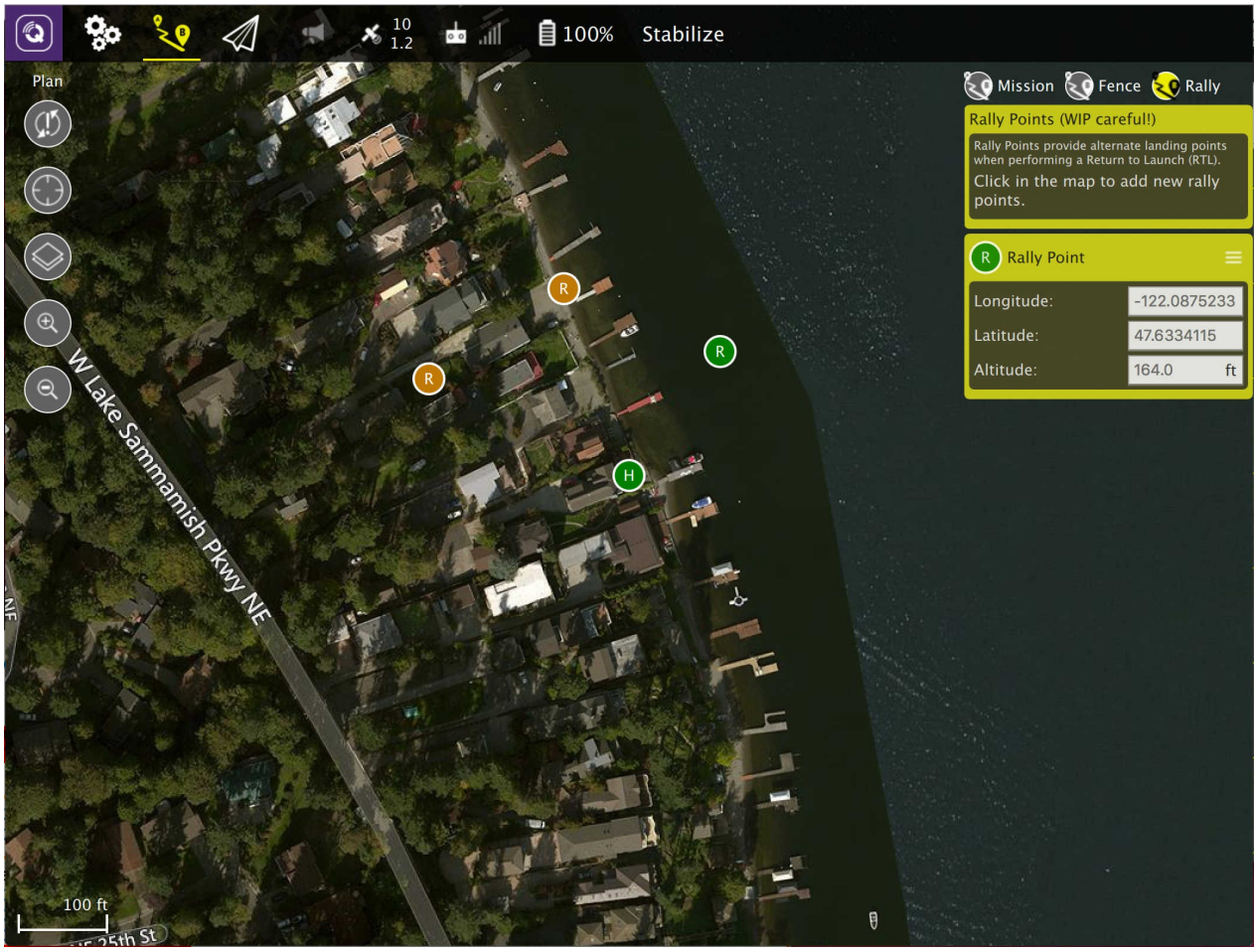
Remaining tools

The rest of the tools work exactly as they do while editing a Mission.

Plan View - Rally Points

Rally Points are alternative landing or loiter locations.

They are typically used to provide a safer or more convenient destination than the home position in RETURN TO LAUNCH (RTL) mode.



> Not all vehicle firmwares support Rally Points, and even if supported the Rally Point capabilities vary. Rally Point docs for ArduPilot can be found here. PX4 does not support rally points at time of writing (April 2017).

Rally Point Setup

The steps to creating a GeoFence are:

1. Change to Plan View
2. Select the Rally button (top right of view)
3. Click in the map to add Rally Points

Rally Points Tools

On the left edge of the screen you will see the Plan Tools. The order of tools from top to bottom is:

- Sync
- Center map
- Map Type

- Zoom In/Out

Sync

The Sync tools allows you to move Rally Points back and forth to your Vehicle or a file. *Before you fly you must be sure to send your Rally Points to your vehicle.* The tool will change to have an "!" within it to indicate that you have changes to your GeoFence which you have not sent to your vehicle.

The Sync tool provides the following functionality:

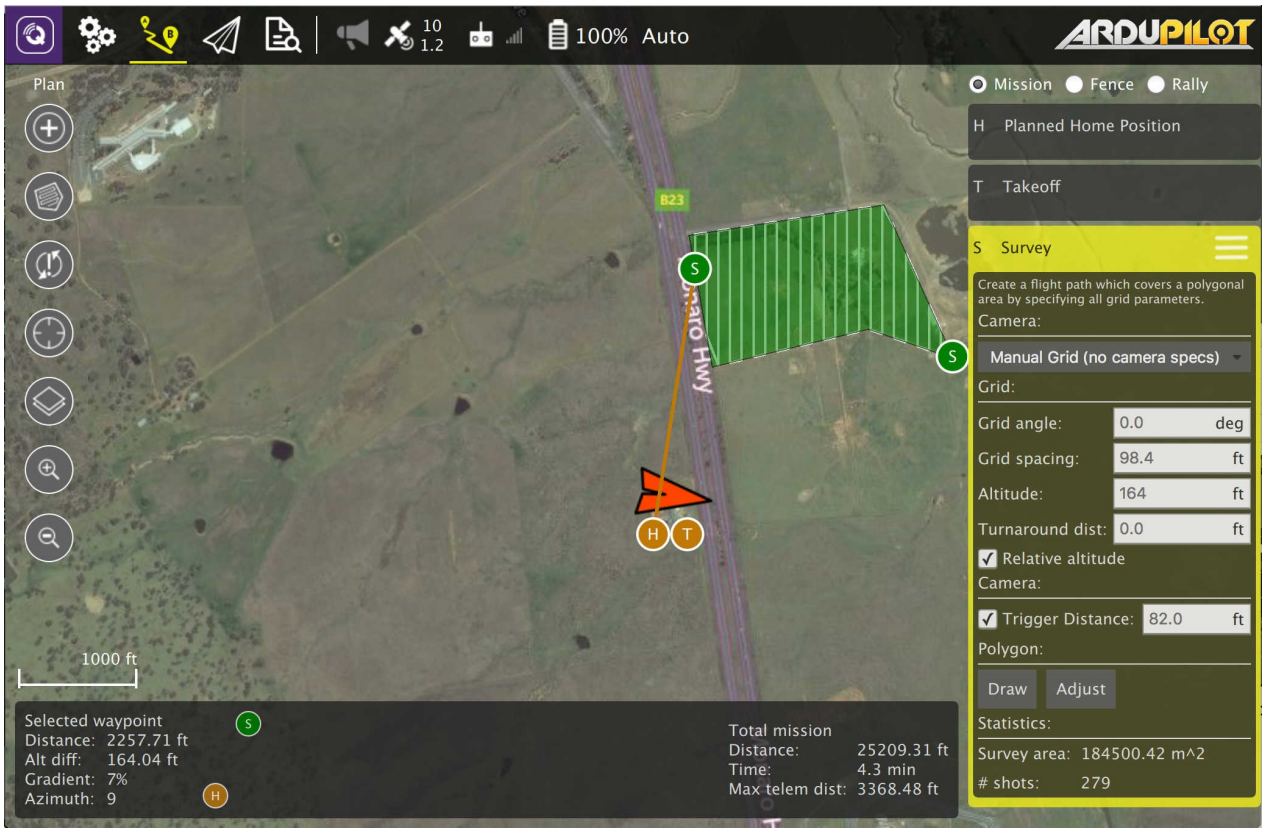
- Send to Vehicle
- Load from Vehicle
- Save to File
- Load from File
- Remove All

Remaining tools

The rest of the tools work exactly as they do while editing a Mission.

Plan - Survey

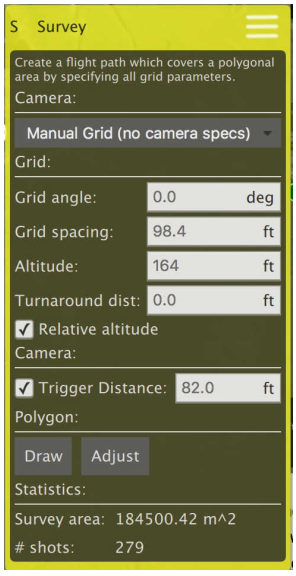
A survey allows you to create a grid flight pattern over a polygonal area. You can specify the polygon as well as the specifications for the grid and camera settings appropriate for creating geotagged images.



To draw the polygon for your survey, click the "Draw" button and click in the map to set polygon vertices.

There are multiple options for a survey grid. You can select the main option from the dropdown at the top of the editor.

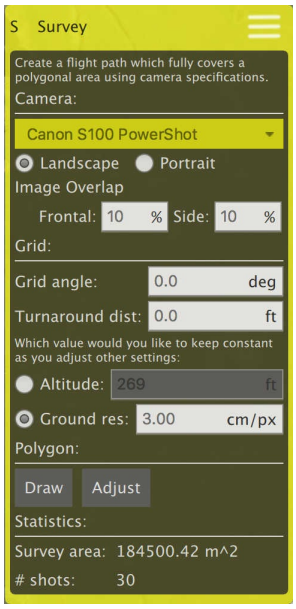
Manual Grid



The Manual Grid option allows you to specify all the values for generating the grid pattern over the polygon by hand.

- Grid angle - The angle for the parallel flight tracks of the grid. For example 0 degrees will generate parallel lines which travel north/south.
- Grid spacing - The distance between each parallel flight track.
- Altitude - The altitude to fly the entire grid pattern.
- Turnaround distance - The mount of additional distance to fly past the edge of the polygon before performing the turnaround for the next flight track.
- Trigger Distance - Used to trigger an image taken by the camera based on distance flown.

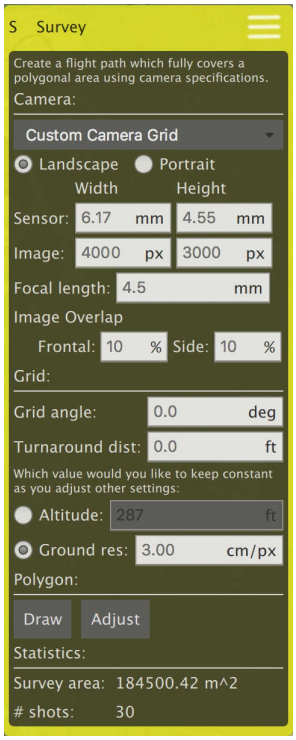
Camera



Selecting a known camera from the option dropdown allows you to generate a grid pattern based on the camera's specifications.

- Landscape/Portrait - Specifies the orientation that the camera is placed on the vehicle.
- Image Overap - Allows you to specify the amount of overlap you want between each image.
- Altitude - Selecting this value allows you to specify the altitude for the survey. The ground resolution will be calculated and shown for the specified altitude.
- Ground resolution - Selecting this value allows you to specify the ground resolution you want for each image. The altitude required to achieve this resolution is calculated and shown.

Custom Camera

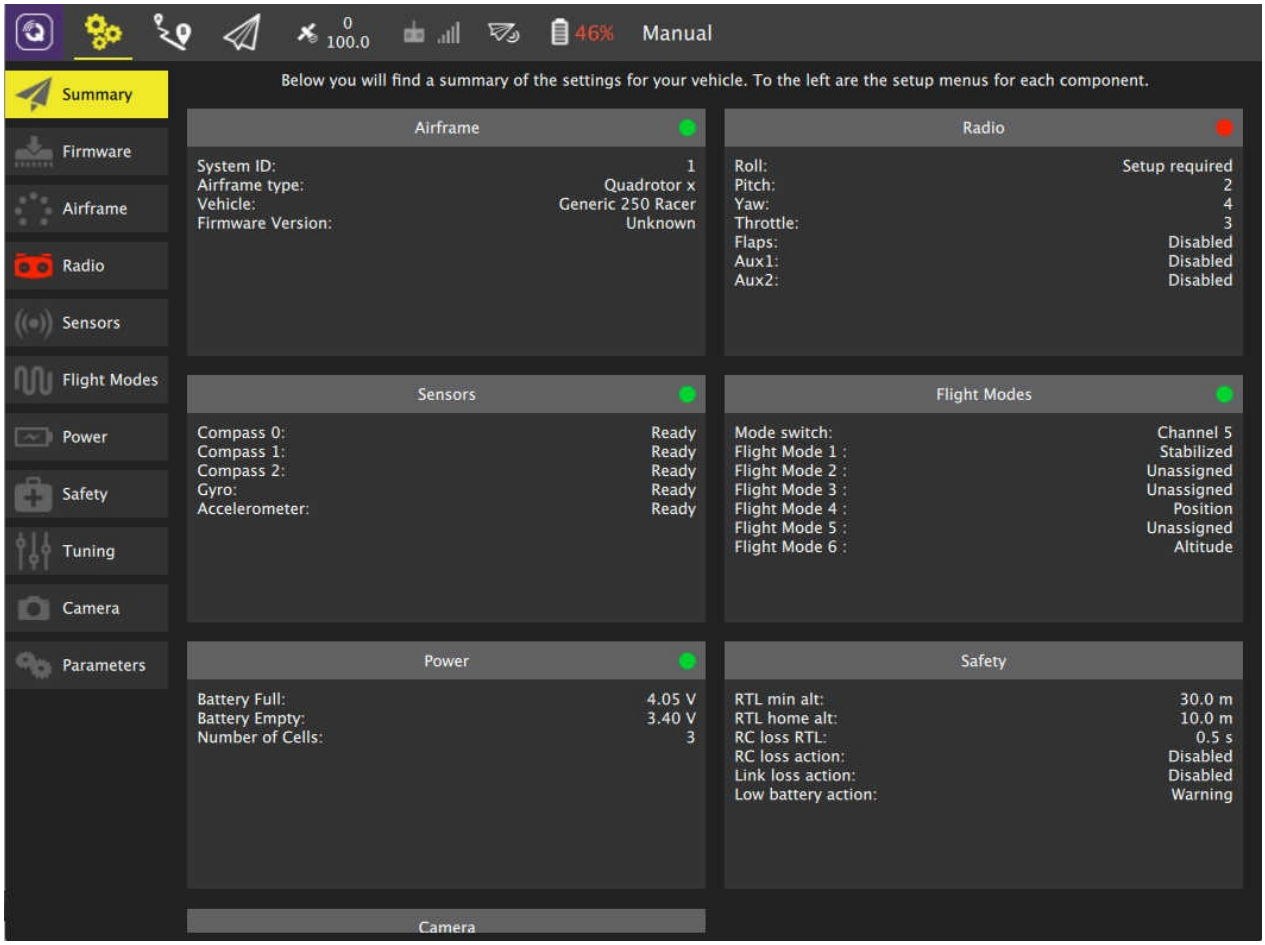


The custom camera option is similar to the known camera option. The difference is that you must specify the details for the camera specifications yourself.

- Sensor width/height - The size of the image sensor of the camera.
- Image width/height - The resolution of the image captured by the camera.
- Focal Length - The focal length of the camera lens.

Setup View

The Setup View is used to configure a new vehicle prior to first flight and/or tune a configured vehicle.



Setup Options

To the left of the screen are the set of available setup options. A setup button is marked with a red icon if there are still settings needed to be adjusted/specified. You should not fly if any of these are red. In the above image the Radio setup is not yet complete.

> The set of options shown and the contents of each option may differ based on whether the vehicle is running PX4 Pro or ArduPilot firmware. The image above is from a vehicle which is running PX4 Pro firmware.

Summary
An overview of all the important setup options for your vehicle. Similar to the individual setup buttons, the summary blocks show a red indicator when those settings are not fully configured.

Firmware
Flash new firmware onto your vehicle.

Airframe
Specify the airframe type for the vehicle.

Radio
Calibrate your Radio Control Transmitter.

Sensors

Calibrate the sensors on the vehicle.

Flight Modes

Used to assign flight modes to your RC Transmitter switches.

Power

Battery settings and additional power options such as ESC calibration.

Safety

Specify settings for options related to Safety such as Return to Home or Failsafes.

Tuning

Tune flight characteristics of the vehicle.

Camera

Configure settings for camera and gimbal.

Parameters

Allows you to modify all parameters associated with your vehicle.

Loading Firmware

QGroundControl **desktop** versions can install PX4 Pro or ArduPilot firmware onto Pixhawk-family flight-controller boards. By default QGC will install the current stable version of the selected autopilot, but you can also choose to install beta builds, daily builds, or custom firmware files.

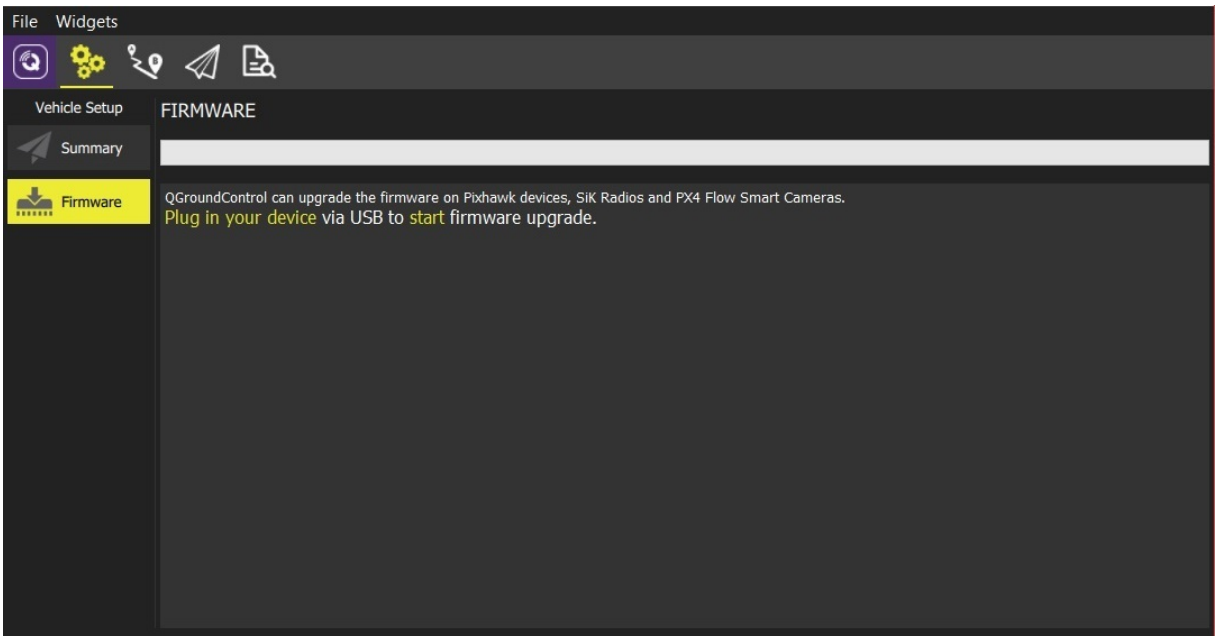
QGroundControl can also install the firmware for SiK Radios and PX4 Flow devices.

> Support for loading Firmware is currently not available on tablet or phone versions of *QGroundControl*.

Connect the device for firmware update

> **Before you start installing Firmware** all USB connections to you vehicle must be *disconnected* (both direct or through a telemetry radio). The vehicle must *not be* powered by a battery.

1. First select the **Gear** icon (*Vehicle Setup*) in the top toolbar and then **Firmware** in the sidebar.



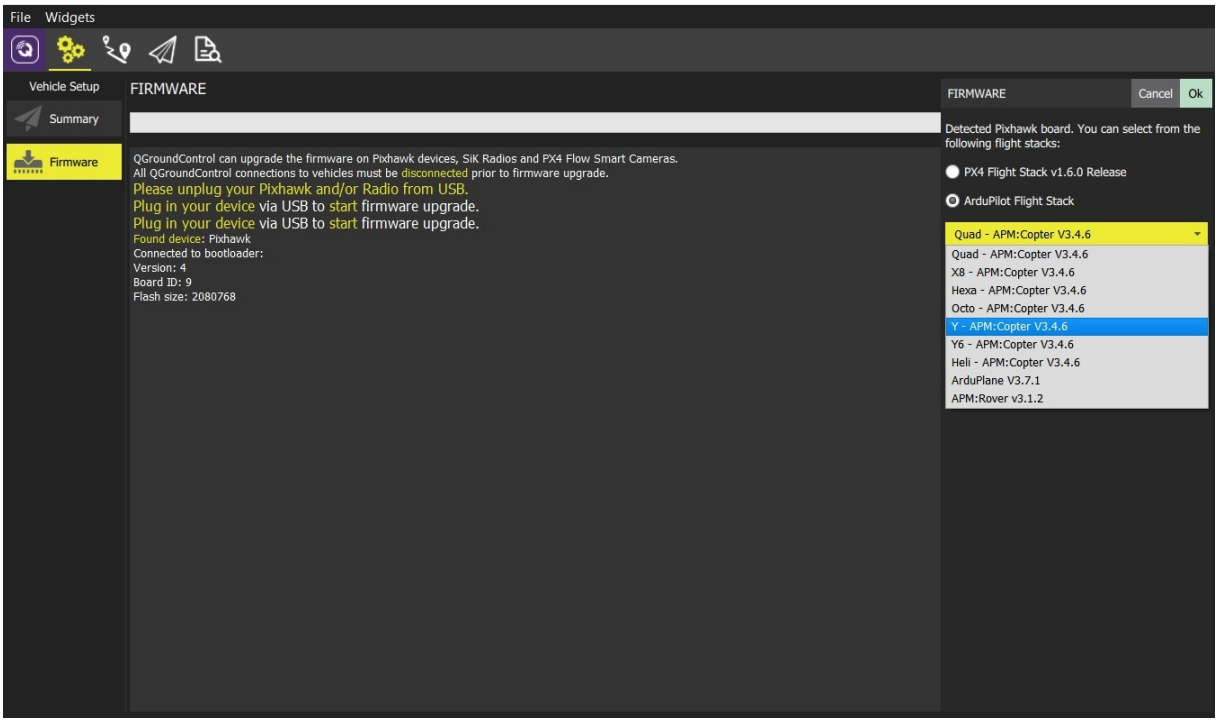
2. Connect your device (Pixhawk, SiK Radio, PX4 Flow) directly to your computer via USB.

   > Connect directly to a powered USB port on your machine (do not connect through a USB hub).

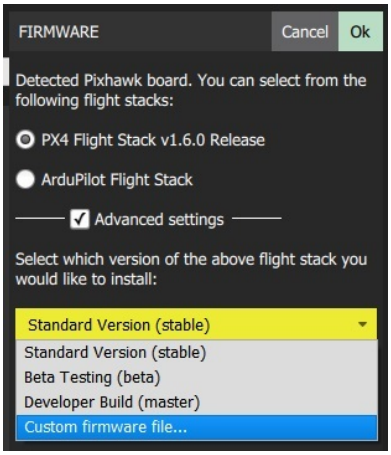
Select the firmware to load

Once the device is connected you can choose which firmware to load (*QGroundControl* presents sensible options based on the connected hardware).

1. For a Pixhawk-compatible board choose either *PX4 Pro* or *ArduPilot* firmware to download the current stable release. If you select *ArduPilot* you will further have to select the specific firmware for each type of vehicle (as shown below).



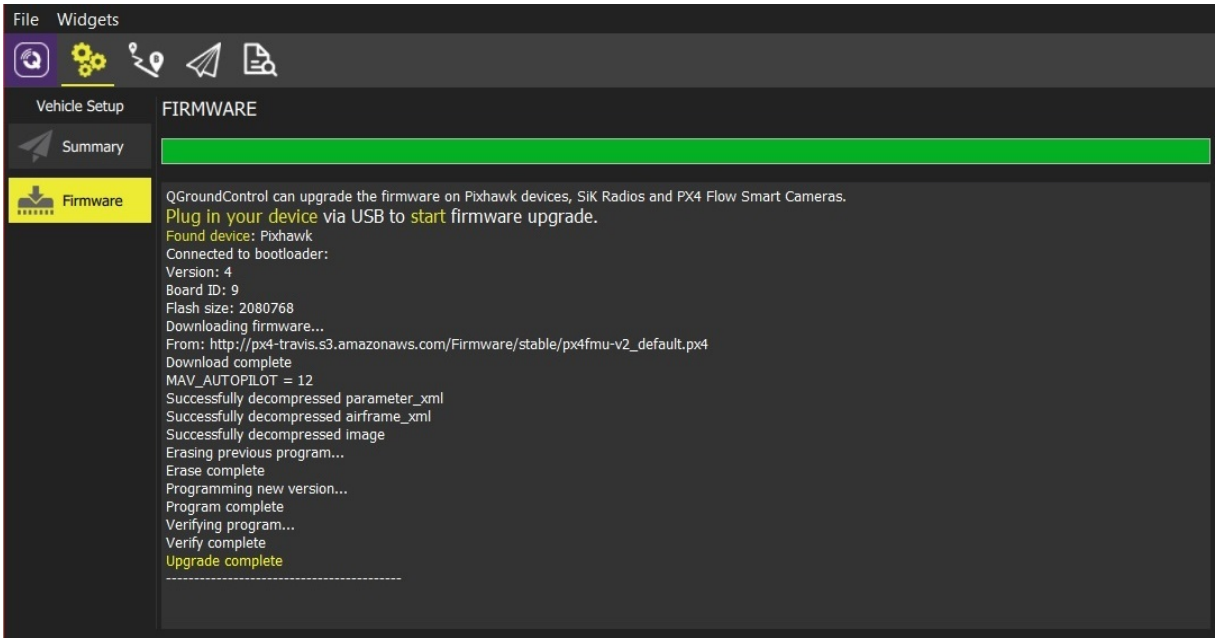
2. Check **Advanced settings** to select specific developer releases or install firmware from your local file system.



Update the firmware

1. Click the **OK** button to start the update.

   The firmware will then proceed through a number of upgrade steps (downloading new firmware, erasing old firmware etc.). Each step is printed to the screen and overall progress is displayed on a progress bar.



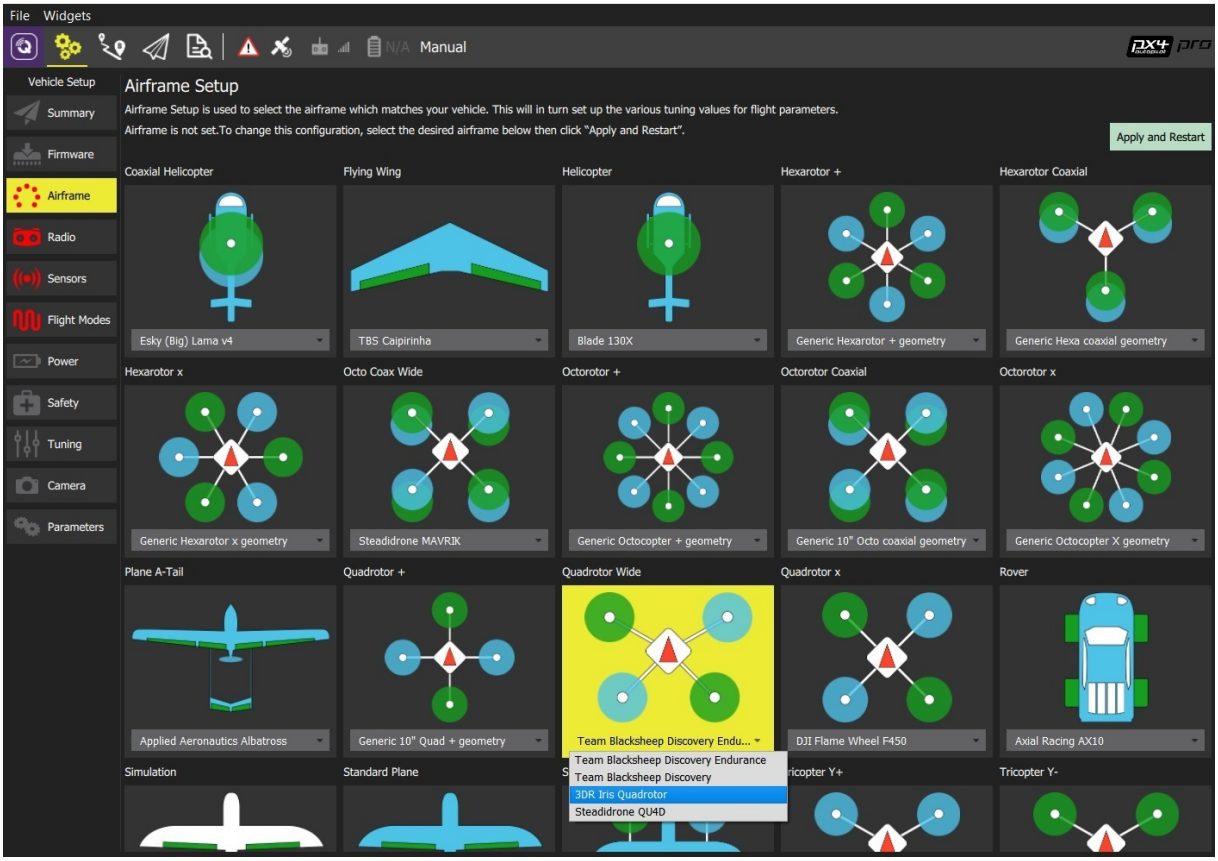
Once the firmware has completed loading the device/vehicle will reboot and reconnect. Next you will need to configure the airframe (and then sensors, radio, etc.)

Airframe Setup

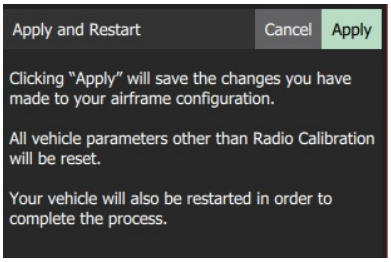
This page allows you to configure the main airframe selection associated with your vehicle. The view differs based on the flight controller firmware used.

PX4 Pro Airframe Setup

1. First select the **Gear** icon (Vehicle Setup) in the top toolbar and then **Airframe** in the sidebar.
2. Select the broad vehicle group/type that matches your airframe and then use the dropdown within the group to choose the airframe that best matches your vehicle.



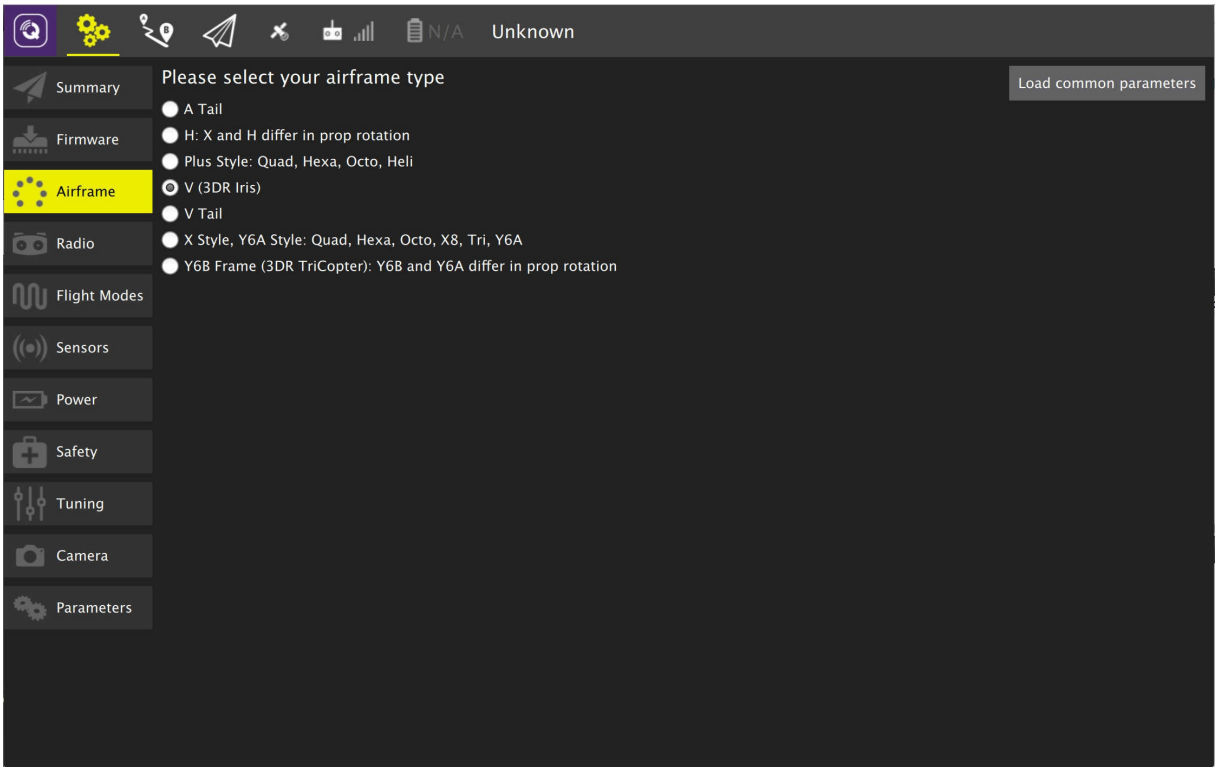
   The example above shows *3DR Iris Quadrotor* selected from the *Quadrotor Wide* group.
3. Click the **Apply and Restart** button to the top right of the screen.
4. Click **Apply** in the following prompt to save the settings and restart the vehicle.



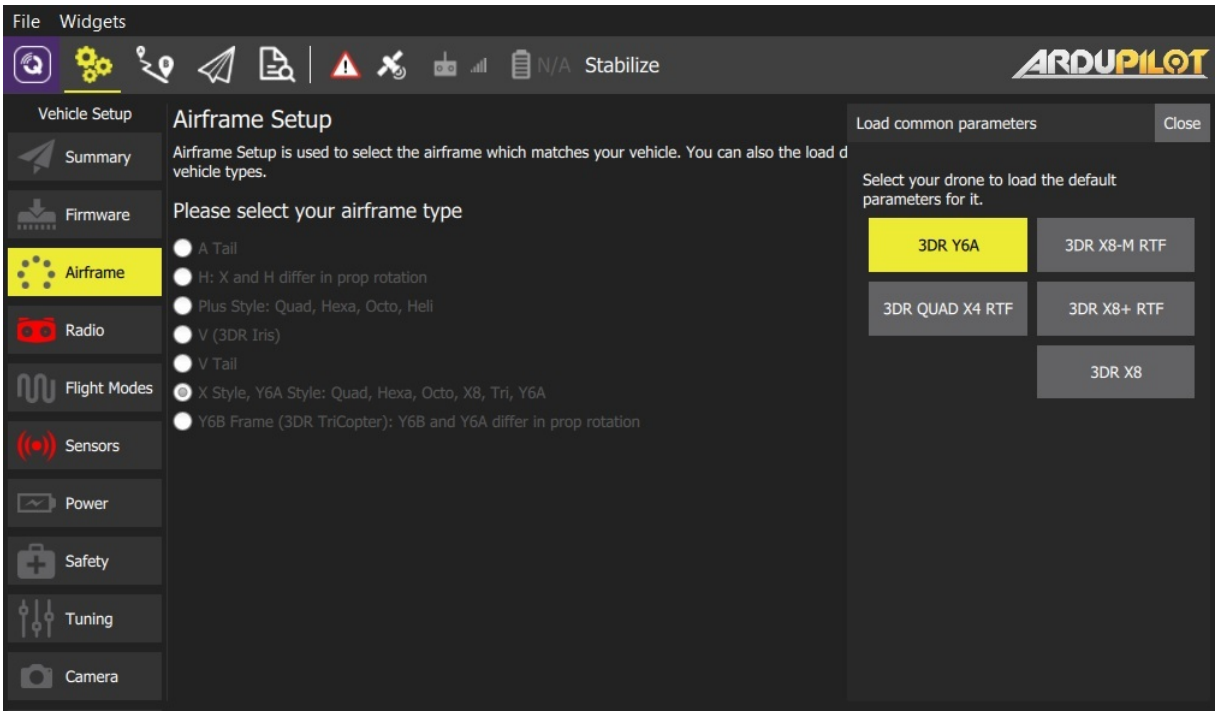
ArduCopter Airframe Setup

> Airframe Setup is only available on *ArduCopter* vehicles (it is not shown for *ArduPilot* Rover or Plane vehicles).

1. First select the **Gear** icon (Vehicle Setup) in the top toolbar and then **Airframe** in the sidebar.
2. Select the broad frame type that matches your vehicle (selecting a radio button applies the selection)



- You can also click **Load common parameters** to load a parameter set for known vehicle types.



> Any selection is automatically applied when you close the prompt.

Radio Setup

Radio Setup is used to configure the mapping of your main transmitter attitude control sticks (roll, pitch, yaw, throttle) to channels, and to calibrate the minimum, maximum, trim and reverse settings for all other transmitter controls/RC channels.

The main calibration process is identical for PX4 and ArduPilot (a number of additional flight-controller specific settings/tools are detailed below).

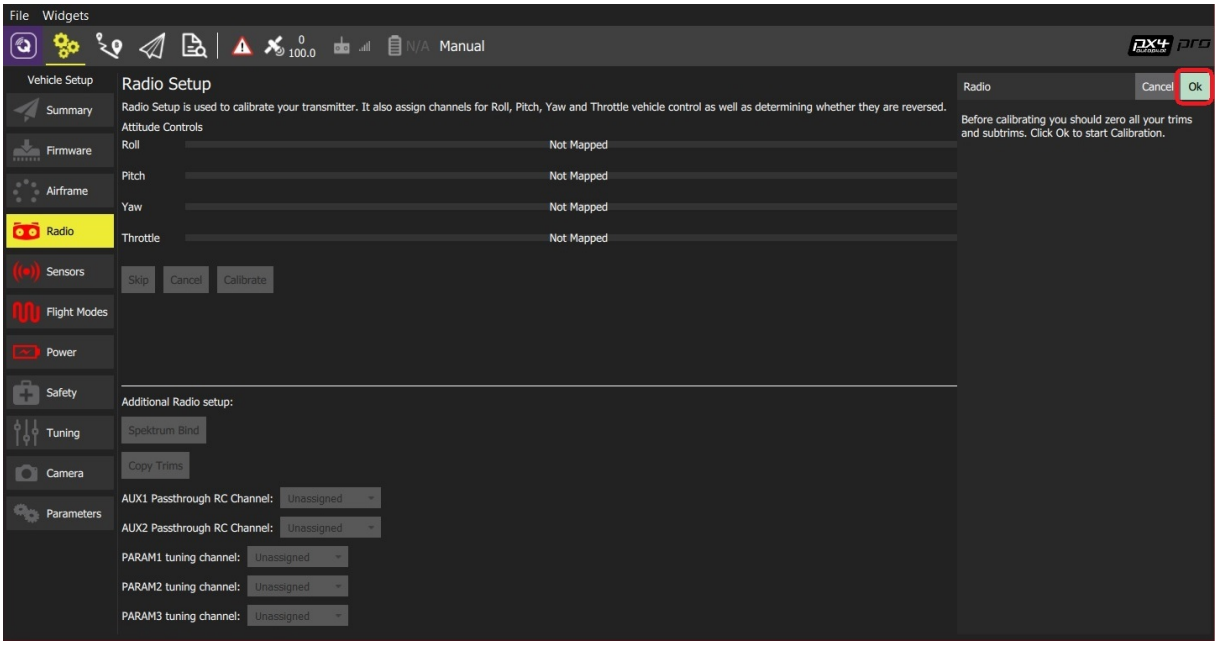
> Before you can calibrate the radio system the receiver and transmitter must be connected/bound. The process for binding a transmitter and receiver pair is hardware specific (see your manual for instructions).

Performing the Calibration

The calibration process is straightforward - you will be asked to move the sticks in a specific pattern that is shown on the transmitter diagram on the top right of the screen. Simply follow the instructions to complete calibration.

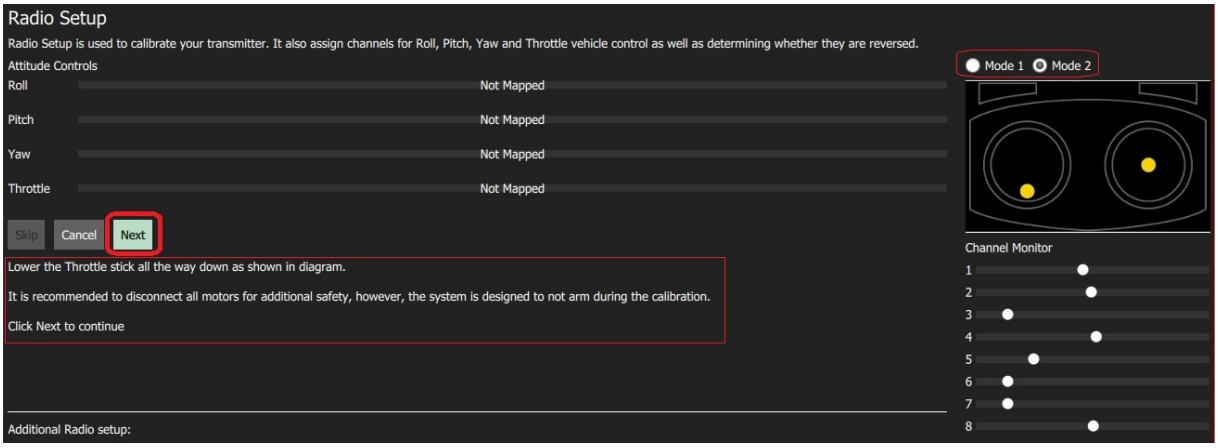
To calibrate the radio:

1. Select the **Gear** icon (Vehicle Setup) in the top toolbar and then **Radio** in the sidebar.
2. Turn on your RC transmitter.
3. Press **OK** to start the calibration.



> The image above is for PX4 Pro. Calibration/top section is the same for both firmware, but the *Additional Radio setup* section will differ.

4. Set the *transmitter mode* radio button that matches your transmitter configuration (this ensures that *QGroundControl* displays the correct stick positions for you to follow during calibration).

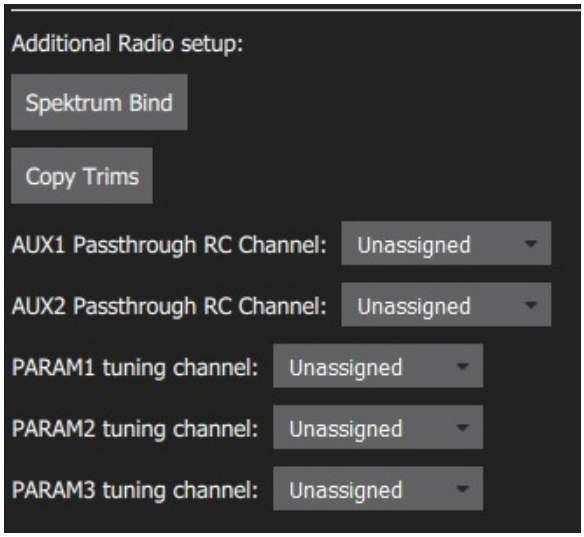
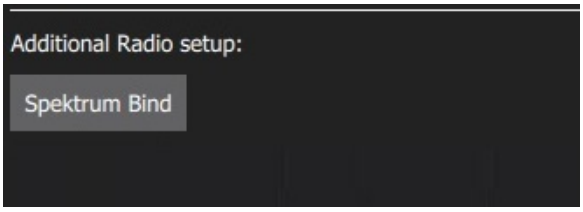


5. Move the sticks to the positions indicated in the text (and on the transmitter image). Press **Next** when the sticks are in position. Repeat for all positions.
6. When prompted, move all other switches and dials through their full range (you will be able to observe them moving on the *Channel Monitor*).
7. Press **Next** to save the settings.

Radio calibration is demonstrated in the PX4 setup video here (youtube).

Additional Radio Setup

At the lower part of the *Radio Setup* screen is firmware-specific *Additional Radio setup* section. The options for each autopilot are shown below.

PX4	ArduPilot
	

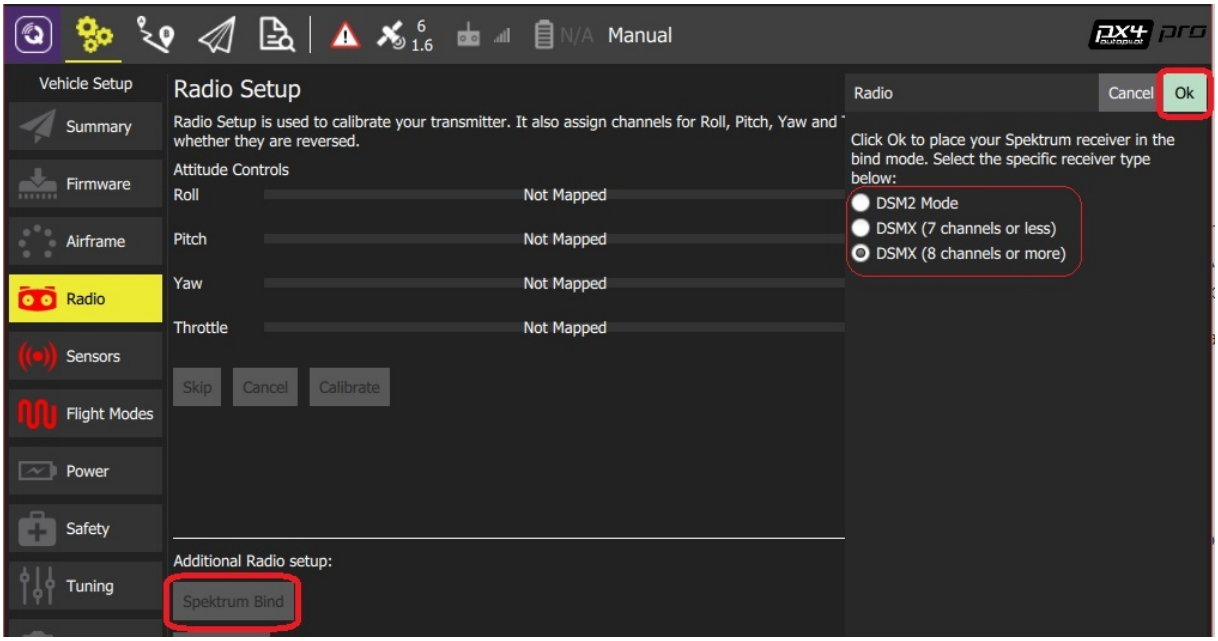
Spectrum Bind (ArduPilot/PX4)

Before you can calibrate the radio system the receiver and transmitter must be connected/bound. If you have a *Spektrum* receiver you can put it in *bind mode* using *QGroundControl* as shown below (this can be particularly useful if you don't have easy physical access to the receiver on your vehicle).

To bind a Spektrum transmitter/receiver:

1. Select the **Spektrum Bind** button
2. Select the radio button for your receiver

3. Press **OK**



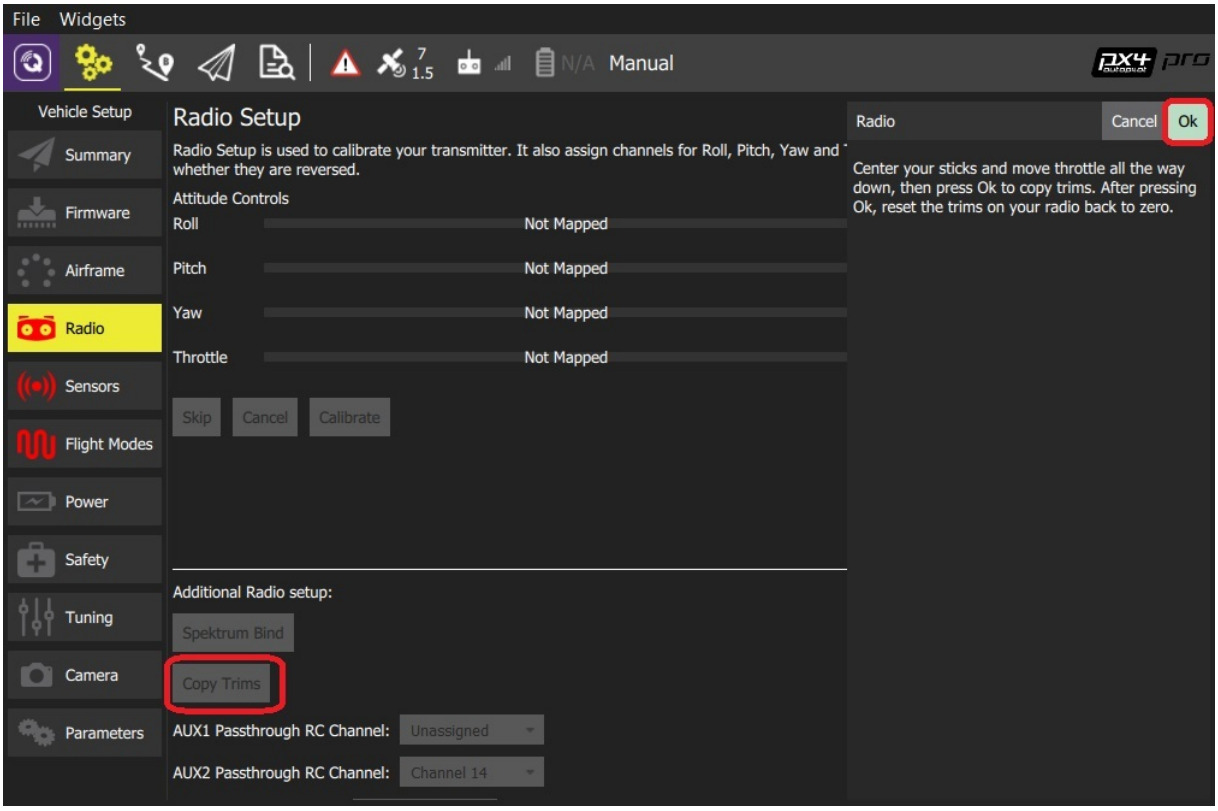
4. Power on your Spektrum transmitter while holding down the bind button.

Copy Trims (PX4)

This setting is used to copy the manual trim settings from your radio transmitter so that they can be applied automatically within the autopilot. After this is done you will need to remove the manually set trims.

To copy the trims:

1. Select **Copy Trims**.
2. Center your sticks and move throttle all the way down.
3. Press **Ok**.



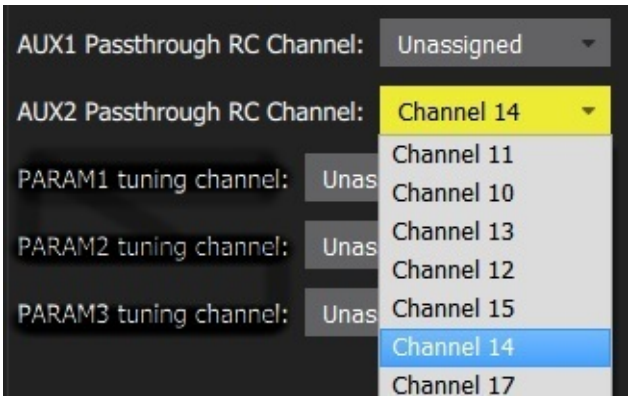
4. Reset the trims on your transmitter back to zero.

AUX Passthrough Channels (PX4)

AUX passthrough channels allow you to control arbitrary optional hardware from your transmitter (for example, a gripper).

To use the AUX passthrough channels:

1. Map up to 2 transmitter controls to separate channels.
2. Specify these channels to map to the AUX1 and AUX2 ports respectively, as shown below. Values are saved to the vehicle as soon as they are set.



The flight controller will pass through the unmodified values from the specified channels out of AUX1/AUX2 to the connected servos/relays that drive your hardware.

Param Tuning Channels (PX4)

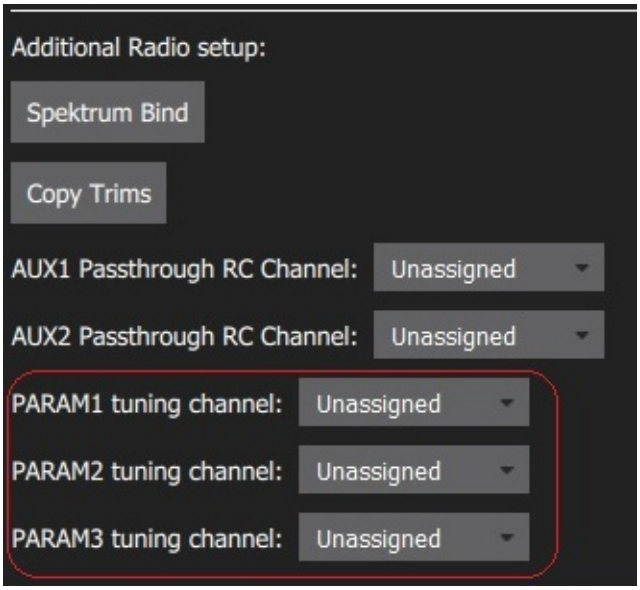
Tuning channels allow you to map a transmitter tuning knob to a parameter (so that you can dynamically modify a parameter from your transmitter).

> This feature is provided to enable manual in-flight tuning.

The channels used for parameter tuning are assigned in the *Radio* setup (here!), while the mapping from each tuning channel to its associated parameter is defined in the *Parameter editor*.

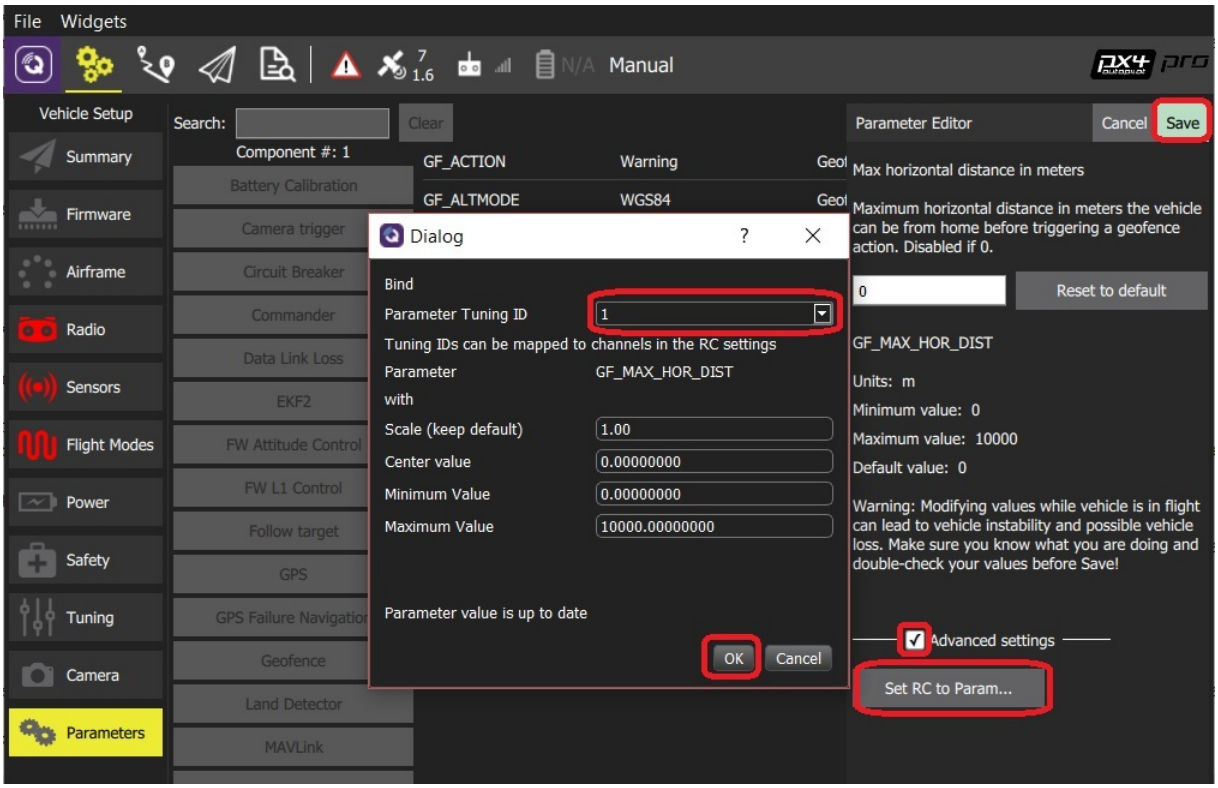
To set up tuning channels:

1. Map up to 3 transmitter controls (dials or sliders) to separate channels.
2. Select the mapping of *PARAM Tuning Id* to radio channels, using the selection lists. Values are saved to the vehicle as soon as they are set.



To map a PARAM tuning channel to a parameter:

1. Open the **Parameters** sidebar.
2. Select the parameter to map to your transmitter (this will open the *Parameter Editor*).
3. Check the **Advanced Settings** checkbox.
4. Click the **Set RC to Param...** button (this will pop-up the foreground dialog displayed below)



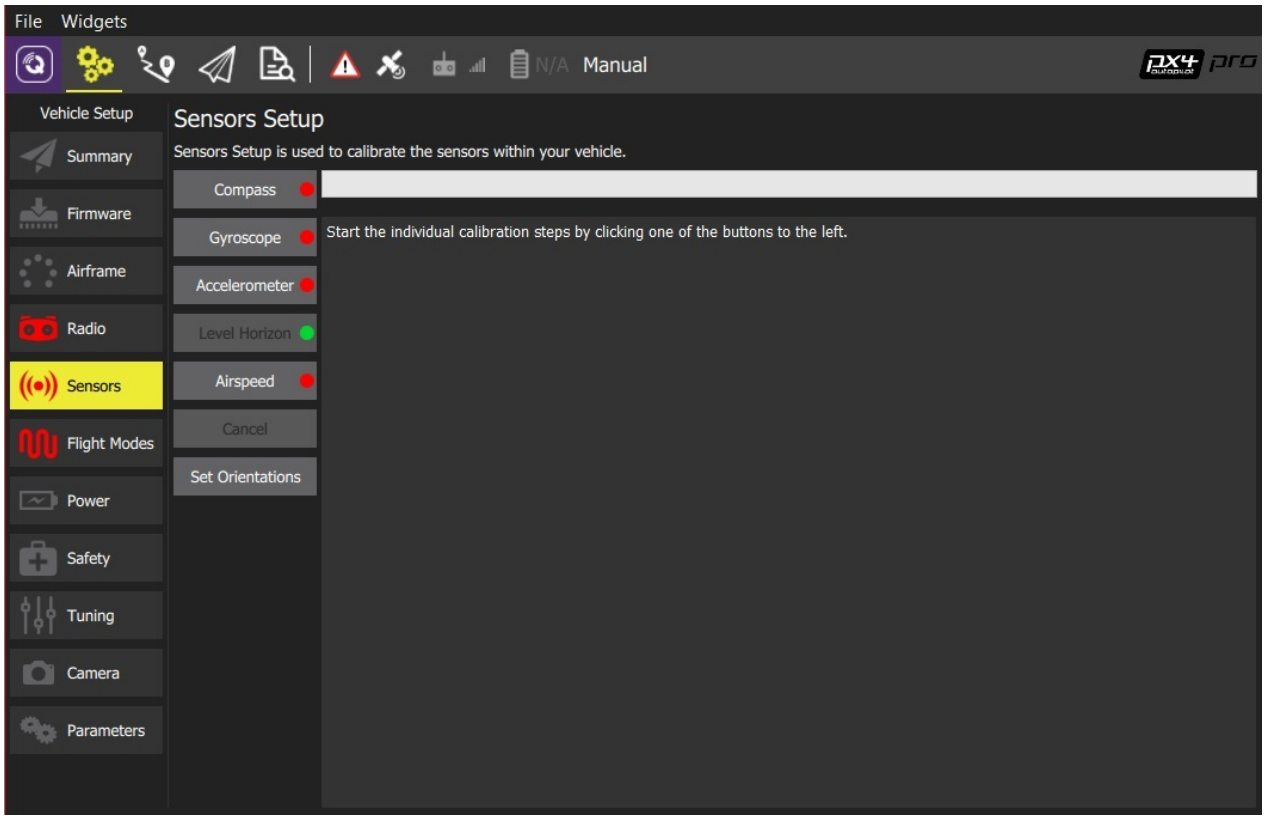
5. Select the tuning channel to map (1, 2 or 3) from the *Parameter Tuning ID* selection list.
6. Press **OK** to close the dialog.
7. Press **Save** to save all changes and close the *Parameter Editor*.

> You can clear all parameter/tuning channel mappings by selecting menu **Tools > Clear RC to Param** at the top right of the *Parameters* screen.

Sensors

The *Sensor Setup* section allows you to configure and calibrate the vehicle's compass, gyroscope, accelerometer and other sensors (if present).

Available sensors are displayed as a list of buttons beside the sidebar. Sensors marked with green are already calibrated. Sensors marked with red require calibration prior to flight.



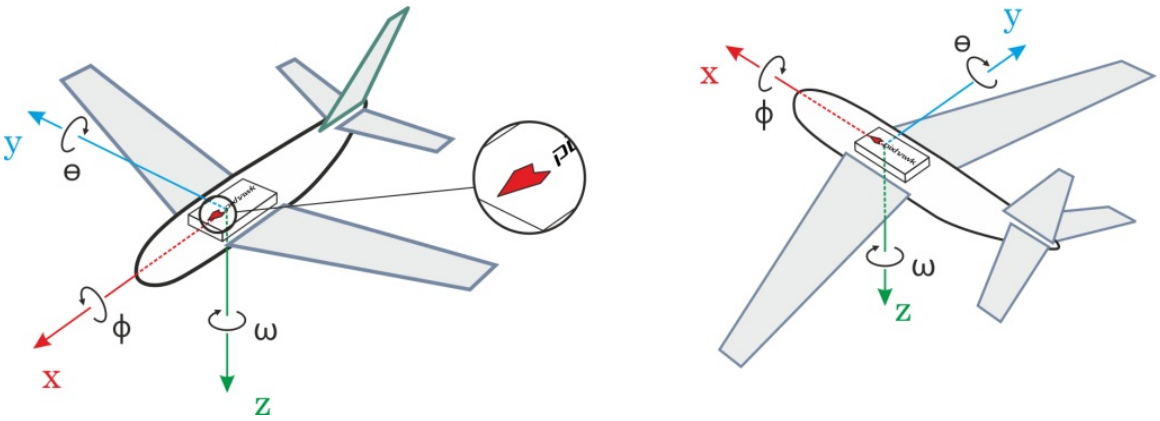
> The image shown is from a VTOL vehicle running PX4 firmware. Other autopilot firmware and vehicles will offer slightly different options.

Click on the button for each sensor to start its calibration sequence.

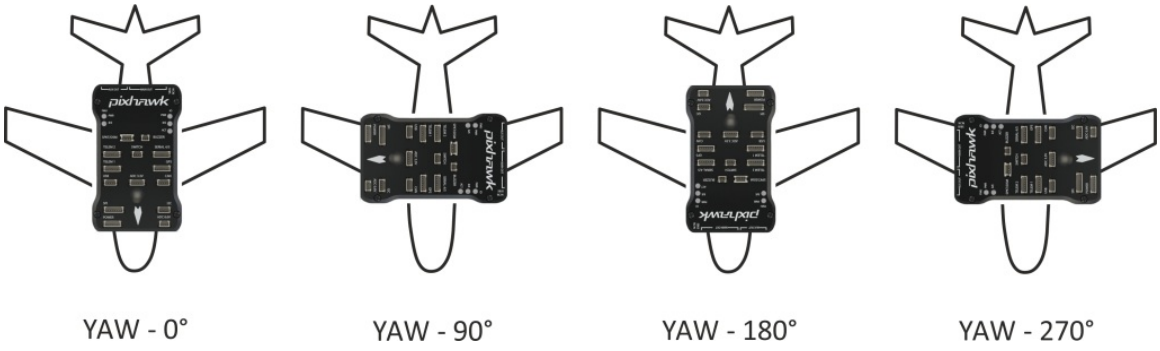
Flight Controller Orientation

> You can skip this section if the flight controller and compass are mounted upright on the vehicle and facing the front (this is the default orientation - `ROTATION_NONE`).

If the autopilot/compass are mounted in any other way you will need to specify their orientations as YAW, PITCH and/or ROLL offsets relative to the forward-facing-upright orientation (clock-wise rotation around the Z, Y and X axis, respectively).



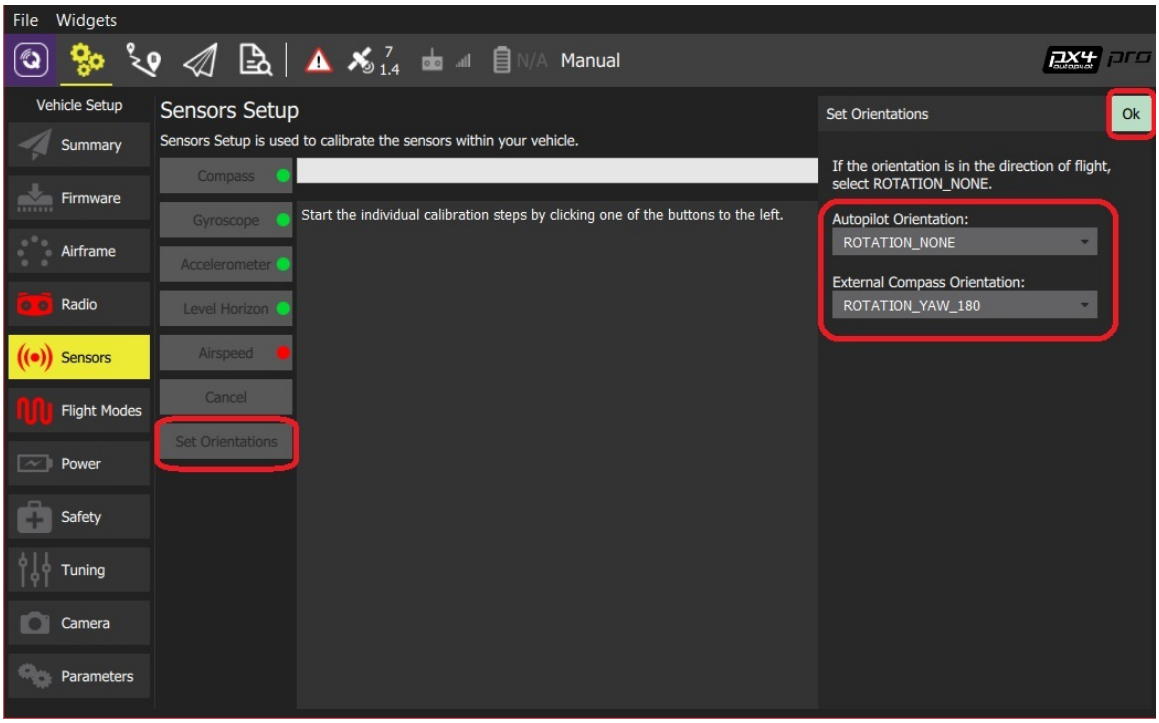
For example, the image below are at orientations: `ROTATION_NONE`, `ROTATION_YAW_90`, `ROTATION_YAW_180`, `ROTATION_YAW_270`.



Set Orientations (PX4)

To set the orientation(s) on PX4:

1. Select the **Set Orientations** button.

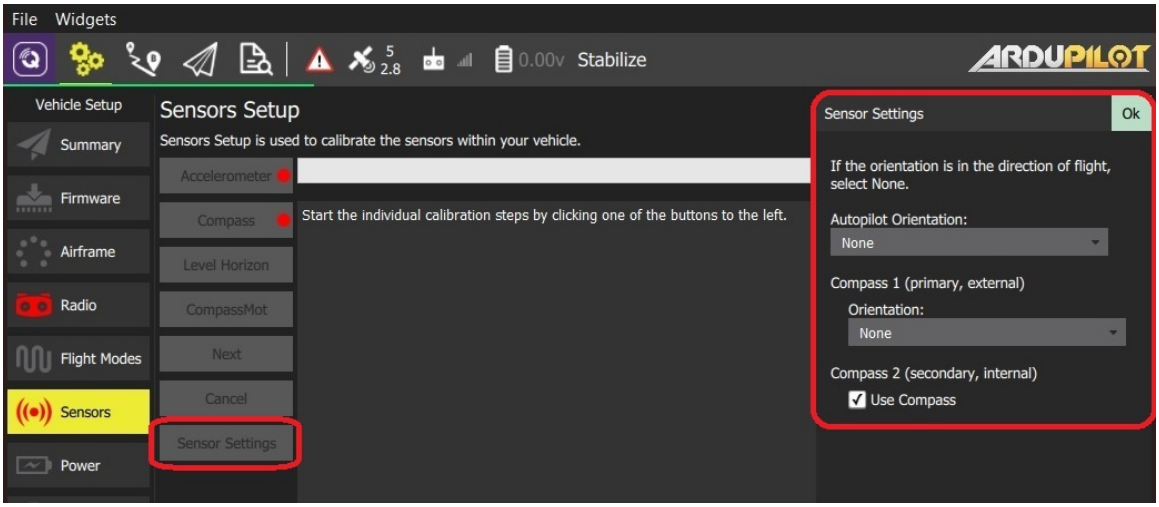


2. Select the **AutoPilot Orientation**.
3. Select the **External Compass Orientation** (this option will only be displayed if there is an external compass).
4. Press **OK**.

Sensor Settings (ArduPilot)

To set the orientation(s) on ArduPilot:

1. Select the **Sensor Settings** button.



2. Select the **AutoPilot Orientation**.
3. Select the *orientation* from **Compass 1 (primary/external) > Orientation** (or check **Compass2 (secondary, external) > Use Compass** to instead use the internal compass).
4. Press **OK**.

Compass

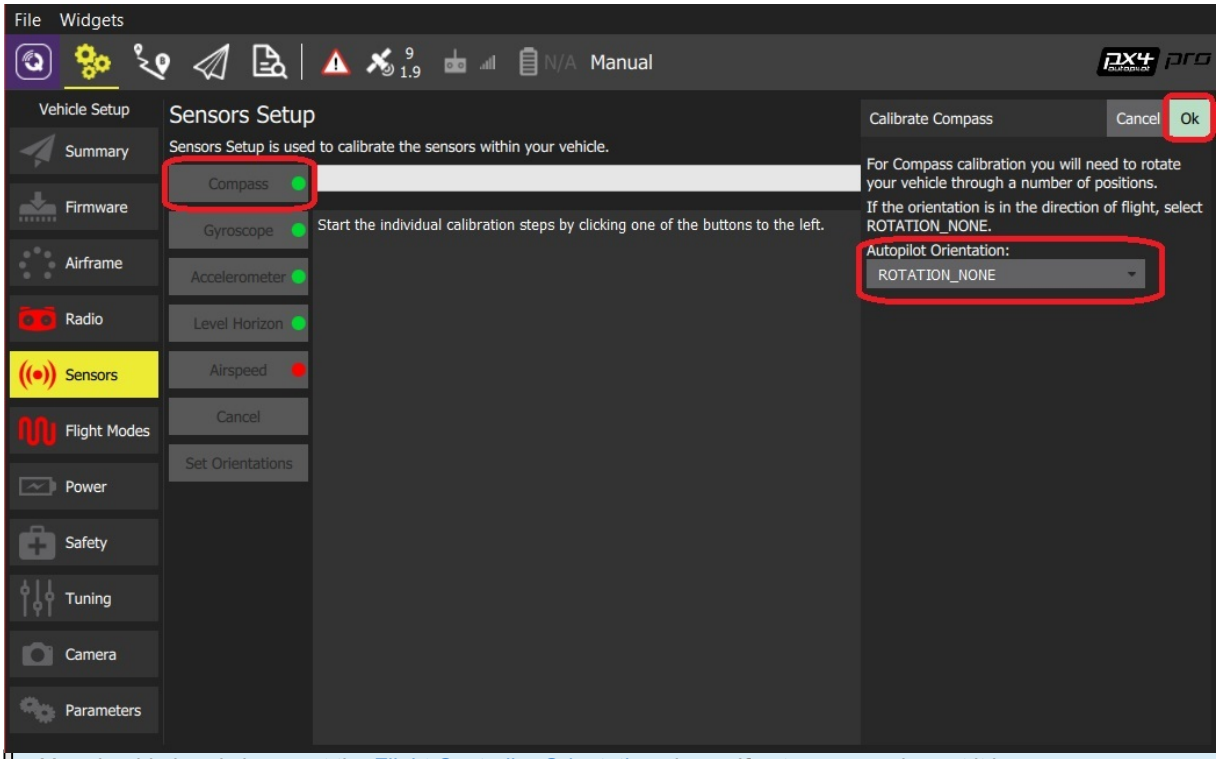
PX4 Compass Calibration

For PX4 you will be guided to position the vehicle in a number of set orientations and rotate the vehicle about the specified axis.

> This process is also used for calibrating the compass on older ArduPilot firmware.

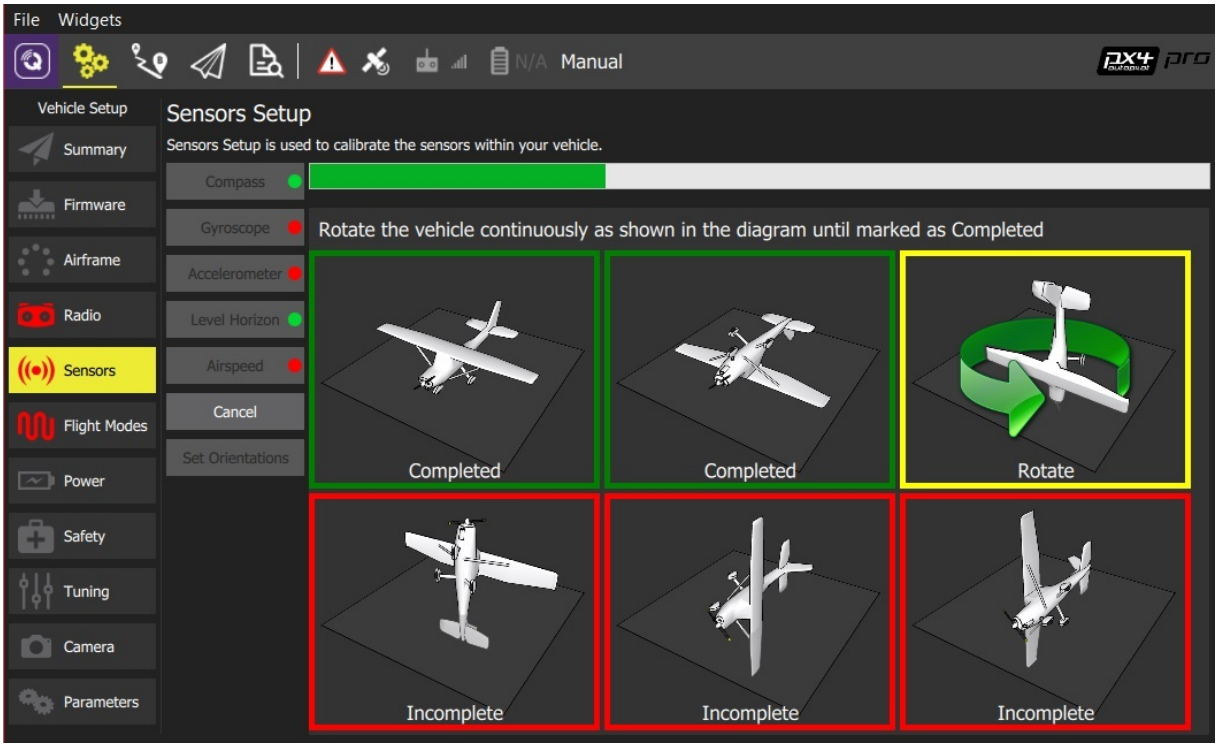
The calibration steps are:

1. Click the **Compass** sensor button



> You should already have set the Flight Controller Orientation above. If not, you can also set it here.

2. Click **OK** to start the calibration.
3. Place the vehicle in any of the orientations shown in red (incomplete) and hold it still. Once prompted (the orientation-image turns yellow) rotate the vehicle around the specified axis in either/both directions. Once the calibration is complete in that orientation the associated image on the screen will turn green.



4. Repeat the calibration process for all vehicle orientations.

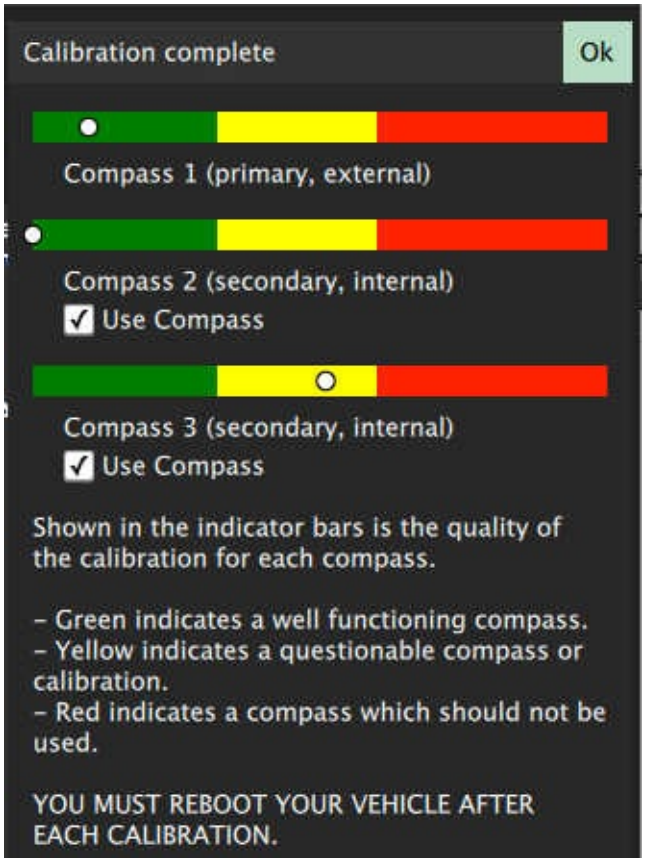
Once you've rotated the vehicle in all the positions *QGroundControl* will display *Calibration complete* (all orientation images will be displayed in green and the progress bar will fill completely). You can then proceed to the next sensor.

ArduPilot Compass Calibration

ArduPilot uses onboard calibration support that allows for more accurate calibration.

> Older ArduPilot firmware can be calibrated using the same process as PX4.

You need to rotate the vehicle randomly around all axes until the progress bar fills all the way to the right and the calibration completes. When the calibration completes you will get the following results:



This shows you the quality of the calibration for each compass. Using these values you can determine whether you may want to turn off usage of poorly performing compasses.

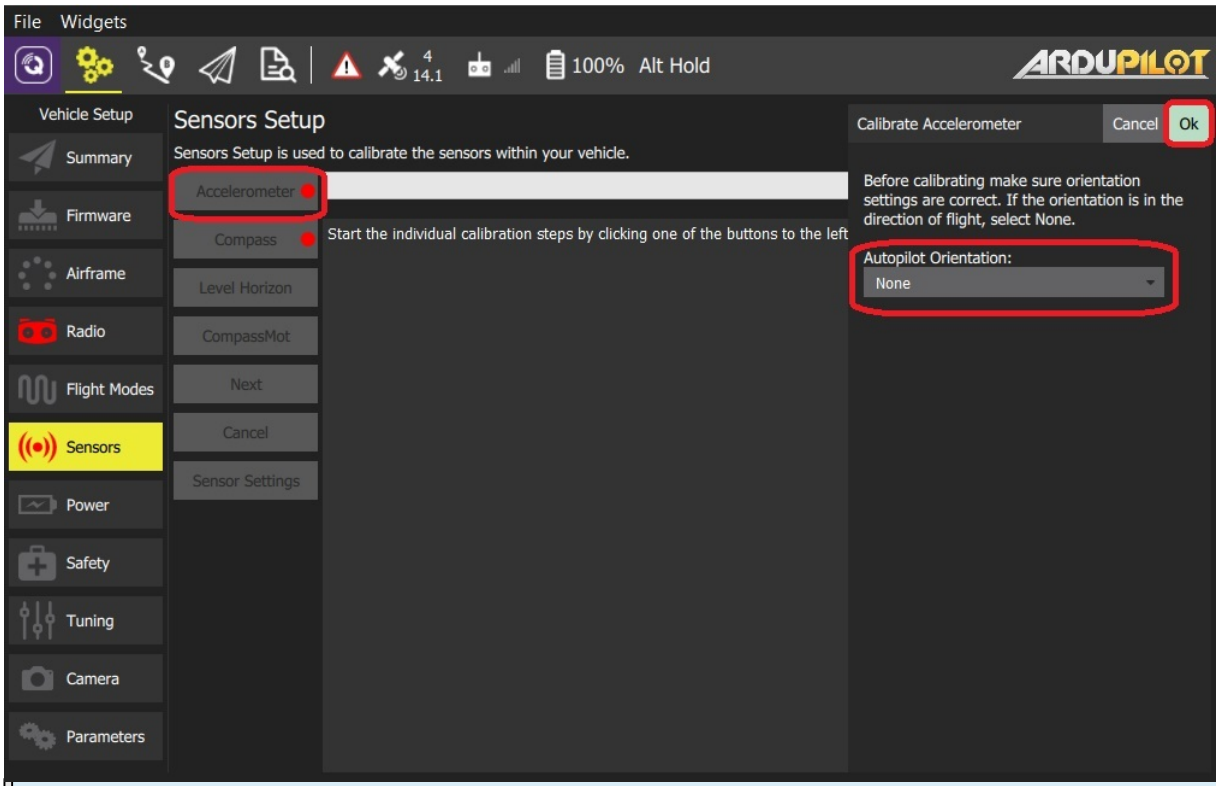
Accelerometer

To calibrate the flight controller accelerometers you will be asked to place and hold your vehicle a number of orientations (you will be prompted when to move between positions). The screens are different for PX4 and ArduPilot.

PX4 Accelerometer Calibration

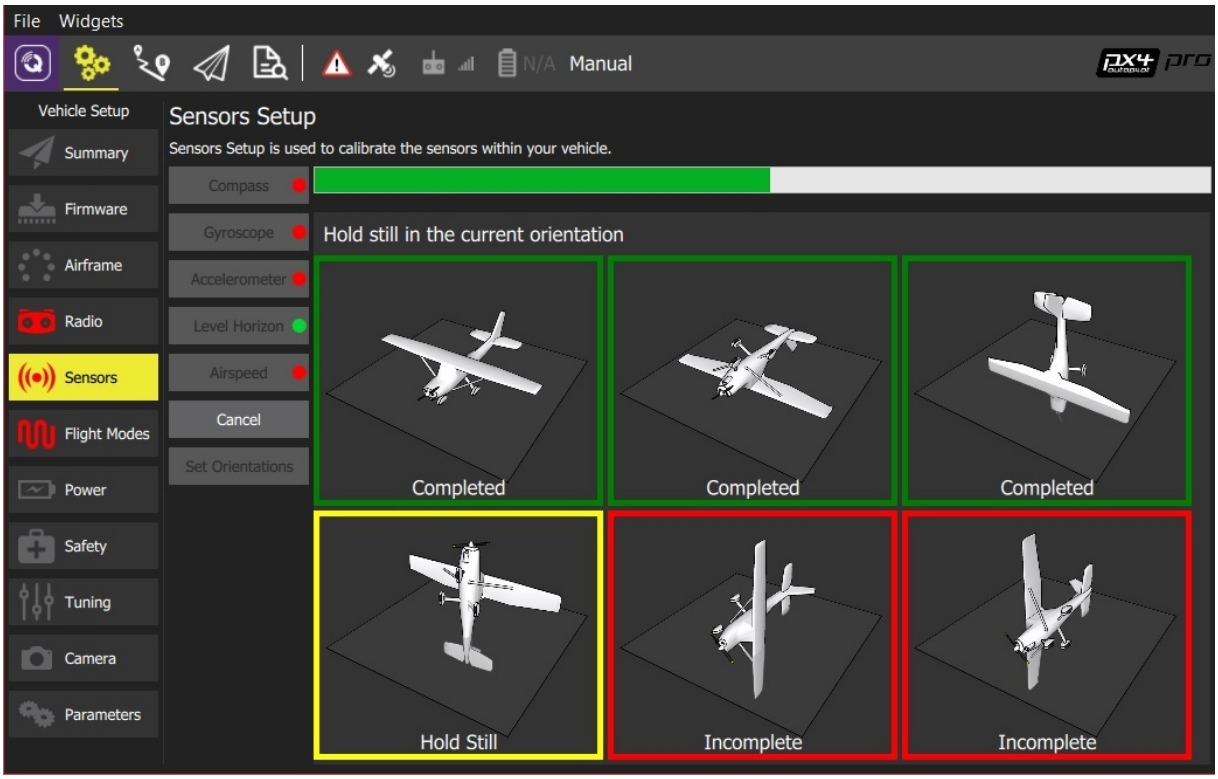
The calibration steps are:

1. Click the **Accelerometer** sensor button.



> You should already have set the Flight Controller Orientation above. If not, you can also set it here.

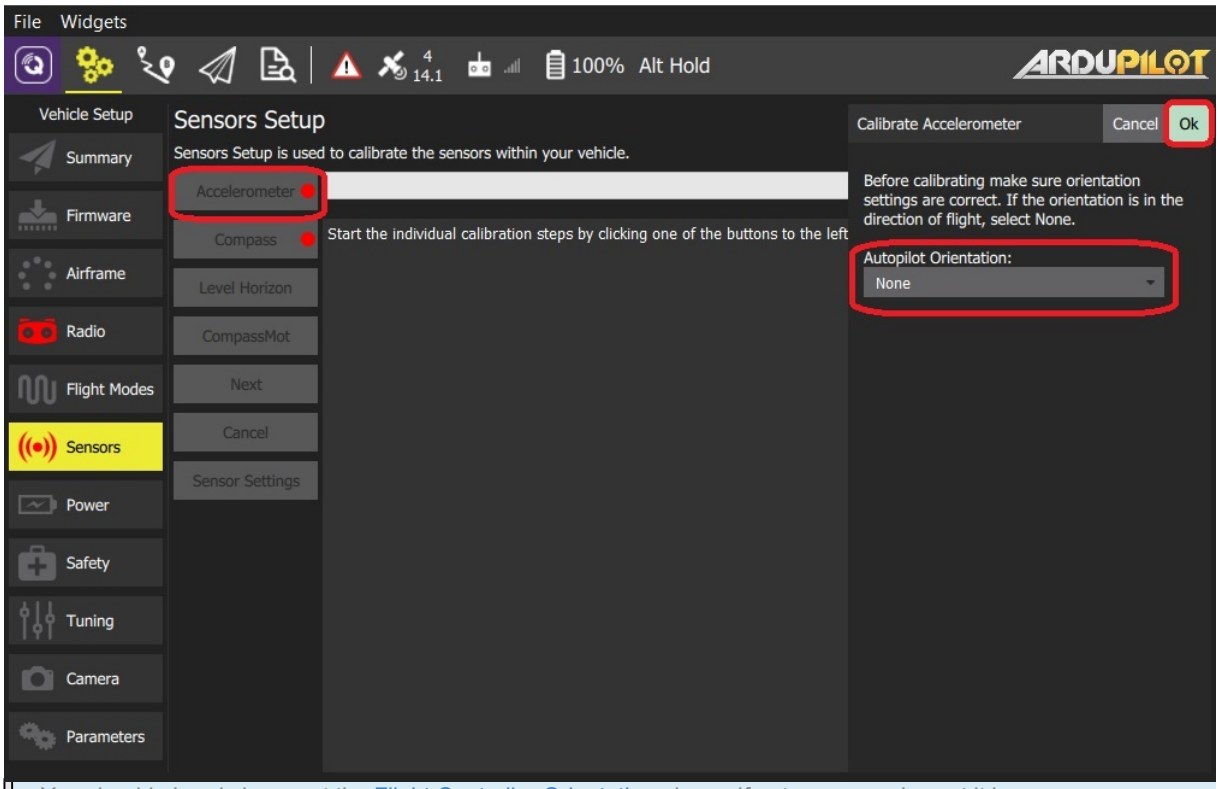
2. Click **OK** to start the calibration.
3. Position the vehicle as guided by the *images* on the screen. This is very similar to compass calibration.



ArduPilot Accelerometer Calibration

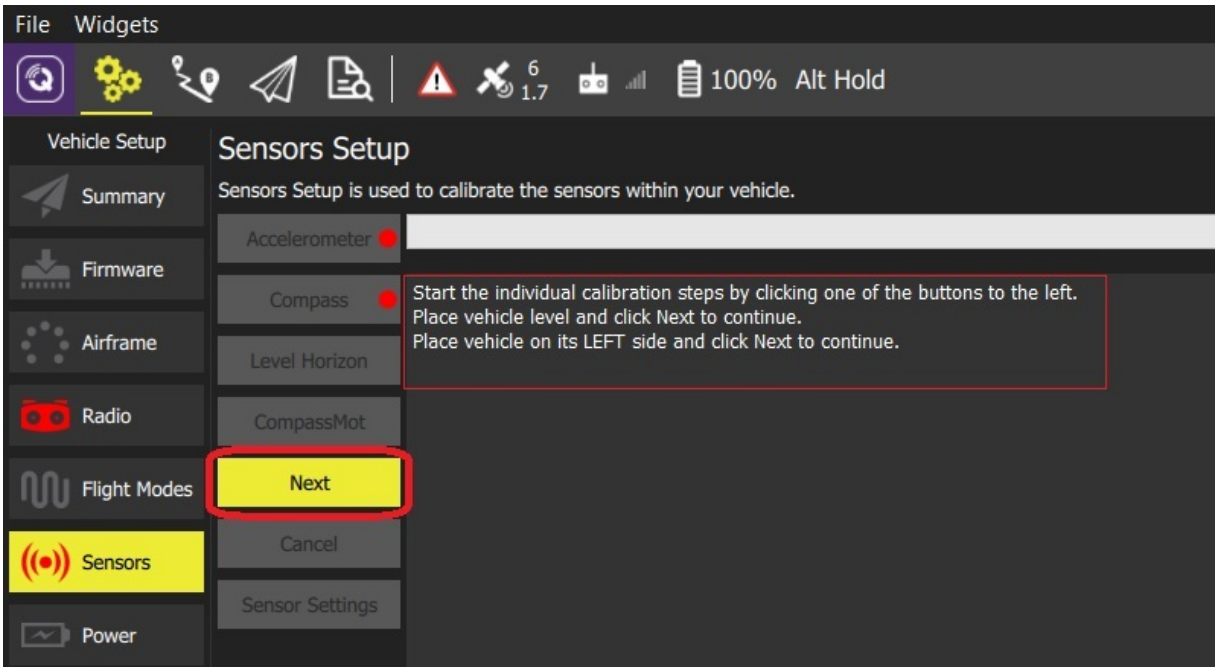
The calibration steps are:

1. Click the **Accelerometer** sensor button.



> You should already have set the Flight Controller Orientation above. If not, you can also set it here.

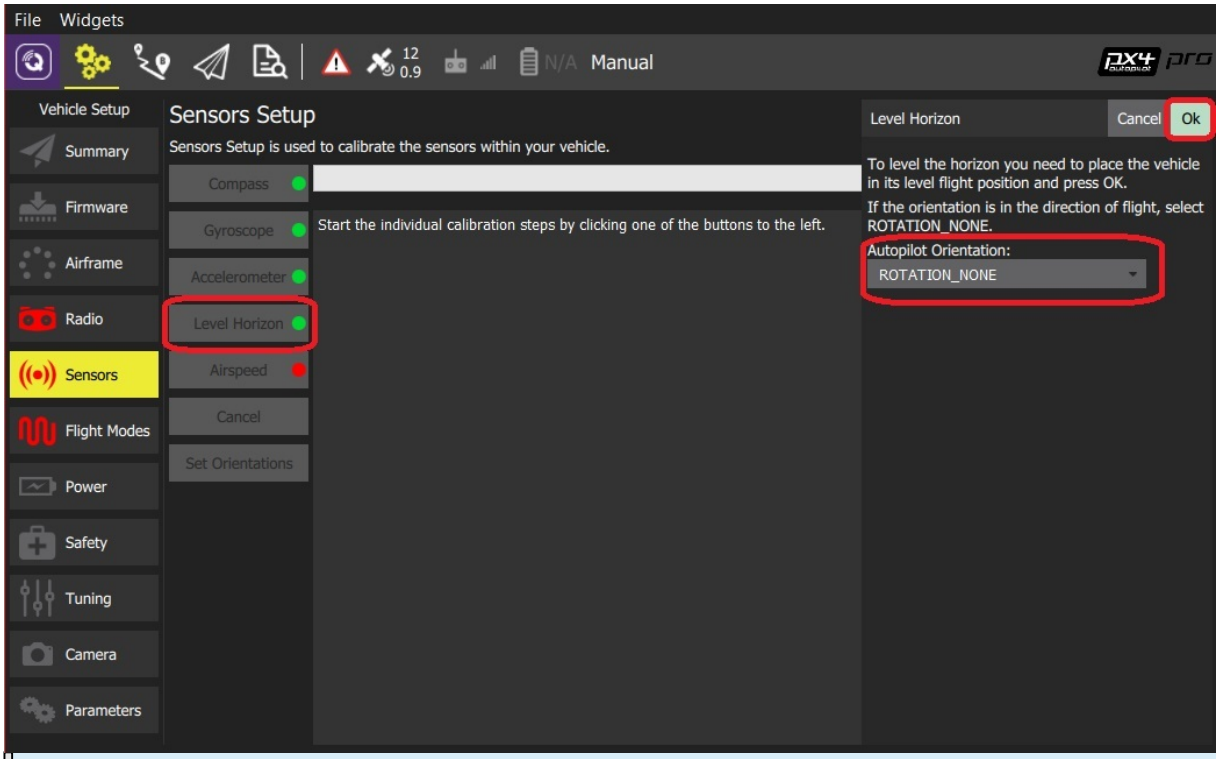
2. Click **OK** to start the calibration.
3. Position the vehicle based on text instructions in the center display. Click the **Next** button to capture each position.



Level Horizon

If the horizon (as shown in the HUD) is not level after completing Accelerometer calibration you can calibrate the level horizon for your vehicle. You will be asked to place the vehicle in a level orientation while it captures the information.

1. Click the **Level Horizon** sensor button.



> You should already have set the Flight Controller Orientation above. If not, you can also set it here.

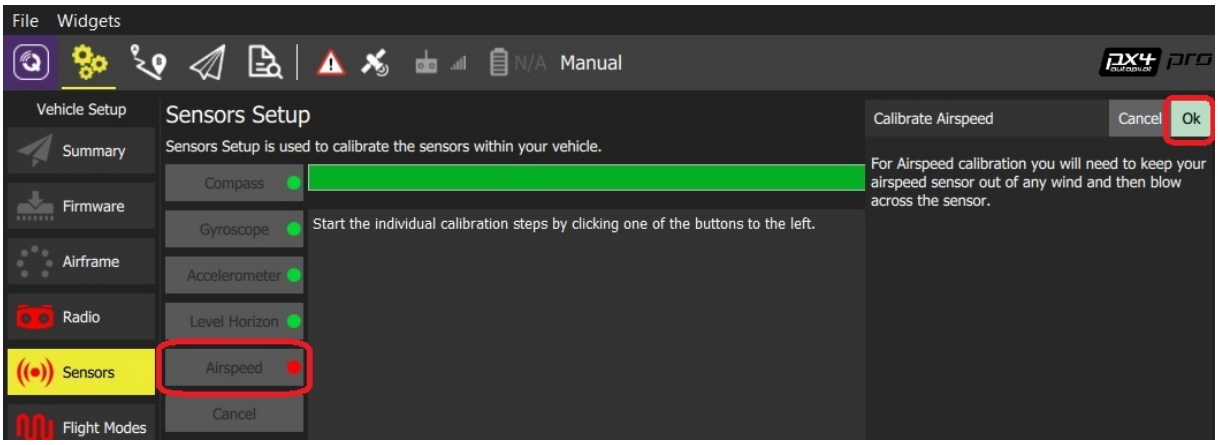
2. Place the vehicle in its level flight orientation on a level surface:
   - For planes this is the position during level flight (planes tend to have their wings slightly pitched up!)
   - For copters this is the hover position.
3. Click **OK** to start the calibration.

Airspeed

For Airspeed calibration you will need to keep your airspeed sensor out of any wind and then blow across the sensor.

To calibrate the airspeed sensor:

1. Click the **Airspeed** sensor button



2. Cover the sensor (i.e. with your hand)

> Do not touch the sensor (obstruct any holes) during calibration.

3. Click **OK** to start the calibration.
4. Blow across the sensor.

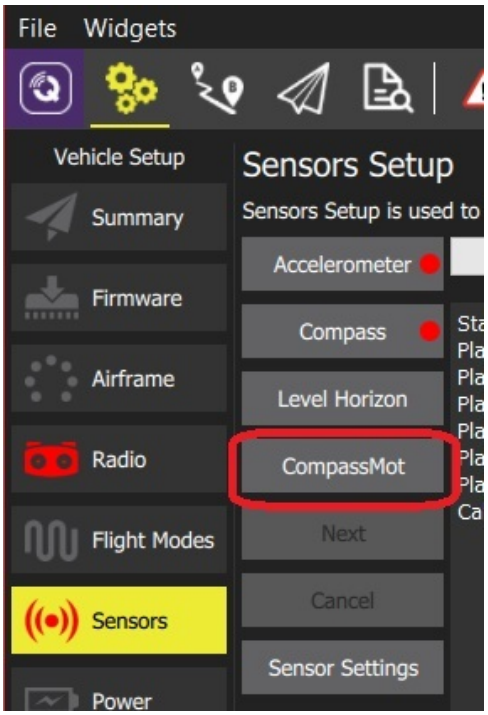
5. Wait for 2-3 seconds before removing the covering (calibration completes silently after several seconds)

CompassMot (Optional - ArduPilot only)

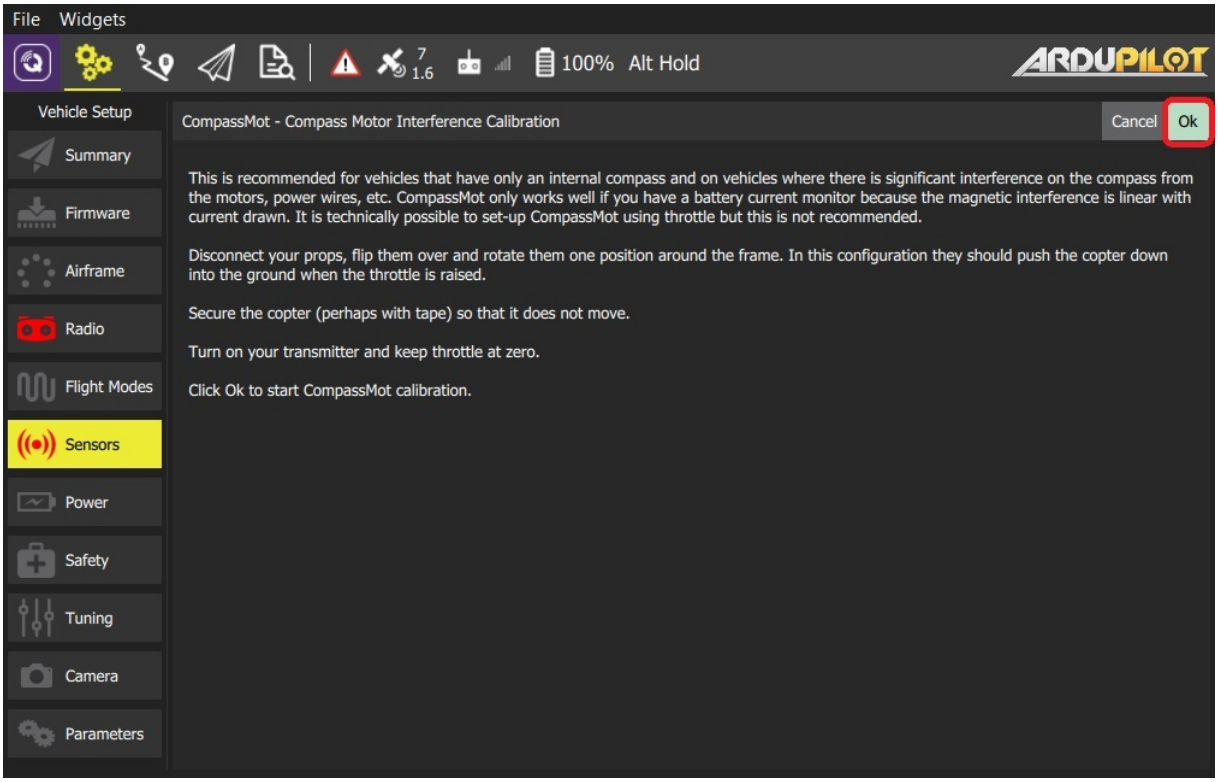
CompassMot calibration is optional! It is recommended for vehicles that only have an internal compass and where there is significant interference on the compass from the motors, power wires, etc. CompassMot only works well if you have a battery current monitor because the magnetic interference is linear with current drawn.

To perform **CompassMot** calibration:

1. Click the **CompassMot** sensor button.



2. Follow the onscreen prompts.


File
Widgets
100%
Alt Hold
ARDUPILOT
Vehicle Setup
Summary
Firmware
Airframe
Radio
Flight Modes
Sensors
Power
Safety
Tuning
Camera
Parameters
CompassMot - Compass Motor Interference Calibration
Cancel
Ok
This is recommended for vehicles that have only an internal compass and on vehicles where there is significant interference on the compass from the motors, power wires, etc. CompassMot only works well if you have a battery current monitor because the magnetic interference is linear with current drawn. It is technically possible to set-up CompassMot using throttle but this is not recommended.
Disconnect your props, flip them over and rotate them one position around the frame. In this configuration they should push the copter down into the ground when the throttle is raised.
Secure the copter (perhaps with tape) so that it does not move.
Turn on your transmitter and keep throttle at zero.
Click Ok to start CompassMot calibration.

Flight Modes Setup

The *Flight Modes* section allows you to map flight modes to radio channel(s), and hence to the switches on your radio control transmitter. Both flight mode setup and the available flight modes are different in PX4 and ArduPilot (and there are some differences between ArduCopter and ArduPlane).

To access this section, select the **Gear** icon (Vehicle Setup) in the top toolbar and then **Flight Modes** in the sidebar.

> You must already have configured your radio in order to set flight modes.

> Flight modes provide different levels of *autopilot-assisted flight*, and *fully autonomous flight* via missions or offboard (API-based) control. Different flight modes allow new users to learn flying with a more forgiving platform than provided by basic RC control alone. They also enable automation of common tasks like taking off, landing and returning to the original launch position.
>
> For more information about the flight modes on each platform see:
>
> - PX4 Flight Modes
> - ArduCopter Flight Modes
> - ArduPlane Flight Modes

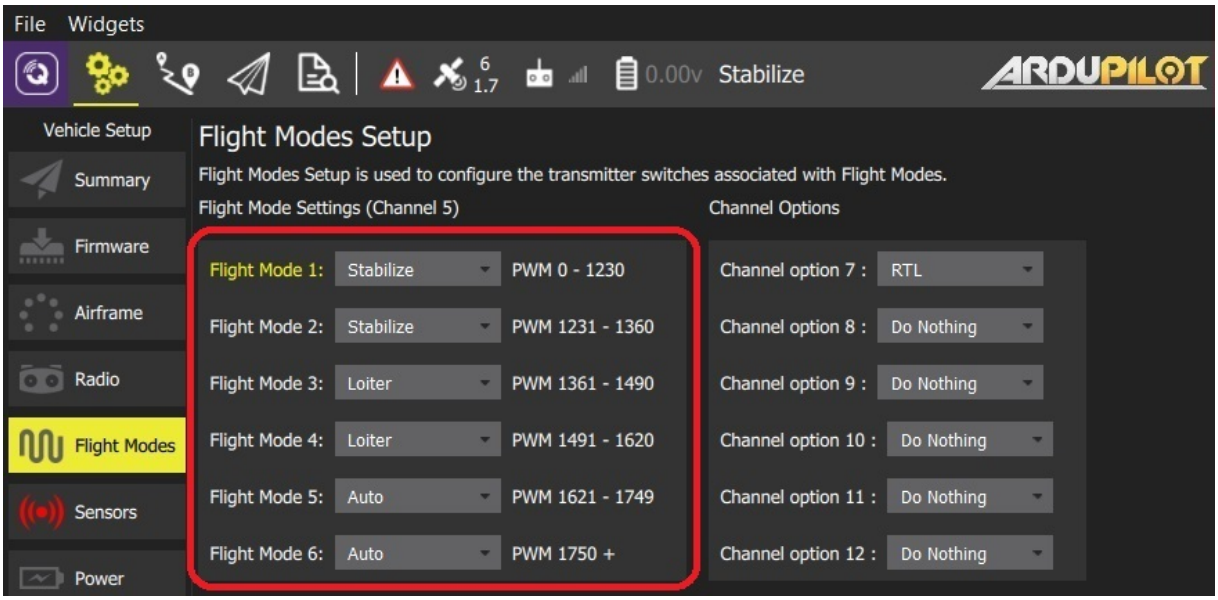
ArduPilot Flight Mode Setup

On ArduPilot you can assign up to 6 different flight modes to a single channel of your transmitter (the channel is selectable on Plane, but fixed to channel 5 on Copter).

ArduCopter (only) also allows you to specify additional *Channel Options* for channels 7-12. These allow you to assign functions to these switches (for example, to turn on a camera, or return to launch). There is additional information about channel configuration in the ArduCopter docs: [Auxiliary Function Switches](

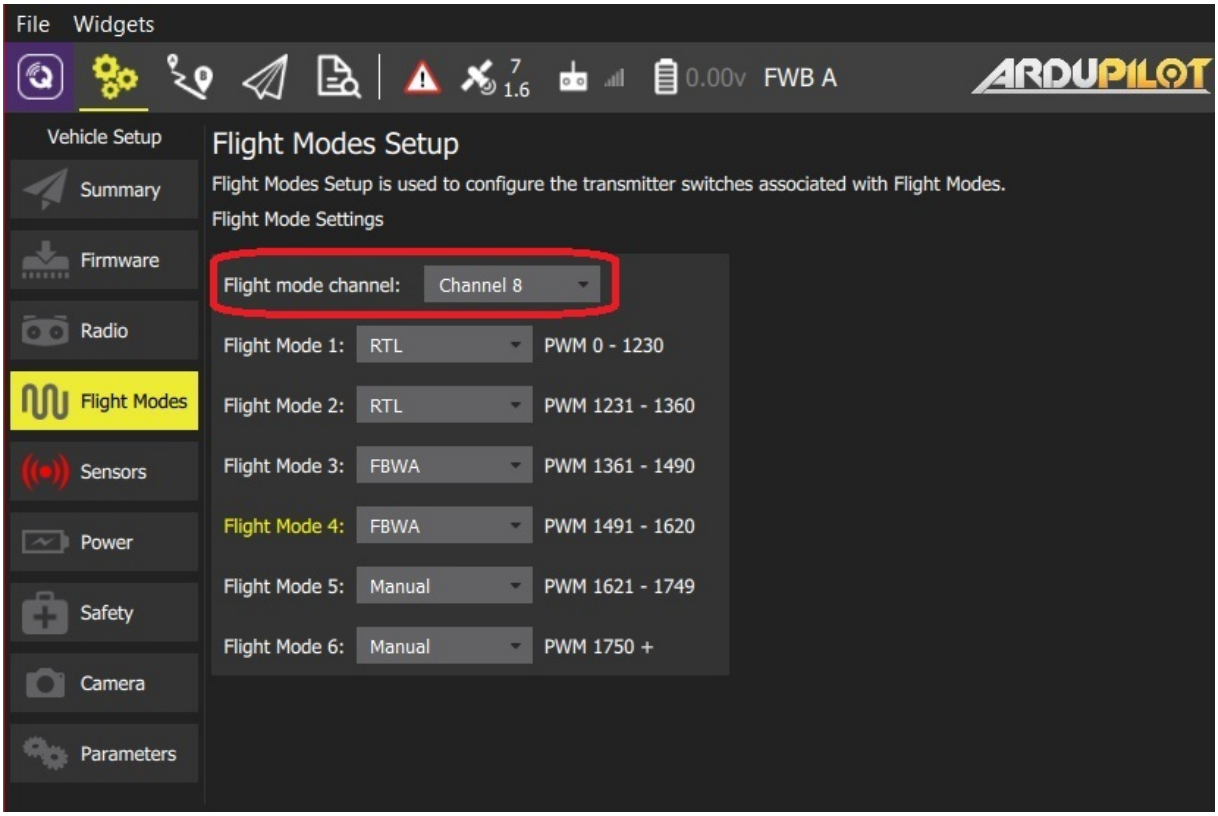
To set the flight modes:

1. Turn on your RC transmitter.
2. Select the **Gear** icon (Vehicle Setup) in the top toolbar and then **Flight Modes** in the sidebar.



> The above image is a screenshot of the flight mode setup for ArduCopter.

3. Select up to 6 flight modes in the drop downs.
4. **ArduCopter only:** Select additional *Channel Options* for channels 7-12.
5. **ArduPlane only:** Select the mode channel from the dropdown.



6. Test that the modes are mapped to the right transmitter switches by selecting each mode switch on your transmitter in turn, and check that the desired flight mode is activated (the text turns yellow on *QGroundControl* for the active mode).

All values are automatically saved as they are changed.

> The ArduCopter screenshot above shows a typical setup for a three position flight mode switch with an additional option of RTL being on a channel 7 switch. You can also setup 6 flight modes using two switches plus mixing on your transmitter. Scroll down to the center section of this page for tutorials on how to do that.

PX4 Pro Flight Mode Setup

PX4 (*QGroundControl*) supports two modes for mapping flight modes to transmitter switches/dials:

- **Single Channel Mode Selection:** Assign up to 6 flight modes to switch positions encoded in a single channel.
- **Multi Channel Mode Selection:** Assign modes to switch positions encoded in one or more channels. Some modes are hard coded to share channels, or are defined/set automatically based on other mode selections (the behaviour of multi-channel mode selection can sometimes be confusing).

> The recommended approach is use *Single Channel Mode Selection* because it easy to understand and configure. It is similar to the approach used by ArduPilot.

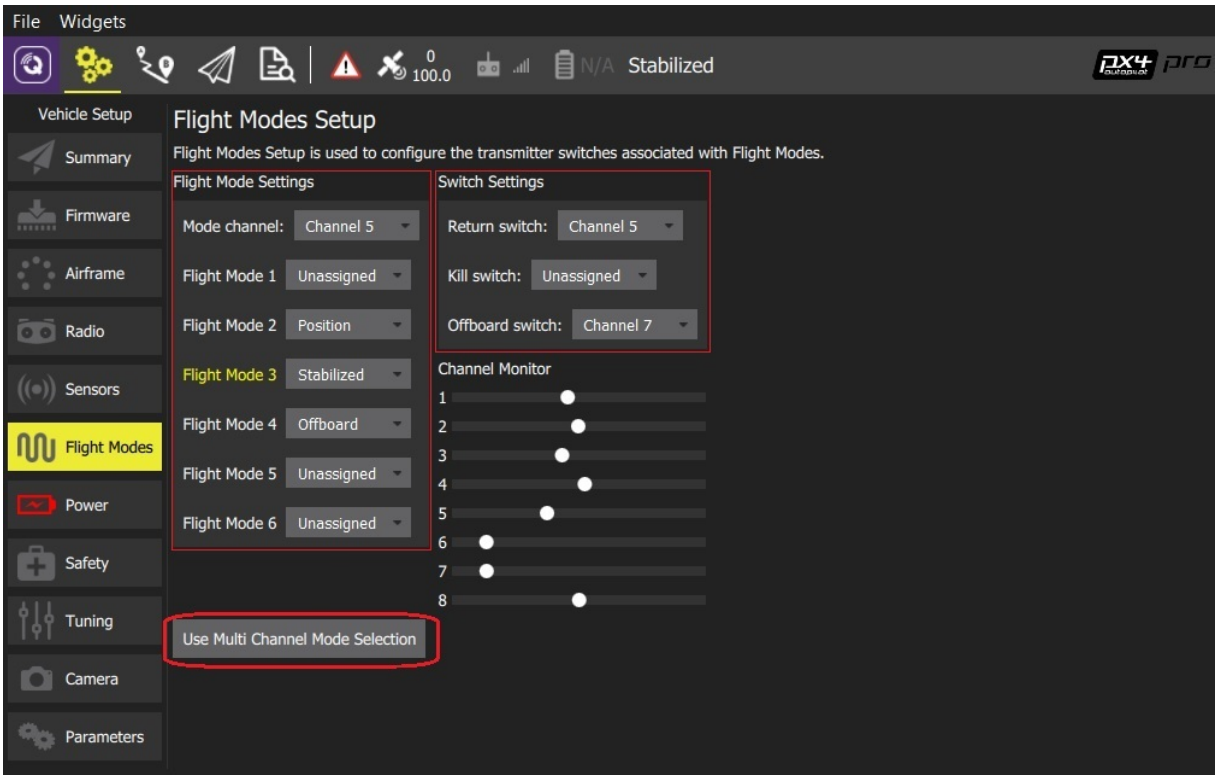
Single-Channel Mode

The single-channel selection mode allows you to specify a "mode" channel and select up to 6 flight modes that will be activated based on the PWM value of the channel. You can also separately specify channels for mapping a kill switch, return to launch mode, and offboard mode.

> In order to use approach you will first need to configure your *transmitter* to encode the physical positions of your mode switch(es) into a single channel. There is a video guide of how this is done for the popular *Taranis* transmitter below (check your documentation if you use a different transmitter).

To configure single-channel flight mode selection:

1. Turn on your RC transmitter.
2. Select the **Gear** icon (Vehicle Setup) in the top toolbar and then **Flight Modes** in the sidebar.



> If the screen opens in *Multi Channel Mode* click the **Use Single Channel Mode Selection** button to change screen.

3. Specify *Flight Mode Settings*:
   - Select the **Mode channel** (above this shown as Channel 5, but this will depend on your transmitter configuration).
   - Select up to six **Flight Modes**.
4. Specify *Switch Settings*:
   - Select channels for *Return To Launch* mode, *Kill Switch*, and *offboard* mode (if you have spare switches and channels on your transmitter).
5. Test that the modes are mapped to the right transmitter switches:
   - Check the *Channel Monitor* to confirm that the expected channel is changed by each switch.
   - Select each mode switch on your transmitter in turn, and check that the desired flight mode is activated (the text turns yellow on *QGroundControl* for the active mode).

All values are automatically saved as they are changed.

Video Example (including Transmitter Setup)

It is common to use the positions of a 2- and a 3-position switch on the transmitter to represent the 6 flight modes, and encode each combination of switches as a particular PWM value for the mode that will be sent on a single channel.

The video below shows how this is done with the *FrSky Taranis* transmitter (a very popular and highly recommended RC transmitter). The process involves assigning a "logical switch" to each combination of positions of the two real switches. Each logical switch is then assigned to a different PWM value on the same channel.

The video then shows how to use *QGroundControl* to specify the mode channel and map modes to each of the 6 "slots".

Video link

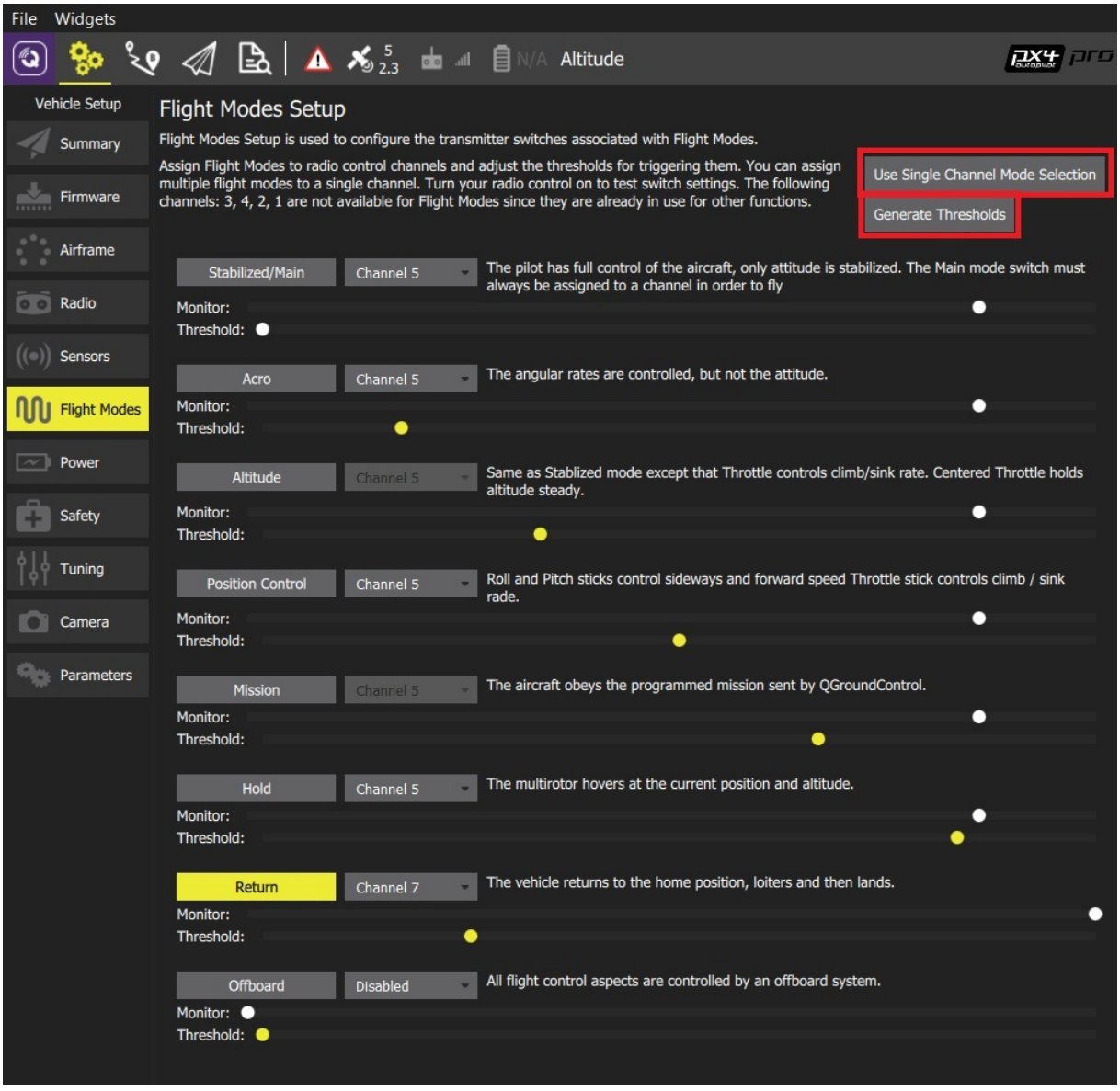
Multi-Channel Mode

> We recommend you use Single Channel Flight Mode selection because the Multi Channel selection user interface can be confusing. If you do choose to use this method, then the best approach is to start assigning channels and take note of information displayed by *QGroundControl* following your selection.

The multi-channel selection UI allows you to map one or more modes to one or more channels. There are some modes (and hence switches) that must always be defined, and the channel to which they must be allocated.

To configure flight modes using the multi-channel UI:

1. Turn on your RC transmitter.
2. Select the **Gear** icon (Vehicle Setup) in the top toolbar and then **Flight Modes** in the sidebar.



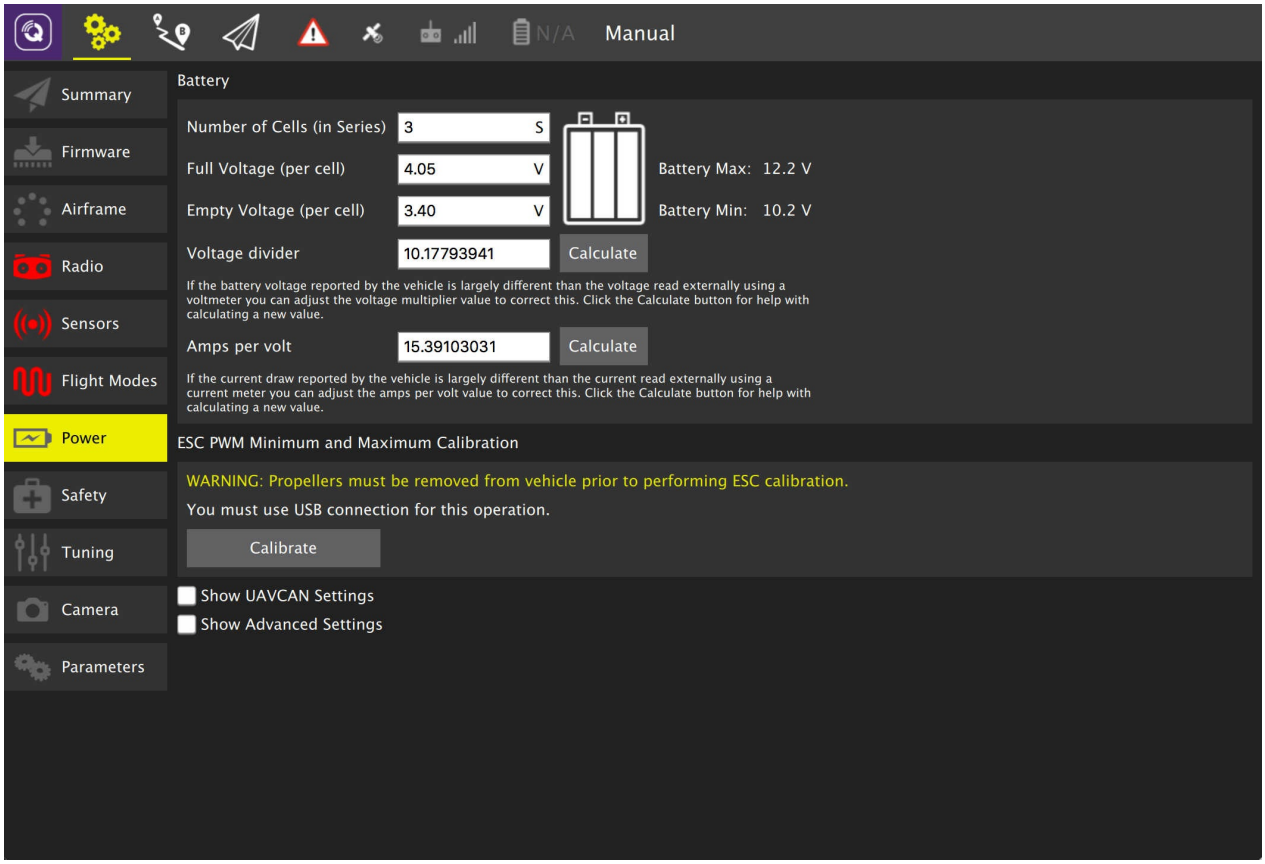
> If the screen opens in *Single Channel Mode* click the **Use Multi Channel Mode Selection** button to change screen.

3. Select the modes you want to assign to your switches and select the associated channel (selected modes will *move* in the UI to be grouped by channel). There are a number of complications on the mode to channel assignments:
   - Some modes will have a grayed out channel selector because they cannot be disabled and you cannot directly set the value. For example:
     - *Mission* mode - Has the same channel number as *Hold* (if it is defined), or otherwise the same channel as *Stabilized/Main* mode.
     - *Altitude* mode - Has the same channel number as *Position Control* (if it is defined), or otherwise the same channel as *Stabilized/Main* mode.
   - *Assist* mode - This mode is added to the same channel as *Stabilized/Main* mode if (and only if) *Position Control* is enabled and defined on a different channel than *Stabilized/Main*.
4. Click the **Generate Thresholds** button.
   - This will automatically create threshold values for all modes, spread evenly across each channel for its assigned modes. For example, in the mode assignment shown above, most modes are assigned to mode 5, and you can see that the channel thresholds for each mode are spread evenly across the channel.

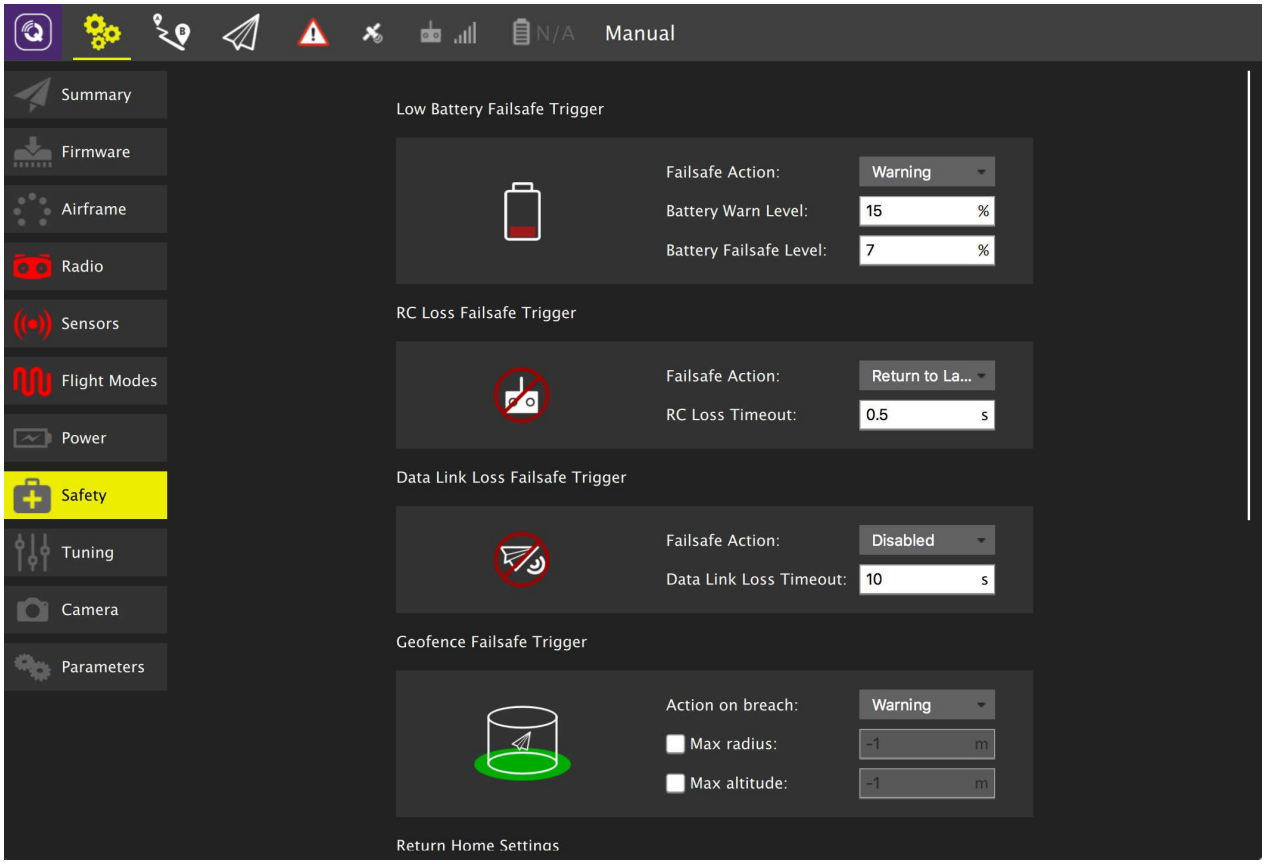
This mode is demonstrated in the PX4 setup video @6m53s (youtube).

> This flight mode selection mechanism is relatively complicated due to the way that PX4 works out which mode should be selected. You may be able to gain some insight from this flow chart (PX4 Developer Guide).

Power Setup


N/A
Manual
Summary
Firmware
Airframe
Radio
Sensors
Flight Modes
Power
Safety
Tuning
Camera
Parameters
Battery
Number of Cells (in Series)
3
S
Full Voltage (per cell)
4.05
V
Empty Voltage (per cell)
3.40
V
Battery Max: 12.2 V
Battery Min: 10.2 V
Voltage divider
10.17793941
Calculate
If the battery voltage reported by the vehicle is largely different than the voltage read externally using a voltmeter you can adjust the voltage multiplier value to correct this. Click the Calculate button for help with calculating a new value.
Amps per volt
15.39103031
Calculate
If the current draw reported by the vehicle is largely different than the current read externally using a current meter you can adjust the amps per volt value to correct this. Click the Calculate button for help with calculating a new value.
ESC PWM Minimum and Maximum Calibration
WARNING: Propellers must be removed from vehicle prior to performing ESC calibration.
You must use USB connection for this operation.
Calibrate
Show UAVCAN Settings
Show Advanced Settings

Safety Setup



The Safety Setup page allows you to configure various failsafe settings as well as return home details.

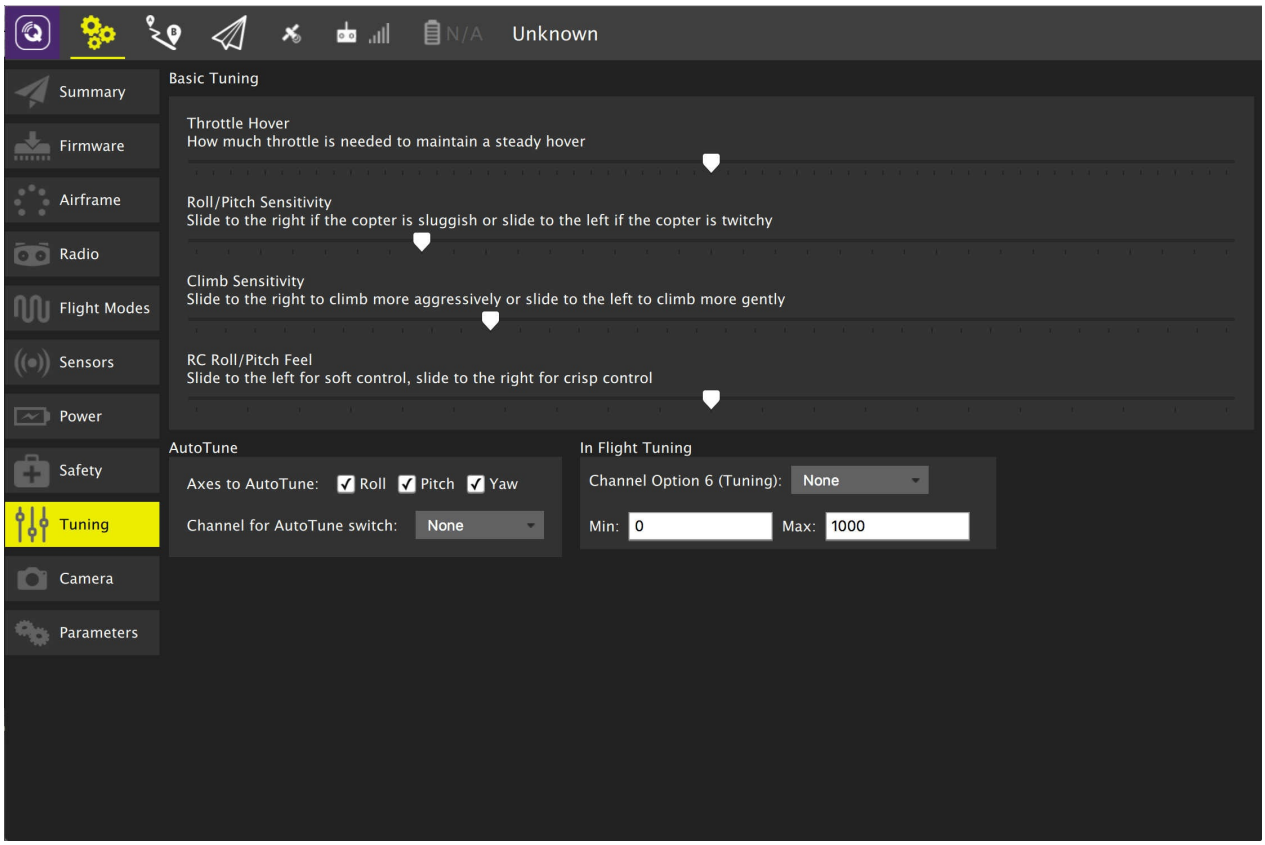
Tuning Setup

This page allows you to configure settings on your vehicle which control basic flight characteristics. The details of the page differ slightly if you are using PX4 Pro firmware or ArduPilot firmware.

Basic Tuning

A set of Basic Tuning sliders are suppored for both firmwares. They allow you to adjust the specified flight characteristic by moving the slider to the left or right.

ArduCopter Tuning



AutoTune

AutoTune is used to automatically tune the rate parameters in order to provide the highest response without significant overshoot.

Performing an AutoTune:

- Select which axes you would like to tune. Tuning all axes at once can take a significant amount of time which may cause you to run out of battery. In order to prevent this you can select to tune only one axis at a time.
- Assign AutoTune to one of your transmitter switches. Ensure that switch is in low position before taking off.
- Take off and put the copter into AltHold.
- Turn on AutoTune with your transmitter switch.
- The copter will twitch around the specified axes for a few minutes.
- When AutoTune completes the copter will change back to the original settings.
- Move the AutoTune switch back to low position and then back to high to test the new settings.
- Move the AutoTune switch to low to test previous settings.

- To save new settings, land and disarm while AutoTune switch is in high position.

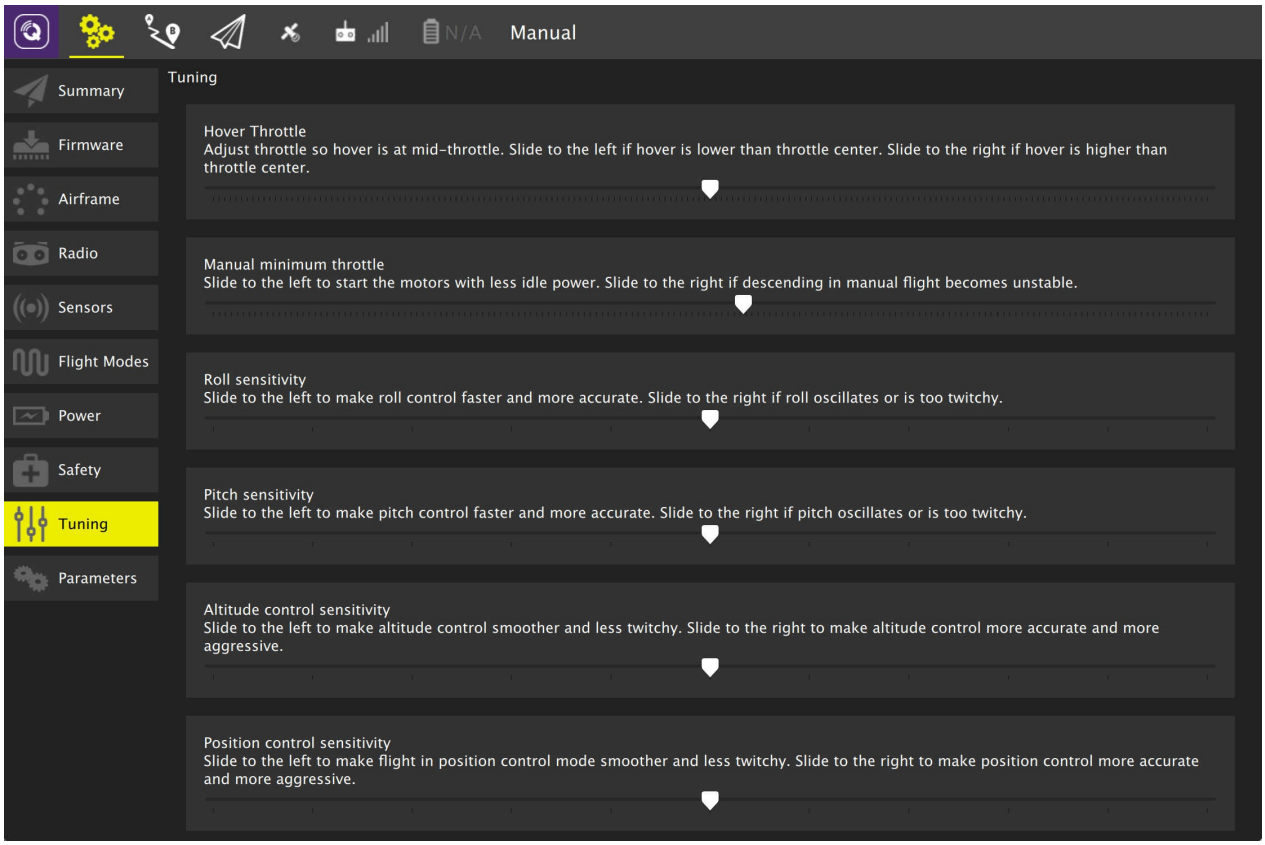
Note:

- Since AutoTune is done in AltHold your copter must already have a tuning which is minimally flyable in AltHold. You can cancel AutoTune at any time by moving the AutoTune switch back to low position.
- You can reposition the copter using your transmitter at any time during AutoTune.

In Flight Tuning

This is an advanced option which allows you to tune a flight control parameter using one of your transmitter dial channels. Select the control option from the dropdown and specify the min/max for the values to assign to the dial.

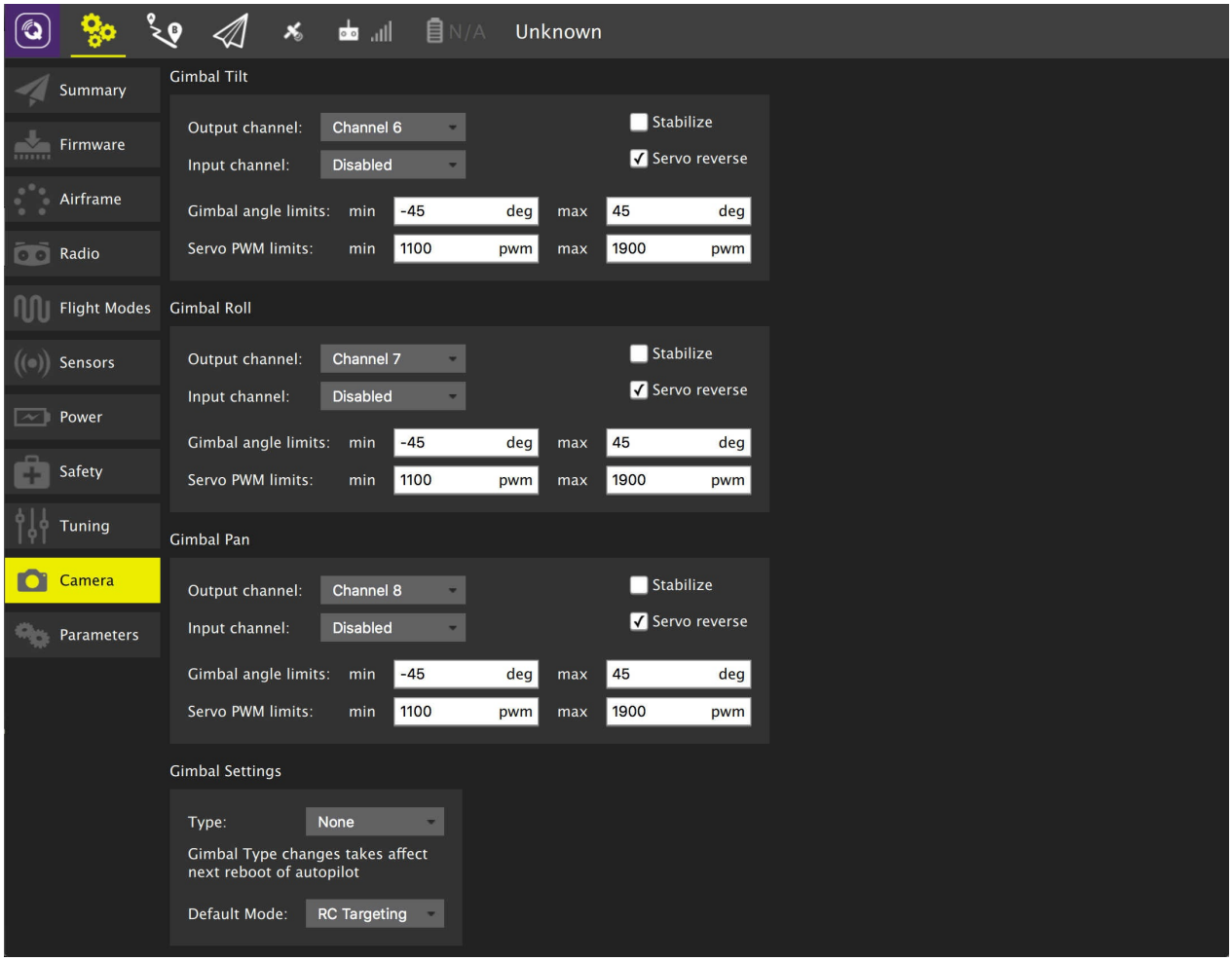
PX4 Copter Tuning



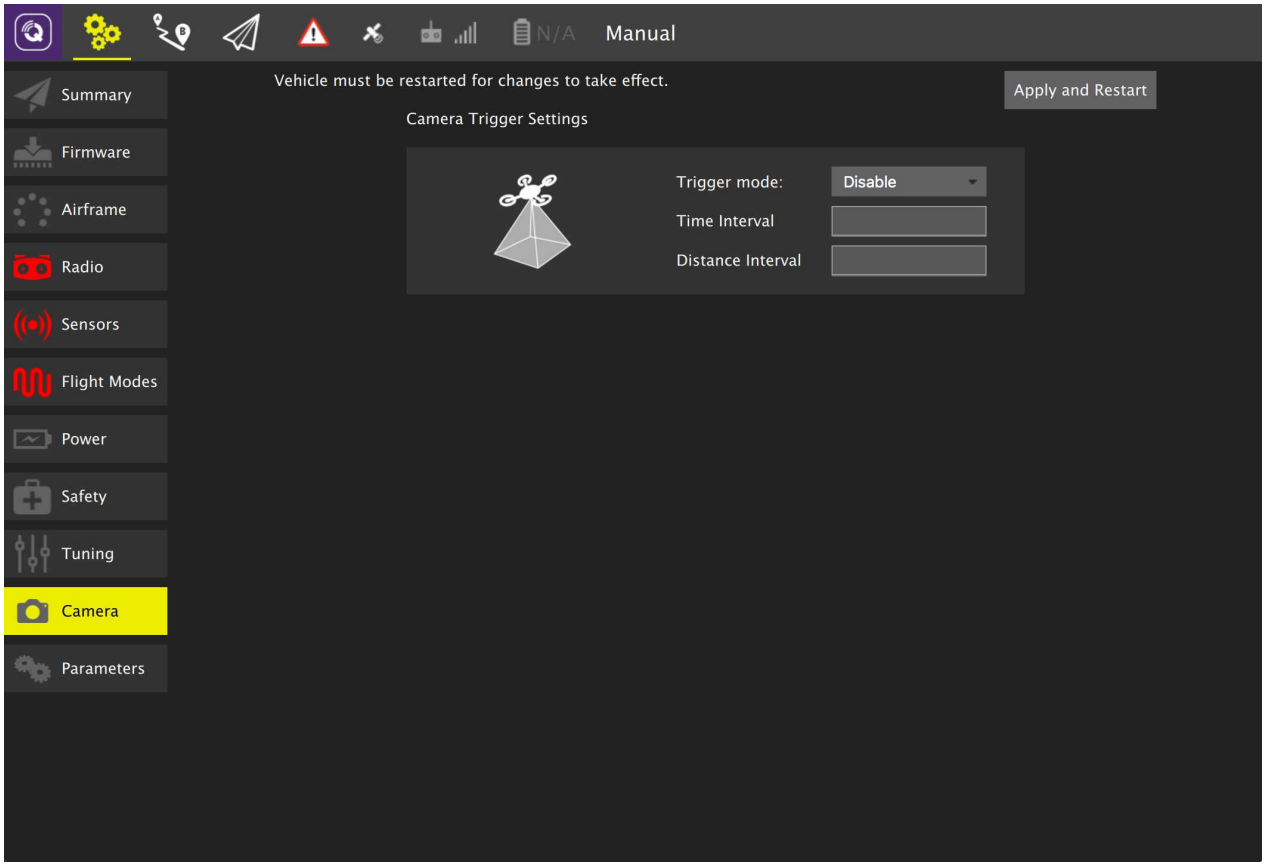
Camera Setup

The details of the page differ if you are using PX4 Pro firmware or ArduPilot firmware.

ArduPilot Camera Setup



PX4 Pro Camera Setup


N/A
Manual
Summary
Firmware
Airframe
Radio
Sensors
Flight Modes
Power
Safety
Tuning
Camera
Parameters
Vehicle must be restarted for changes to take effect.
Apply and Restart
Camera Trigger Settings
Trigger mode:
Disable
Time Interval
Distance Interval

Joystick Setup (PX4 only)

QGroundControl allows you to control a vehicle using a joystick or gamepad instead of an RC Transmitter.

> Flying with a Joystick (or virtual thumb-sticks) is not as responsive as RC Control because joystick information is sent over MAVLink.

> Joystick and Gamepad support is enabled using the cross-platform SDL2 library. Compatibility with a particular controller depends on SDL (all buttons that are exposed by that API are displayed through the *QGroundControl* UI). A number of common joysticks and gamepads are known to work.

Enabling PX4 Joystick Support

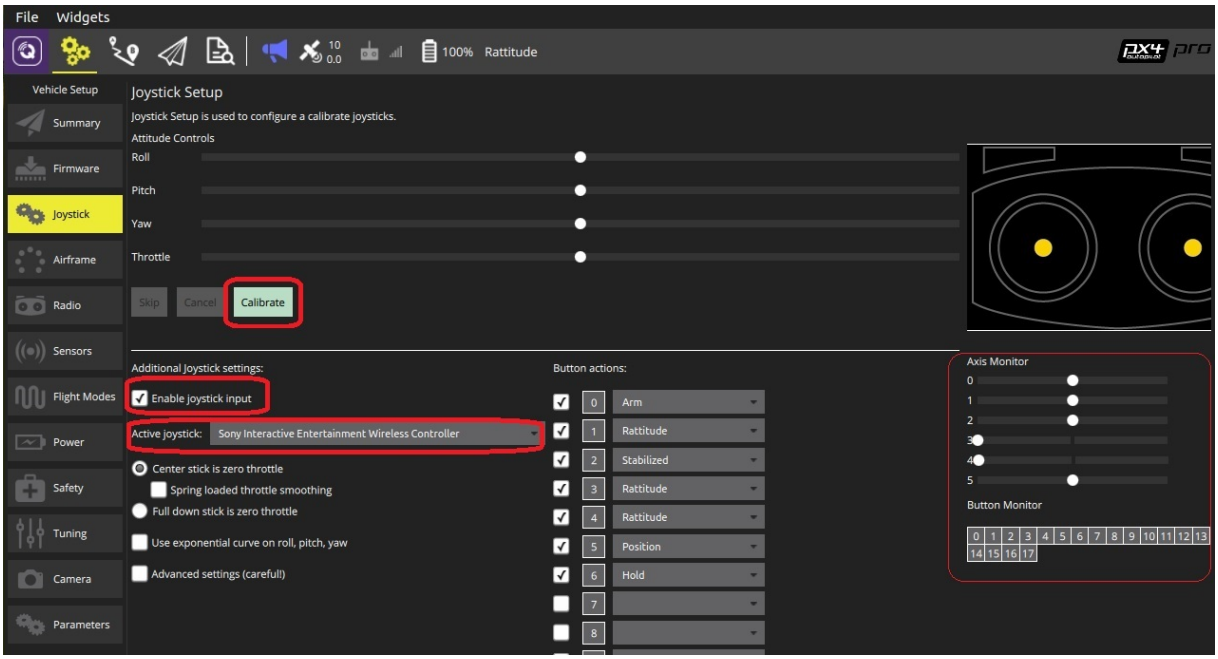
To enable Joystick support in PX4 you need to set the parameter `COM_RC_IN_MODE` to 1 - *Joystick/No RC Checks*. If this parameter is not set then *Joystick* will not be offered as a setup option.

This is enabled by default for PX4 SITL builds (see the Parameters topic for information on how to find and set a particular parameter).

Configuring the Joystick

To configure a joystick:

1. Shut down *QGroundControl*
2. Connect the Joystick or Gamepad to a USB port
3. Start *QGroundControl* and connect to a vehicle
4. Select the **Gear** icon (Vehicle Setup) in the top toolbar and then **Joystick** in the sidebar. The screen below will appear.



5. Press the **Calibrate** button and then follow the on-screen instructions to calibrate/move the sticks.
6. Check the **Enable joystick input** checkbox
7. Make sure your joystick is selected in the **Active joystick** dropdown.
8. Select the flight modes/vehicle functions activated by each joystick button. A maximum of 16 joystick *button actions*

can be set.
9. Test the buttons and sticks work as intended by pressing them, and viewing the result in the Axis/Button monitor.

Supported Joysticks

The following joysticks/controllers have been shown to work with relatively recent *QGroundControl* builds.

Sony Playstation 3/4 Controllers

These are both highly recommended. They work well "out of the box" and have many buttons that you can map to flight modes.

FrSky Taranis XD9 plus

The *FrSky Taranis XD9 plus* remote control can also be connected as a joystick. You will need to connect it via the USB port on the back.

The Taranis does not allow you to use button options (to be precise, you can set the options, but toggling the buttons on your transmitter does not cause them to be pressed).

> The Taranis is an open system that is openly being worked on. It is possible that at time of writing there is a firmware or configuration that allows it to work effectively as a joystick.

Logitech Gamepad F310

The Logitech Gamepad F310 has been tested via USB on MacOSX "Sierra".

Logitech Extreme 3D Pro

The Logitech Extreme 3D Pro Joystick has been tested on all platforms (Linux, Windows, Mac OSX). This is a single stick controller that can also be twisted. The main stick axes are used for pitch and roll, while the twist action is used for yaw. The throttle is mapped onto a separate wheel.

Logitech F710 Gamepad

This gamepad is great for flying a multirotor manually via QGroundControl. It works on Windows, Linux and Mac OS.

Mac OS Leopard / Lion Setup

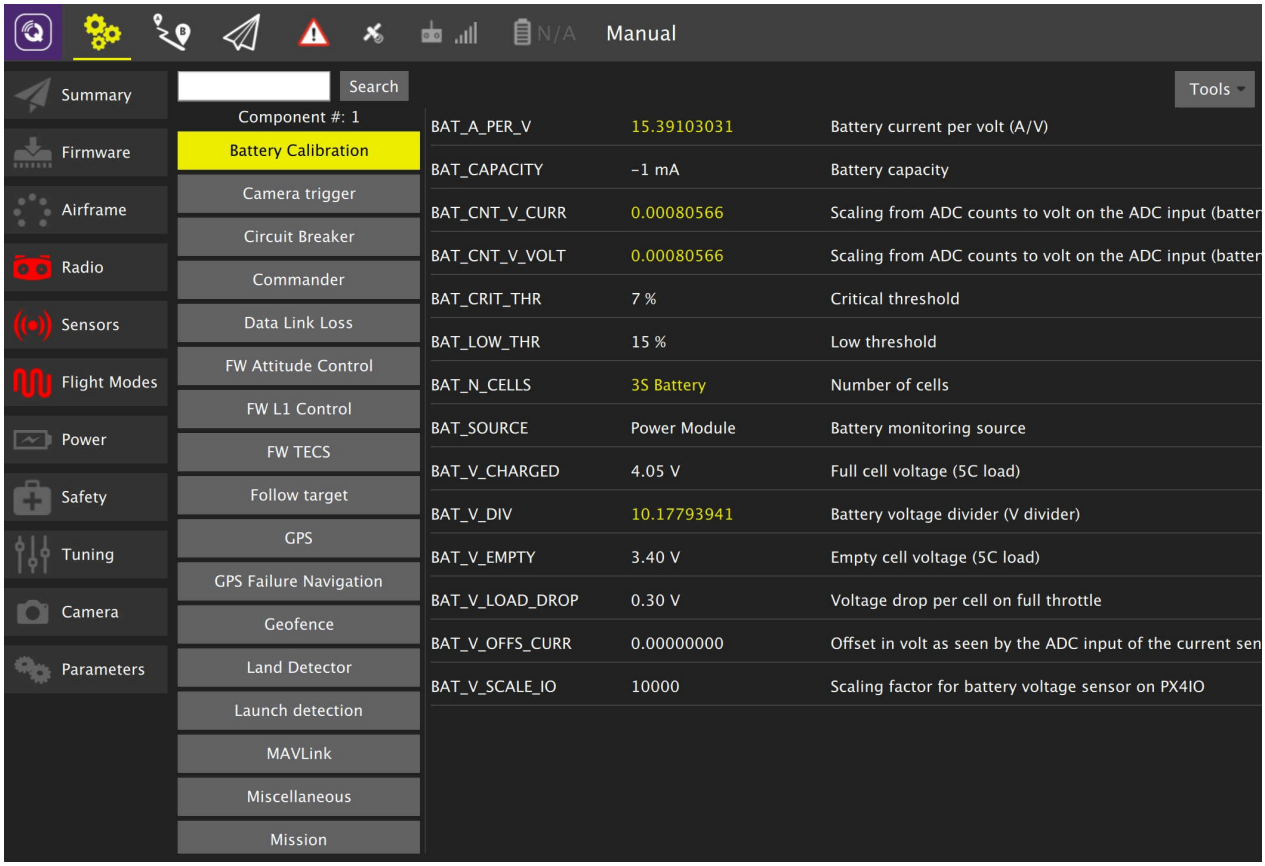
The F710 is detected under Leopard / Lion but is not automatically configured as an input device. In order to get a working configuration, the F710 has to be recognised as *Rumblepad2*.

First check how it is recognised: **Apple > About this Mac > Additional Information > System Report > USB**. I it is detected as "Logitech Cordless RumblePad 2" then nothing further needs to be done.

If it is detected as a "Logitech Wireless 710", perform these steps:

1. Unplug the USB receiver of the gamepad
2. Prepare to quickly plug it into a USB port
3. Hit the Logitech button (its silver with the Logitech Logo on it in the center of the pad)
4. Quickly connect the USB receiver to your Mac
5. The pad should now be detected in the system report as "Logitech Cordless RumblePad 2". If not, retry the above steps.

Parameters



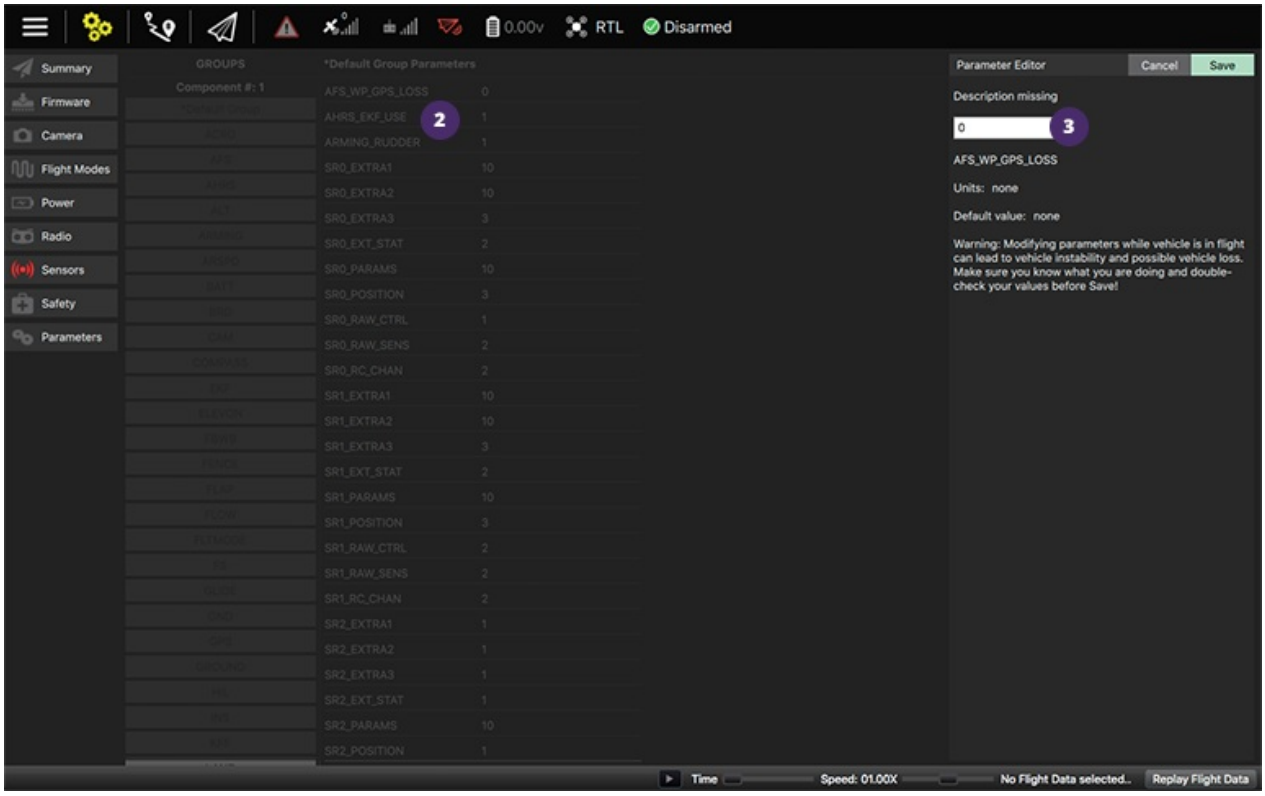
Note: This image is from a vehicle running PX4 Pro firmware. ArduPilot works similary, just the parameter set will differ.

The Parameters screen allows you to modify any of the parameters associated with the vehicle.

The parameters are organized in groups. You can select a group of parameters to view by clicking on one of the group buttons to the left. In the example image the "Battery Calibration" group is selected.

Changing a value

To change the value of a parameter click on the parameter value in the list. This will open a side dialog which allows you to update the value and also provides additional detailed information on the parameter.

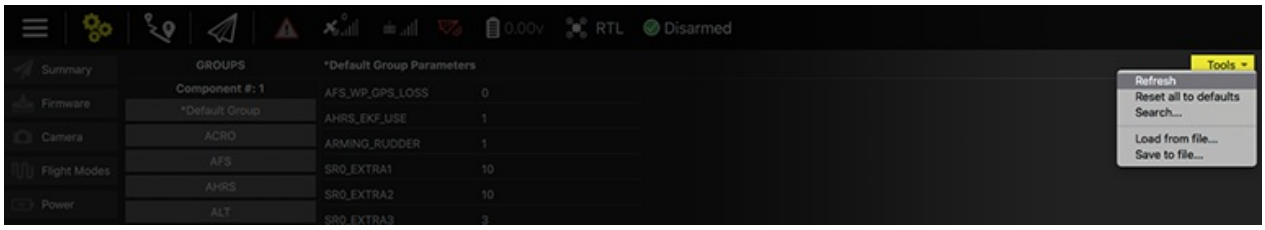


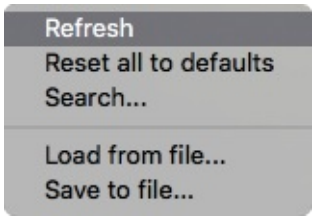
Note: This image is out of date.

Searching for a parameter

Enter the string you are searching for in the text field to right of the Search button and then click Search. This will show you a list of parameters which match you search criteria. Search will not only match on parameter names, but it will also match on parameter descriptions.

Tools





Note: These images are out of data.

You can select additional options from the Tools menu.

Refresh
Refresh the parameter values by re-requesting all of them from the vehicle.

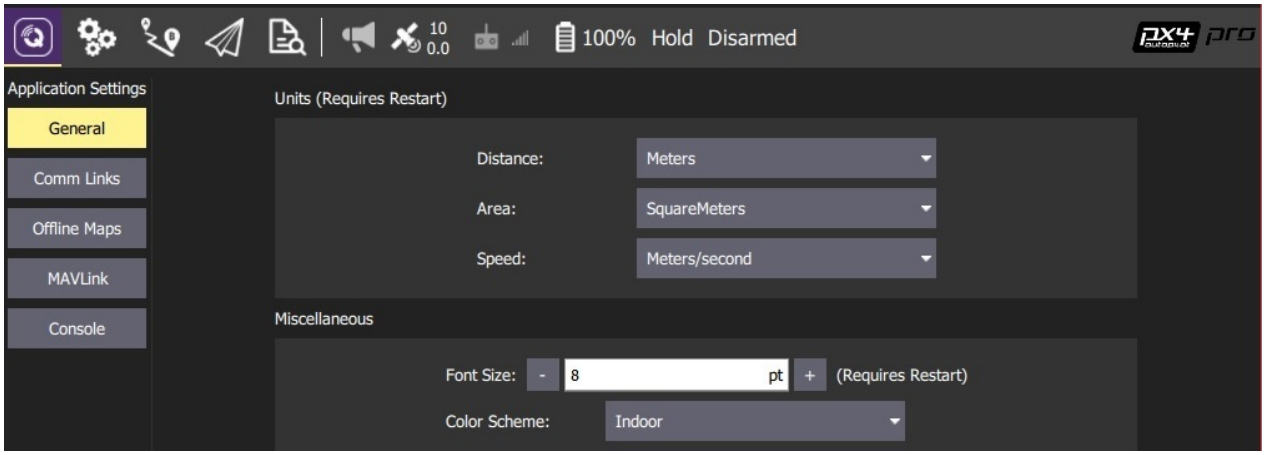
Reset all to defaults
Reset all parameters to their original default values.

Load from file / Save to file
Load parameters from an existing file or Save your current parameter settings to a file.

Settings View

The *Settings View* is used to configure the settings for the *QGroundControl* application (rather than a specific vehicle). You do not have to have a vehicle connected to change these values.

You can switch between the various settings options by clicking the buttons in the left-sidebar.



Settings Options

General

The main application configuration settings. These are used to specify: display units, autoconnection devices, video display and storage, RTK GPS, etc.

Comm Links

Allows you to manually create communication links and connect to them. *Keep in mind that normally this is not needed since QGroundControl will automatically connect to the most common devices.*

Offline Maps

Allows you to cache maps for use while you have no Internet connection.

Mavlink

Settings associated with the MAVLink connection to a vehicle.

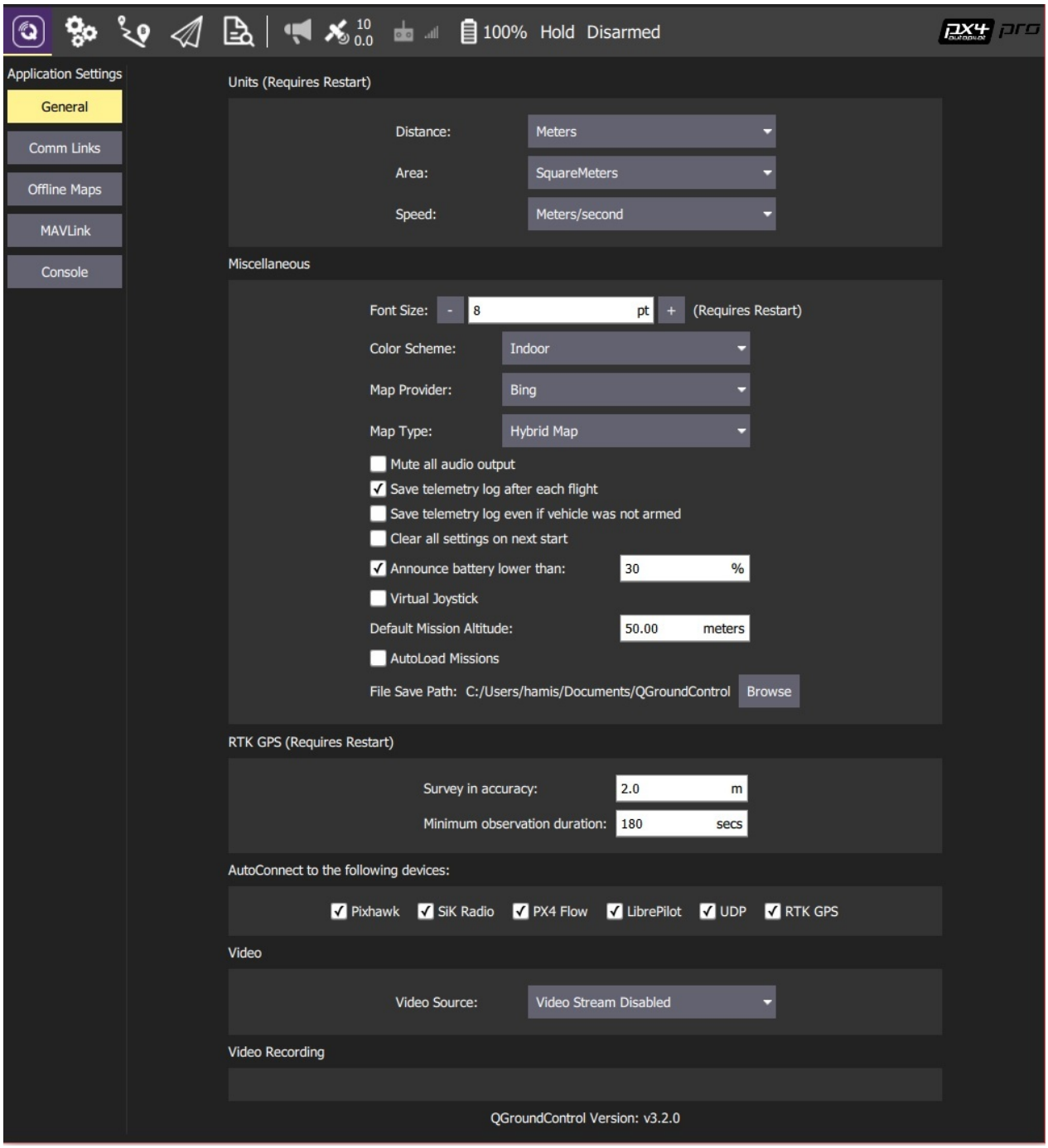
Console

Used to capture application logs for help with diagnosing application problems.

General Settings (Settings View)

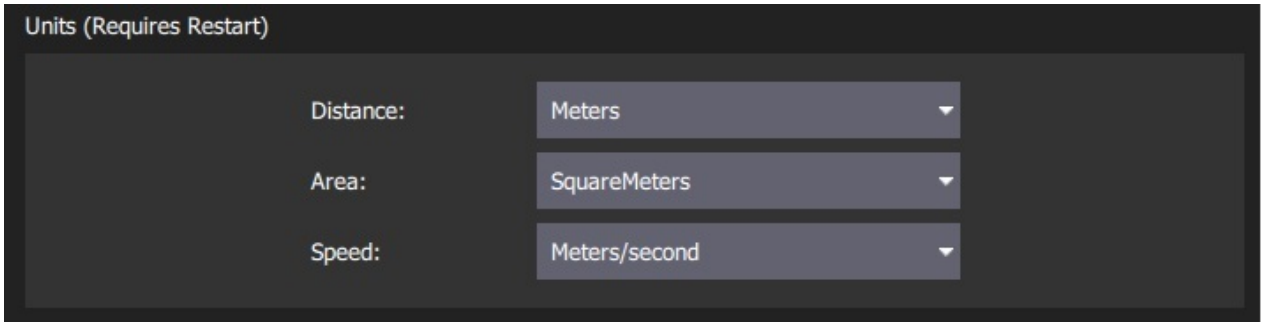
The general settings (**SettingsView > General Settings**) are the main place for application-level configuration. Settable values include: display units, autoconnection devices, video display and storage, RTK GPS, and other miscellaneous settings.

> Values are settable even if no vehicle is connected. Settings that require a vehicle restart are indicated in the UI.



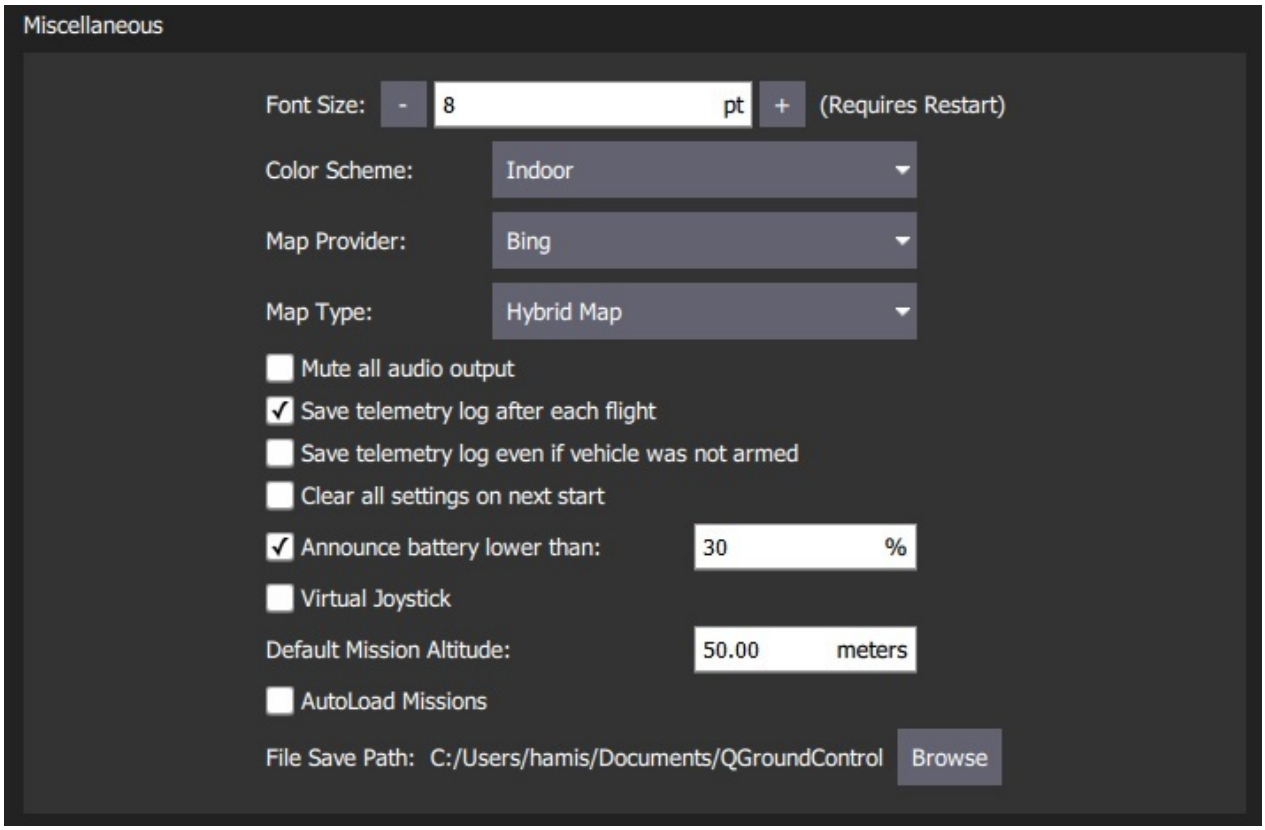
Units

This section defines the display units used for: distance, area and speed.



Miscellaneous

This section defines a number of miscellaneous settings, related to (non exhaustively): font sizes, colour schemes, map providers, map types, telemetry logging, audio output, low battery announcement levels, default mission altitude, virtual joysticks, mission autoloading, default file save path etc.

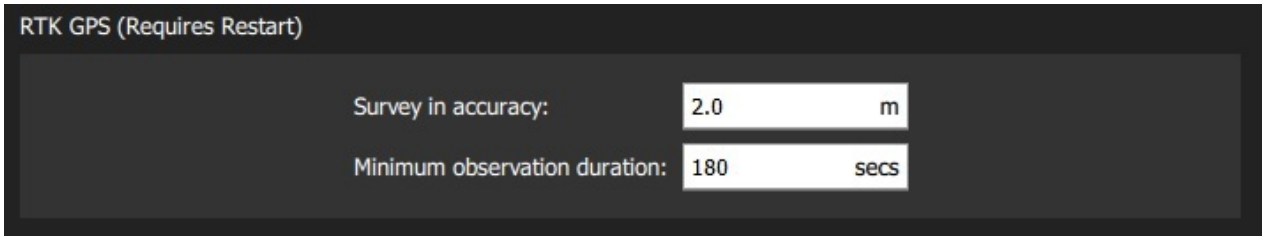


RTK GPS

This section specifies the RTK GPS "Survey-in" settings:

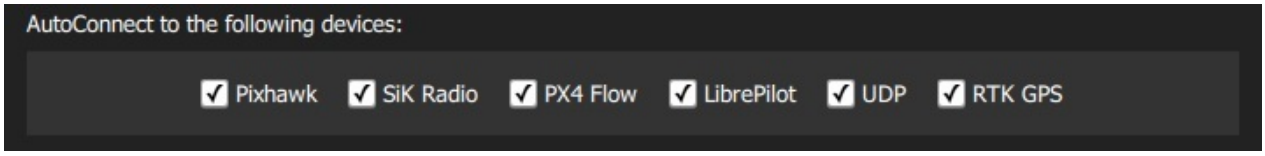
- **Survey-in accuracy:** The minimum position accuracy for the RTK Survey-in process to complete.
- **Minimum observation duration:** The minimum time that will be taken for the RTK Survey-in process.

> The *Survey-In* process is a startup procedure required by RTK GPS systems to get an accurate estimate of the base station position. The process takes measurements over time, leading to increasing position accuracy. Both of the setting conditions must met for the Survey-in process to complete. For more information see RTK GPS (PX4 docs) and GPS- How it works (ArduPilot docs).



Autoconnect to the following devices

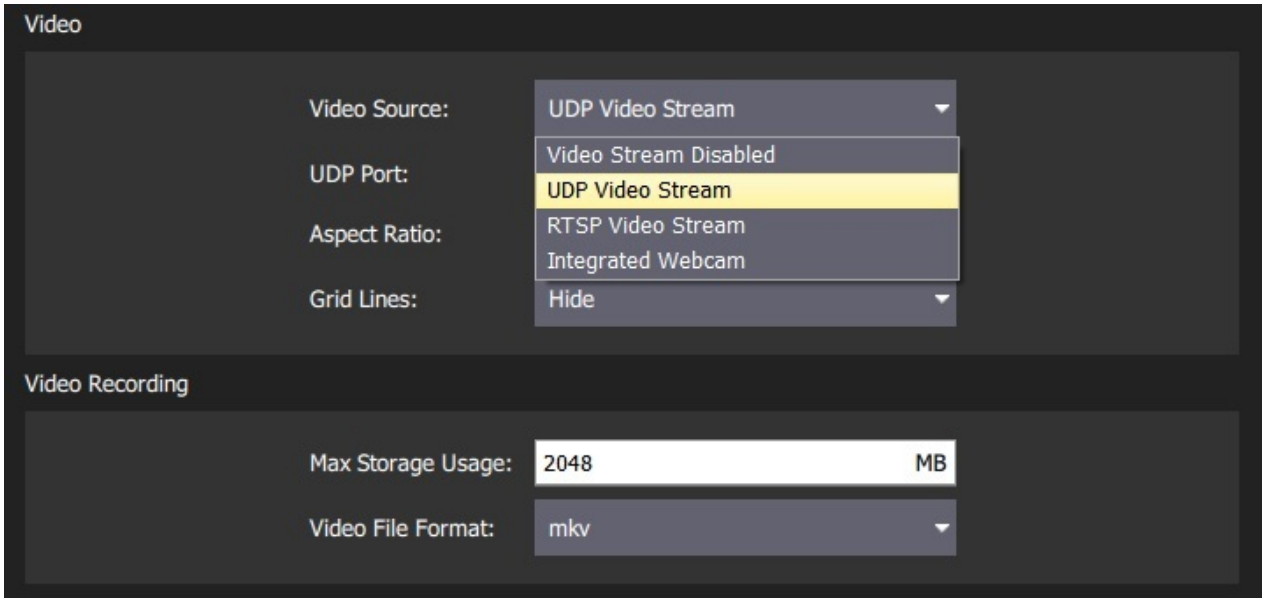
This section defines the set of devices to which *QGroundControl* will auto-connect. Options include: **Pixhawk**, **SiK Radio**, **PX4 Flow**, **Libre Pilot**, **UDP**, **RTK GPS**.



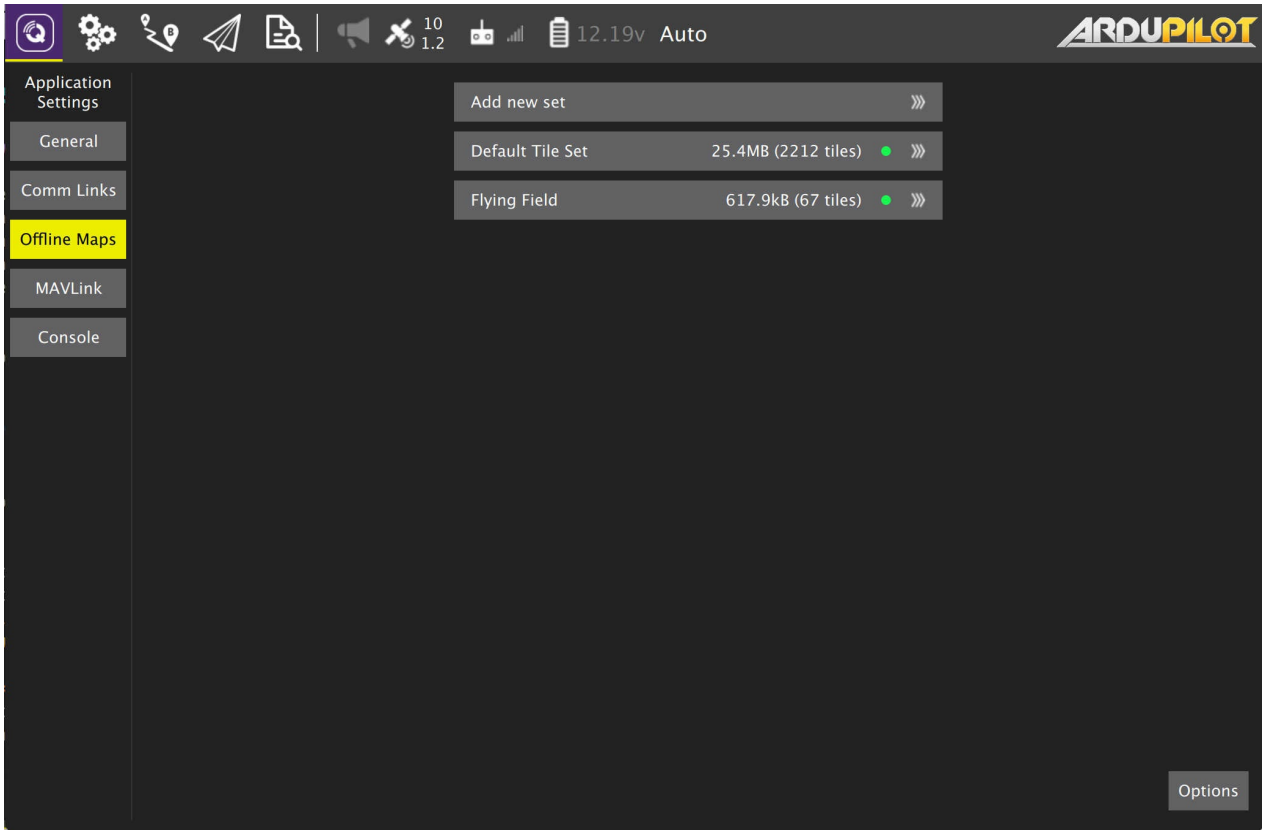
Video / Video Recording

The *Video* section is used to define the source and connection settings for video that will be displayed in *Fly View*. The *Video Recording* section is used to specify the file format and maximum allocated file storage for storing video.

> The values displayed in this setting depend on the video source. If no video source is specified then no other video or video recording settings will be displayed (below we see the settings when UDP source is selected).



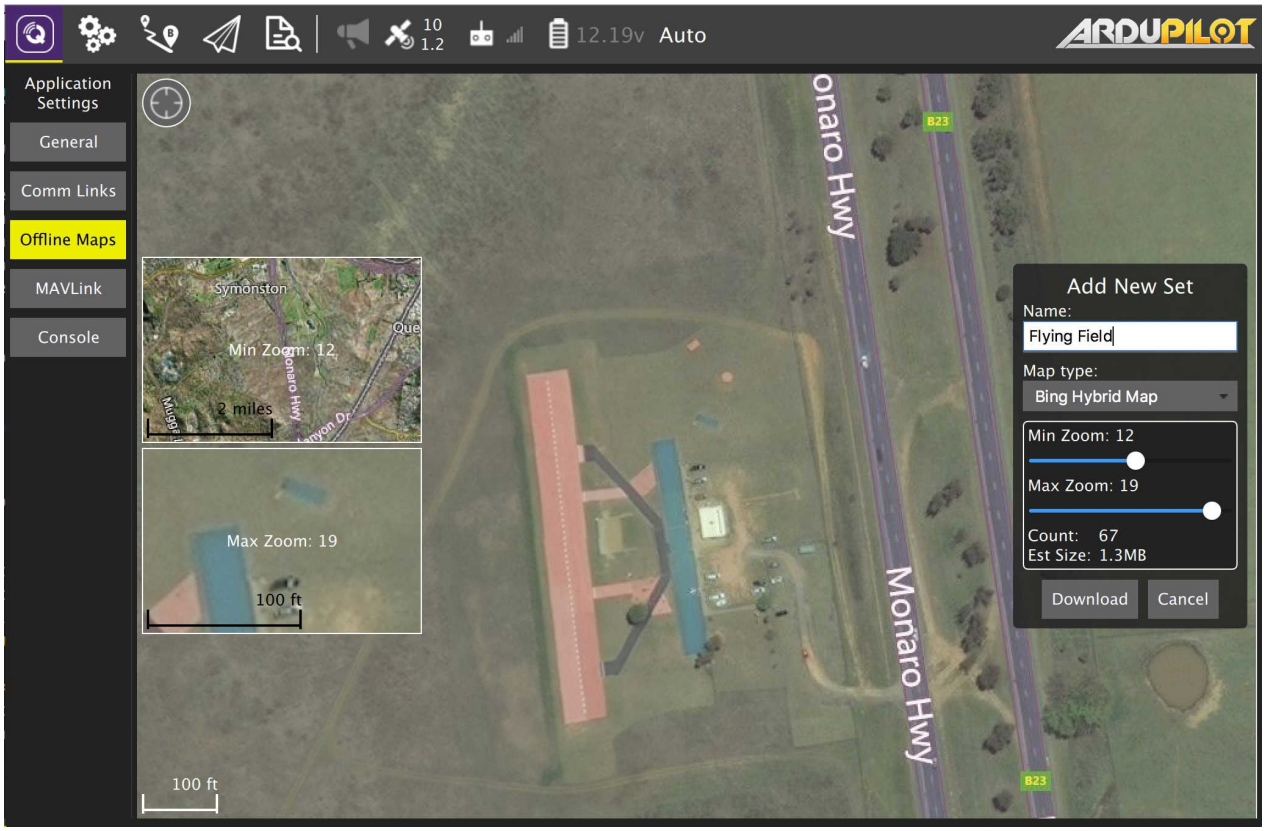
Offline Maps



Offline Maps allows you to cache map tiles for use when not connected to the internet. You can create multiple offline sets, each for a different location.

Add new set

To create a new offline map set, click "Add new set". Which will take you to this page:



From here you can name you set as well as specify the zoom levels you want to cache. Move the map to the position you can to cache and then set the zoom levels and click Download to cache the tiles.

To the left you can see previews of the min and max zoom levels you have chosen.

Virtual Joystick (PX4 only)

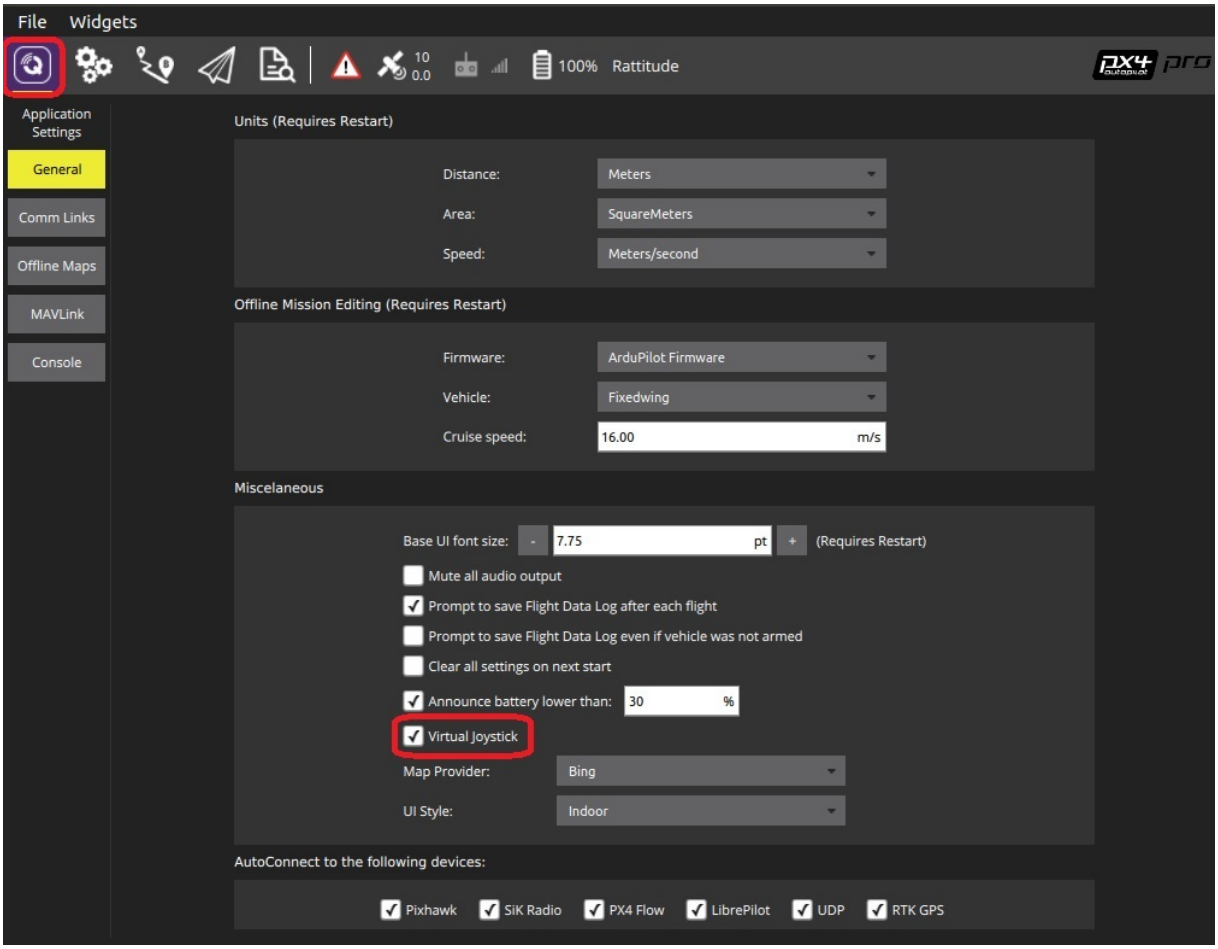
QGroundControl allows you to control a vehicle with on-screen virtual thumbsticks. These are displayed as shown below in the flight view.

> Thumbstick control is not as responsive as using an RC Transmitter (because the information is sent over MAVLink). Another alternative is to use a USB Joystick/Gamepad.

Enable the thumbsticks

To enable the virtual joysticks:

1. Select the **Q** icon (*Application Settings*) from the top toolbar and then **General** from the sidebar.
2. Select the **Virtual joystick** checkbox


File
Widgets
100%
Rattitude
Application Settings
General
Comm Links
Offline Maps
MAVLink
Console
Units (Requires Restart)
Distance:
Meters
Area:
SquareMeters
Speed:
Meters/second
Offline Mission Editing (Requires Restart)
Firmware:
ArduPilot Firmware
Vehicle:
Fixedwing
Cruise speed:
16.00
m/s
Miscelaneous
Base UI font size:
7.75
pt
(Requires Restart)
Mute all audio output
Prompt to save Flight Data Log after each flight
Prompt to save Flight Data Log even if vehicle was not armed
Clear all settings on next start
Announce battery lower than:
30
%
Virtual Joystick
Map Provider:
Bing
UI Style:
Indoor
AutoConnect to the following devices:
Pixhawk
SiK Radio
PX4 Flow
LibrePilot
UDP
RTK GPS

Releases

This section contains information about releases and daily builds.

Release Notes

This topic contains the cumulative release notes for *QGroundControl*.

Stable Version 3.2 (Current)

> More detailed release notes for version 3.2 can be found here.

This section contains a high level and *non-exhaustive* list of new features added to *QGroundControl* in version 3.2.

- **Settings**
  - **File Save path** - Specify a save path for all files used by QGC.
  - **Telemetry log auto-save** - Telemetry logs are now automatically saved without prompting.
  - **AutoLoad Plans** - Used to automatically load a Plan onto a vehicle when it first connects.
  - **RTK GPS** - Specify the Survey in accuracy and Minimum observation duration.
- **Setup**
  - ArduPilot only
    - **Pre-Flight Barometer and Airspeed calibration** - Now supported
    - **Copy RC Trims** - Now supported
- **Plan View**
  - **Plan files** - Missions are now saved as .plan files which include the mission, geo-fence and rally points.
  - **Plan Toolbar** - New toolbar which shows you mission statistics and Upload button.
  - **Mission Start** - Allows you to specify values such as flight speed and camera settings to start the mission with.
  - **New Waypoint features** - Adjust heading and flight speed for each waypoint as well as camera settings.
  - **Visual Gimbal direction** - Gimbal direction is shown on waypoint indicators.
  - **Pattern tool** - Allows you to add complex patterns to a mission.
    - Fixed Wing Landing (new)
    - Survey (many new features)
  - **Fixed Wing Landing Pattern** - Adds a landing pattern for fixed wings to your mission.
  - **Survey** - New features
    - **Take Images in Turnarounds** - Specify whether to take images through entire survey or just within each transect segment.
    - **Hover and Capture** - Stop vehicle at each image location and take photo.
    - **Refly at 90 degree offset** - Add additional pattern at 90 degree offset to original so get better image coverage.
    - **Entry location** - Specify entry point for survey.
    - **Polygon editing** - Simple on screen mechanism to drag, resize, add/remove points. Much better touch support.
- **Fly View**
  - **Arm/Disarm** - Available from toolbar.
  - **Guided Actions** - New action toolbar on the left. Supports:
    - Takeoff
    - Land
    - RTL
    - Pause
    - Start Mission
    - Resume Mission - after battery change
    - Change Altitude

        - Land Abort
        - Set Waypoint
        - Goto Location
    - **Remove mission after vehicle lands** - Prompt to remove mission from vehicle after landing.
    - **Flight Time** - Flight time is shown in instrument panel.
    - **Multi-Vehicle View** - Better control of multiple vehicles.
- **Analyze View** - New
    - **Log Download** - Moved to Analyze view from menu
    - **Mavlink Console** - NSH shell access
- **Support for third-party customized QGroundControl**
    - Standard QGC supports multiple firmware types and multiple vehicle types. There is now support in QGC which allows a third-party to create their own custom version of QGC which is targeted specifically to their custom vehicle. They can then release their own version of QGC with their vehicle.

Stable Version 3.1

New Features

- Survey mission support
- GeoFence support in Plan View
- Rally Point support in Plan View (ArduPilot only)
- ArduPilot onboard compass calibration
- Parameter editor search will now search as you type for quicker access
- Parameter display now supports unit conversion
- GeoTag images from log files (PX4 only)
- System health in instrument panel
- MAVLink 2.0 support (no signing yet)

Major Bug Fixes

- Fixed crash after disconnect from Vehicle
- Fixed android crash when using SiK Radios
- Many multi-vehicle fixes
- Bluetooth fixes

QGroundControl v3.2 Release Notes (Detailed)

This topic contains a high level and *non-exhaustive* list of new features added to *QGroundControl* in version 3.2.

Settings

Telemetry log auto-save

If you have *Save telemetry log after each flight* turned on you will no longer be prompted as to where to save the log each time the vehicle disarms. Logs will automatically be saved to the save path specified in *Settings*.

AutoLoad plans

If this setting is turned on, QGC will automatically upload a plan to the vehicle when it connects. The plan file must be named **AutoLoad#.plan** where the # is replaced with the vehicle id. The location of the plan file is in the file save path as specified above.

File Save path

You can now specify a save path which QGC will use as the default location to save files such as Parameters, Telemetry or Mission Plans.

RTK GPS

You can now specify the *Survey in accuracy* and *Minimum observation duration* for use with a connected RTK GPS. See SettingsView > General.

Setup

ArduPilot - Pre-Flight Barometer and Airspeed calibration

This is now supported from the Sensors page.

ArduPilot - Copy RC Trims

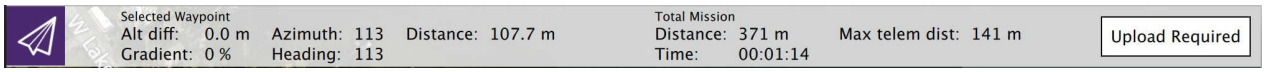
This is now supported from the Copy Trims button on the Radio setup page.

Plan View

Plan files

Previous version of QGC saved missions, geo-fences and rally points in separate files (**.mission**, **.fence**, **.rally**). QGC now save all information related to a flight plan into a single file called a *Plan File* with a file extension of **.plan**.

Plan Toolbar

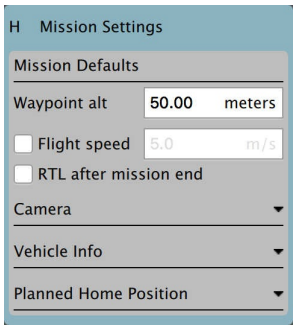


The new Plan Toolbar is displayed at the top of the Plan View. It shows you information related to the currently selected waypoint as well as statistics for the entire mission.

When you are connected to a vehicle it also show an *Upload* button which can be used to upload the plan to the vehicle.

Mission Settings

The Mission Settings panel allows you to specify values which apply to the entire mission, or settings you want to control right at the beginning of a mission. This is the first item in the mission list on the right of the screen.



Mission defaults

Waypoint alt

This specifies the default altitude for newly added mission items. If you update this value while you have a mission loaded it will prompt you to update all the the waypoints to this new altitude.

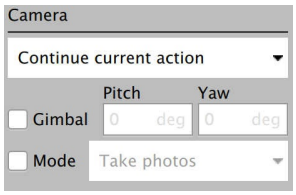
Flight speed

This allows you to set the flight speed for the mission to be different than the default mission speed.

RTL after mission end

Check this if you want your vehicle to RTL after the final mission item.

Camera section

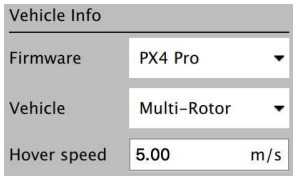


The camera section allows you to specify a camera action to take, control the gimbal and set your camera into photo or video mode.

The camera actions available are:

- Continue current action
- Take photos (time)
- Take photos (distance)
- Stop taking photos
- Start recording video
- Stop recording video

Vehicle Info section

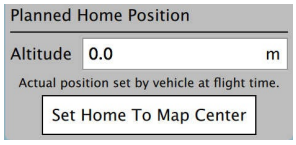


When planning a mission the firmware being run on the vehicle as well as the vehicle type must be known in order for QGroundControl to show you the mission commands which are appropriate for your vehicle.

If you are planning a mission while you are connected to your vehicle the Firmware and Vehicle Type will be determined from the vehicle. If you are planning a mission while not connected to a vehicle you will need to specify this information yourself.

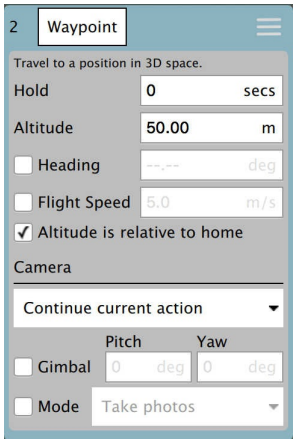
The additional value that can be specified when planning a mission is the vehicle flight speed. By specifying this value, total mission or survey times can be approximated even when not connected to a vehicle.

Planned Home Position



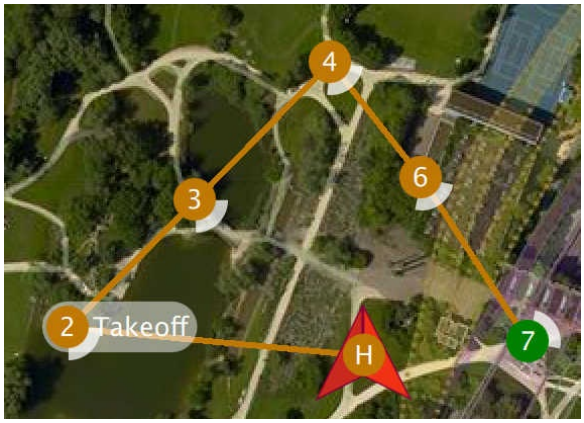
The planned home position allows you to simulate the vehicle's home position while planning a mission. This way you see the waypoint trajectory for your vehicle from takeoff to mission completion. Keep in mind that this is only the "planned" home position and you should place it where you plan to start the vehicle from. It has no actual impact on flying the mission. The actual home position of a vehicle is set by the vehicle itself when arming.

New Waypoint features



- You can now adjust heading and flight speed for each waypoint.
- There is a camera section available for camera changes on each waypoint. Explanation of Camera Section can be read under Mission Settings above.

Visual Gimbal direction



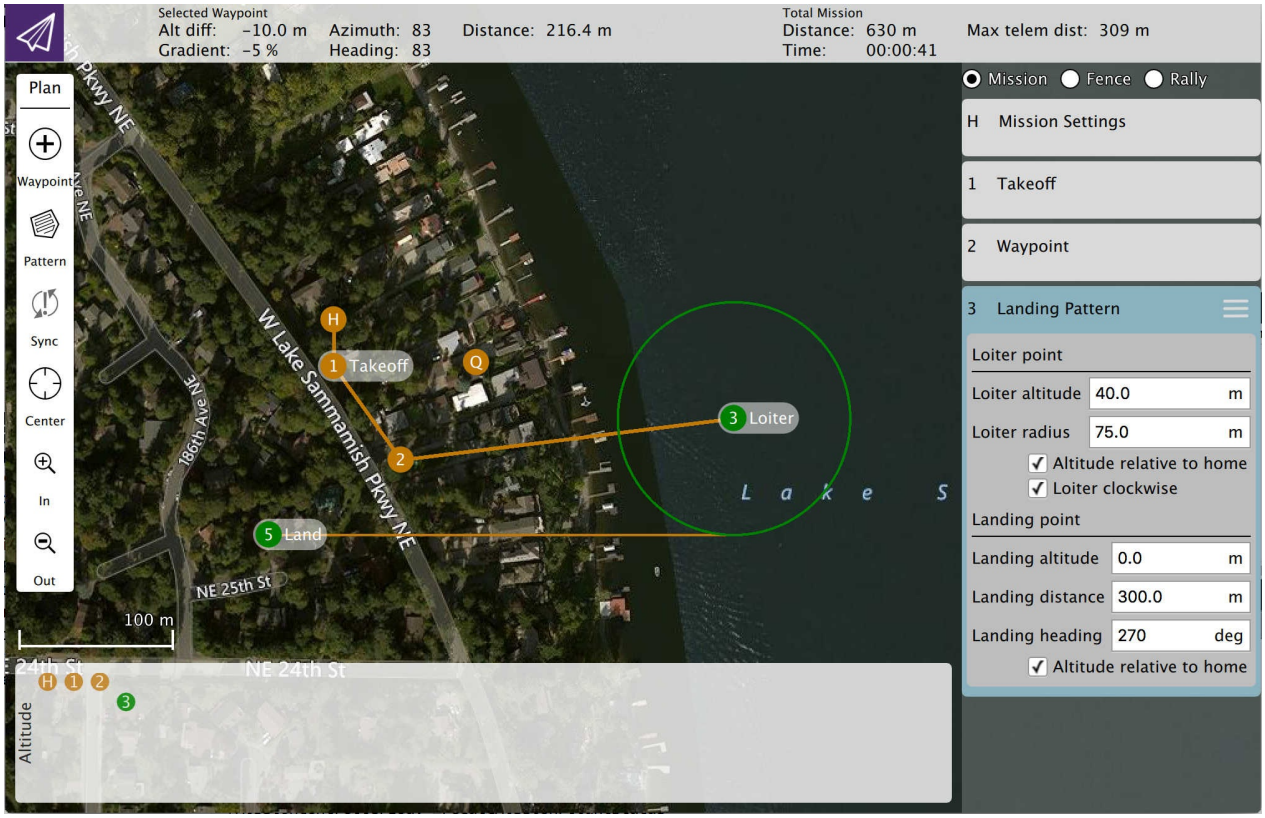
If you specify gimbal yaw changes on waypoints, both the plan and fly views will show you a visual representation of the gimbal direction.

Pattern tool

There is a new *Pattern tool*. The following patterns are supported:

- Fixed Wing Landing (new)
- Survey (with new features)

Fixed Wing Landing Pattern



This adds a landing pattern for fixed wings to your mission. The first point of the pattern is the loiter point which commands to vehicle to loiter to a specific altitude. Once that altitude is reached, the vehicle will begin the landing sequence and fly down to the specified landing spot.

Both the loiter and land points can be dragged to adjust. Also all the various values associated with the pattern can be adjusted.

Survey (new features)

- Images are not automatically taken in the turnaround zone outside of the polygonal survey area.
- There is a new *Hover and Capture* option which can be used to capture the highest quality image at each image location. The vehicle will stop at each image location prior to taking the image such that the vehicle is stable while the image is taken.
- There is a new option to re-fly the survey grid at a 90 degree angle to the previous pass. This allows you to generate much denser coverage for the images.

Manipulating the survey area polygon is now easier to use on tablets with touch screens:

- You can drag the entire polygon to a new location by dragging the center point handle.
- Each polygon vertex can be dragged to a new location.
- To remove a polygon vertex, simple click on the drag handle for it.
- Click on the **+** handles to add a new vertex between two existing vertices.

Fly View

RTK GPS

RTK status is now shown in the toolbar.

Arm/Disarm

There is an armed/disarmed indicator in the toolbar. You can click it to arm/disarm your vehicle. If you click Disarm in the toolbar while your vehicle is flying you will provided the option to Emergency Stop your vehicle.

Guided Actions

- Takeoff
- Land
- RTL
- Pause

- Actions
  - Start Mission
  - Resume Mission
  - Change Altitude
  - Land Abort
- Direct interaction with map
  - Set Waypoint
  - Goto Location

Resume Mission

The Resume Misison guided action is used to resume a mission after performing an RTL from within the mission to perform a battery change. After the vehicle lands from RTL and you have disconnected the battery **do not** disconnect QGC from the Vehicle. Put in your new battery and QGC will detect the vehicle again and automatically restore the connection. Once this happens you will be prompted with a Resume Mission confirmation slider. If you want to resume the mission, confirm this and the mission will be rebuilt from your last waypoint travelled through. Once the mission is rebuilt you will be presented with another Resume Mission slide whic allows you to review the rebuilt mission before starting it again. Confirm this Resume Mission slider to continue on with the mission.

How resume mission rebuilding works

In order to resume a mission you cannot simply continue it from the last mission item the vehicle ran. The reason is is that may skip over important change speed commands or camera control commands which are prior to that item in the mission. If you skippped over those the remainder of the mission will not run correctly. In order to make resume mission work correctly QGC rebuilds the mission looking backwards from the last mission item flown and automatically appends relevant commands to the front of the mission. By doing this the state of the mission prior to the resume point is restore. The following mission commands are the ones scanned for:

```
* MAV_CMD_DO_CONTROL_VIDEO
* MAV_CMD_DO_SET_ROI
* MAV_CMD_DO_DIGICAM_CONFIGURE
* MAV_CMD_DO_DIGICAM_CONTROL
* MAV_CMD_DO_MOUNT_CONFIGURE
* MAV_CMD_DO_MOUNT_CONTROL
* MAV_CMD_DO_SET_CAM_TRIGG_DIST
* MAV_CMD_DO_FENCE_ENABLE
* MAV_CMD_IMAGE_START_CAPTURE
* MAV_CMD_IMAGE_STOP_CAPTURE
* MAV_CMD_VIDEO_START_CAPTURE
* MAV_CMD_VIDEO_STOP_CAPTURE
* MAV_CMD_DO_CHANGE_SPEED;
* MAV_CMD_NAV_TAKEOFF
```

Remove mission after vehicle lands

You will be prompted to remove the mission from the vehicle after the mission completes and the vehicle lands and disarms. This is meant to prevent issues where stale missions are unknowingly left on a vehicle cause unexpected behavior.

Instrument panel

Camera trigger

Flight Time

Flight time is now available for display in the instrument panel. For new users, flight time will be shown by defeault. For existing users who have already modified their instrument panel values you will have to add it yourself if you want to use it.

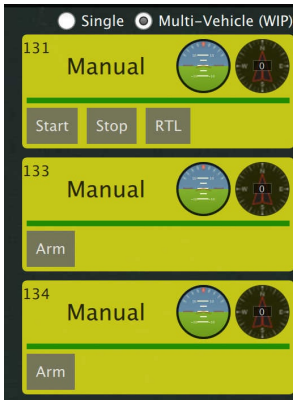
Analyze View

- Log download moved to Analyze view from menu
- New GeoTag images support for PX4 Pro firmware
- New Mavlink Console which provides access the the nsh shell running on the vehicle.

Multi-Vehicle View

There is a new view available when you have multiple vehicles connected to QGC. It will only show up when more than one vehicle is connected. When that happens you will see an additional set of radio button at the top right of the Plan view.

Click the **Multi-Vehicle** radio button to replace the instrument panel with the multi-vehicle list:



The example above shows three vehicles. The numbers are the vehicle id. In the large font is the current flight mode. You can click the flight mode name to change to a different flight mode. To the right are small version of the instruments for each vehicle. You can command the vehicle to do the following actions from the control panel:

- Arm/Disarm
- Start/Stop a mission
- Return to Launch
- Take Control back of the vehicle by returning to manual control from a mission.

Multi-Vehicle Gotchas - Unique vehicle ids

Each vehicle connected to QGC must have a unique id. Otherwise QGC will think the vehicles are actually the same vehicle. The symptom of this is the Plan view jerking around as it tries to position itself to one vehicle and then the next. For PX4 Pro firmwares this is the `MAV_SYS_ID` parameter. For ArduPilot firmwares it is the `SYSID_THISMAV` parameter.

Support for third-party customized QGroundControl

Standard QGC supports multiple firmware types and multiple vehicle types. There is now support in QGC which allows a third-party to create their own custom version of QGC which is targeted specifically to their custom vehicle. They can then release their own version of QGC with their vehicle.

Daily Builds

Daily Builds of *QGroundControl* have the absolute latest set of new features.

> Daily Builds are less tested than stable builds. Use at your own risk!

These can be downloaded from the links below (install as described in Download and Install):

- Windows
- OS X
- Linux
  - AppImage
  - Compressed Archive
- Android (Google Play)

  > The old opt-in beta test is no longer valid. If you were a member of that you should opt-out.
- iOS (Open Beta via Test Flight)

Installing iOS Beta using Test Flight

The iOS version of *QGroundControl* is currently in open Beta. You can opt-in to the Beta by adding your email address here.

Once installed you will be notified of new versions through the Test Flight app. The release frequency of iOS beta builds is on an ad-hoc basis more on the order of a new build every week or two.

> Due to device restrictions on iOS only WiFi connections are supported.

Daily Build Major Changes

This topic contains a high level and *non-exhaustive* list of new features added to *QGroundControl* since the last stable release. These features are available in daily builds.

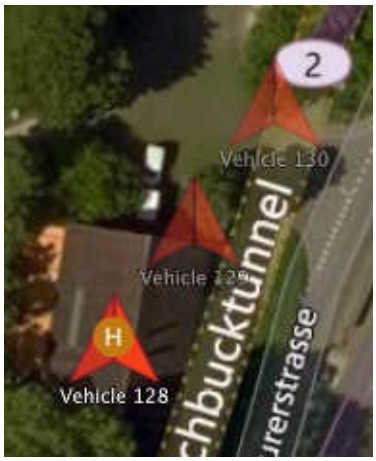
- Plan: Fixed Wing Landing Pattern: You can now adjust the distance from the loiter to land point by either distance or glide slope fall rate.
- Fly: Better display of vehicle icons when connected to multiple vehicles.
- Fly: Multi-Vehicle View supports commands which apply to all vehicles.
- Fly: Displays vehicles reported from ADS-B sensor.

Detailed Notes

Fly View

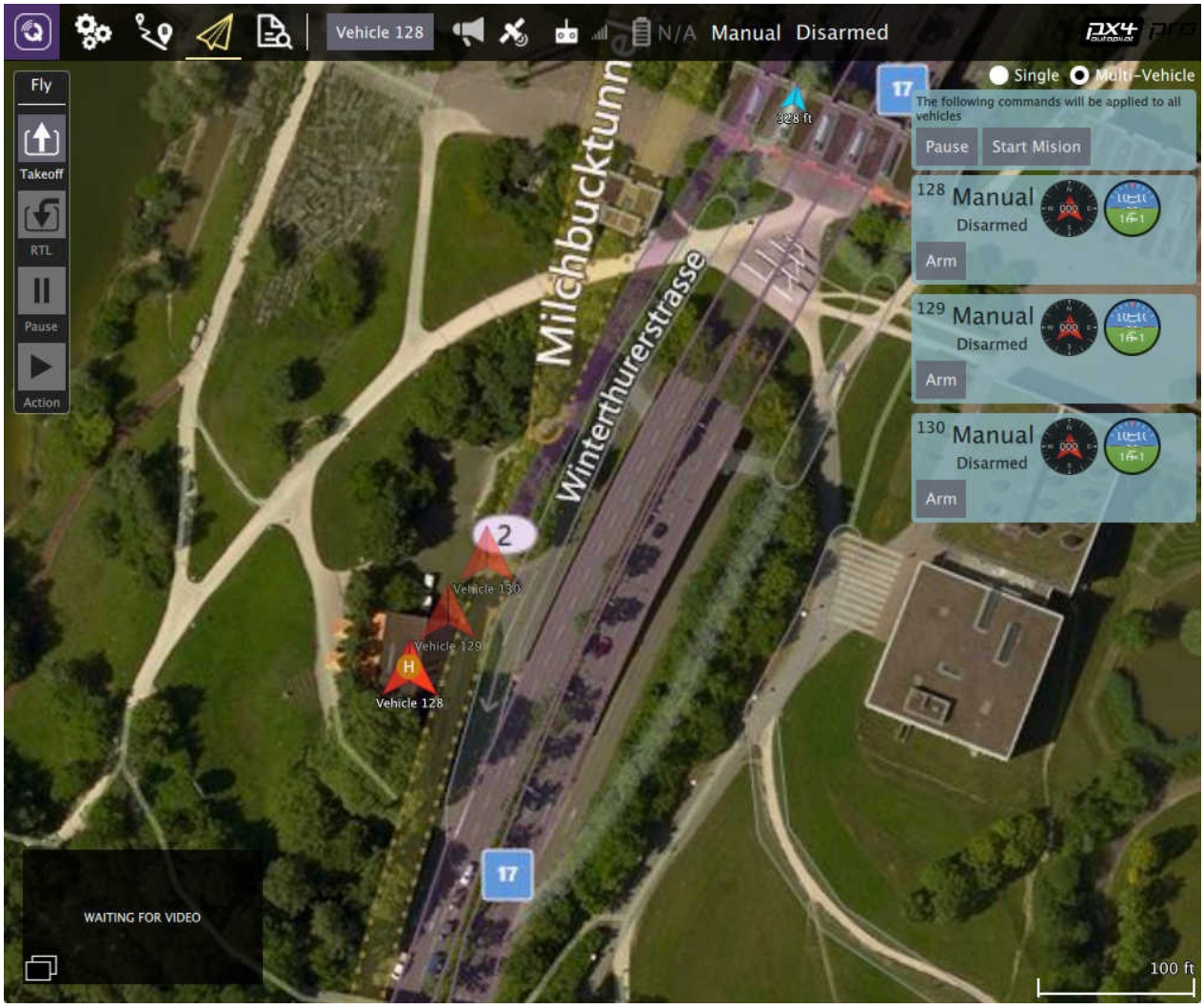
Multi-Vehicle vehicle indicators

When you are connected to multiple vehicles the vehicle id will be shown below the vehicle icon. The active vehicle will be opaque and the inactive vehicles will be semi-transparent.



Multi-Vehicle View supports batch commands

The multi-vehicle list now supports commands which apply to all vehicles.



The current list of available commands are Pause and Start Mission but that will be exapanded upon with further development.

ADS-B sensor vehicle display

Vehicle reported by ADS-B sensor on vehicle are shown on map as smaller blue icons with altitude and callsign below the icon.

Google Play Privacy Policy

QGroundControl may require access to personal and/or sensitive user data. None of this data is used outside of *QGroundControl*.

The list below explains how some of the data is used:

- Camera sensor: This is used for the purpose of overlaying the video with flight telemetry data.
- Location: This is used for tracking current user position on the map.

> This privacy policy is required in order to satisfy Google Play's User Data policy.

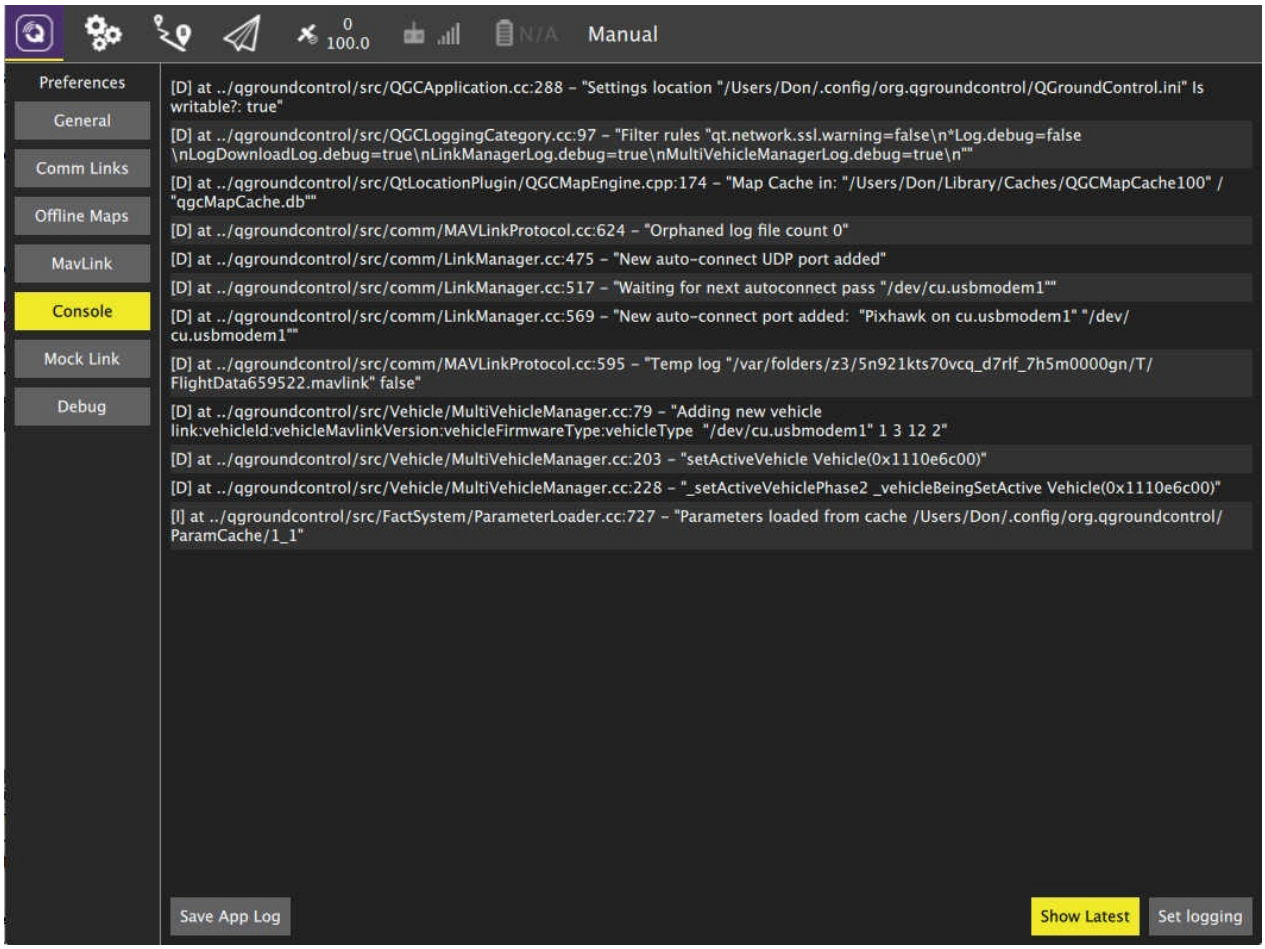
Support

This user guide is meant to be the main provider of support for *QGroundControl*. If you find incorrect or missing information please report an Issue.

Questions about *QGroundControl* should be raised in the associated flight stack's discussion server at the links below:

- PX4 Flight Stack (discuss.px4.io).
- ArduPilot Flight Stack (discuss.ardupilot.org).

Console Logging



The Console can be helpful tool for diagnosing *QGroundControl* problems. It can be found in the SettingsView. It allows you turn turn on/off the logging options available in *QGroundControl*. Click the "Set Logging" button to select logging options.

Commonly used logging options

- `LinkManagerLog` , `MultiVehicleManagerLog` - Debug connection problems.
- `LinkManagerVerboseLog` - Very noisy connection problem debugging. Continuous output of available serial ports.
- `FirmwareUpgradeLog` - Debug firmware flash issues.
- `ParameterLoaderLog` - Debug parameter load problems.
- `ParameterLoaderVerboseLog` - Debug parameter load problems with full trace of parameters coming/going/in system.
- `MissionManagerLog` - Debug mission protocol issues.
- `RadioComponentControllerLog` - Debug Radio calibration issues.

Logging from the command line

An alternate mechanism for logging is using the --logging command line option. This is handy if you are trying to get logs from a situation where *QGroundControl* crashes.

How you do this and where the traces are output vary by OS:

- Windows
  - You must open a command prompt, change directory to the **qgroundcontrol.exe** location, and run it from there:

    ```
    cd "\Program Files (x86)\qgroundcontrol"
    qgroundcontrol --logging:full</code>
    ```

  - When *QGroundControl* starts you should see a separate console window open which will have the log output
- OSX
  - You must run *QGroundControl* from Terminal. The Terminal app is located in Applications/Utilities. Once Terminal is open paste the following into it:

    ```
    cd /Applications/qgroundcontrol.app/Contents/MacOS/
    ./qgroundcontrol --logging:full
    ```

  - Log traces will output to the Terminal window.
- Linux

    ```
    ./qgroundcontrol-start.sh --logging:full
    ```

  - Log traces will output to the shell you are running from.

Developer Chat

The *QGroundControl* developers as well as many *QGroundControl* users can be found on the *QGroundControl* Gitter channel. If you are a heavy user of *QGroundControl* and want to keep up to date on the latest information or help with *QGroundControl* we suggest monitoring that channel.

GitHub Issues

Issues are used to track bugs against *QGroundControl* as well as feature requests for later versions. The current list of issues can be found on GitHub here.

Please don't enter Issues directly into GitHub without first contacting developers using the Gitter channel as described below.

Reporting Bugs

It is best to first ask any question around a bug on the Gitter channel. There are many cases where something that seems like a bug is actually a vehicle setup problem. After that if directed to you can enter a GitHub Issue for the bug using the link above.

Feature Requests

Feature Requests should also first go through the Gitter channel to determine whether the feature is actually missing. That way you may be directed to a feature you haven't found which covers what you were looking for. If the feature is truly not available, then you can enter a GitHub Issue for the request using the link above.

Help out your fellow QGroundControl users

Just like *QGroundControl* itself, the user guide is an open source, user created and supported GitBook. We welcome Pull Requests against the guide for fixes and/or updates.