PX4 Drone Guidelines Notes

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Pixhawk Quick-Start guide
https://docs.px4.io/main/en/assembly/quick_start_pixhawk4.html

Sensor Being Used (TBD):
https://store.bitcraze.io/products/loco-positioning-node

Drone Being Used (Fixed):
https://holybro.com/collections/x500-kits/products/px4-development-kit-x500-v2?variant=42765381959869

Ardupilot Controller:
https://firmware.ardupilot.org/Copter/2023-04/2023-04-28-20:04/Pixhawk6C/

Section 1: Basic Concepts and Getting Started

Getting Started:

Basic Concepts:

https://docs.px4.io/main/en/getting_started/px4_basic_concepts.html#escs-motors

What is a drone?

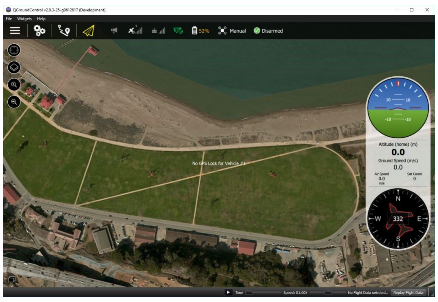
- A drone is an unmanned "robotic" vehicle that can be remotely or autonomously controlled.
- The "**brain**" of the drone is called an **autopilot**. It consists of **flight stack *software*** running on **vehicle controller ("flight controller") *hardware***.

What is PX4 Autopilot?

- powerful open source autopilot **flight stack *software*.**
    - **Features:**
    - Controls many different vehicle frames/types, including: aircraft (multicopters, fixed wing aircraft and VTOLs), ground vehicles and underwater vehicles.
    - Great choice of hardware for vehicle controllers, sensors and other peripherals.
    - Flexible and powerful flight modes and safety features.

What is QGroundControl?

- The dronecode ground control station: Use QGroundControl to **load (flash)** PX4 onto the **vehicle controller hardware**.
    - **Features:**
    - Set up the vehicle
    - change different parameters
    - get real-time flight information
    - create and execute fully autonomous missions.



Vehicles/Flight Controller (Basic):

- Primarily pixhawk series controllers

Sensors (Basic):

- Minimum Requirements for Stabilisation and vehicle state:
    - Gyroscope
    - Accelerometer
    - Magnetometer (compass)
    - Barometer
    - Positioning System - for automatic/assisted modes

Outputs: Motors, Servos, Actuators (Basic):

- Uses **outputs** to control **payloads**:
    - Motor speed (via **ESC (Electronic Speed Controller)**):
    - Flight surfaces (e.g. ailerons/flaps)
    - Camera triggers
    - Parachutes, Grippers, and other payloads.
- Outputs may be PWM ports or mapped to DroneCAN nodes (e.g. DoneCAN motor controllers)
- Outputs are divided into **MAIN** and **AUX** outputs, numbered (i.e. MAINn and AUXn, where n is from 1 to 6-8)
    - **Main**: core flight controls **(motors)**
    - **Aux:** payload controls or spare main **(sensors)**
    - E.G.: Generic Quadcopter, MAIN 1-4 is used for corresponding motors. Remaining outputs are used for **RC(Radio Control)** Passthrough
- ***Usually*** the ports are mapped to PWM outputs as shown above, which are commonly screen printed MAIN OUT and AUX OUT. **(See Guidelines for Further Details)**

ESC and Motors (Basic):

- PX4 flight drones use a brushless motors that are driven by the flight controller via an Electronic Speed Controller (ESC)
    - (the ESC converts a signal from the flight controller to an appropriate level of power delivered to the motor)

Radio Control/RC (Basic):

- Radio Control system is used to manually control the vehicle.
- Uses a radio transmitter to send and receive **telemetry** signals back from the autopilot.

GCS Joystick Controller (Basic):

- “Computer joystick” that can also be used to control the drone - converted to MAVLink messages.
- Can be used for simulation

Safety Switch:

- Switch that must be turned on in order to arm the drone (when armed, motors are powered and propellers can turn).

Data/Telemetry Radios (Basic):

- Provides a wireless MAVLink communication between ground control and drone.
- Functions:
    - tune parameters while a vehicle is in flight,
    - inspect telemetry in real-time,
    - change a mission on the fly.

***Offboard/Companion Computer (Basic):**

- PX4 can be controlled from a separate on-vehicle companion computer via a serial cable or wifi.
- See ROS for Robotics API

SD Cards (Removable Memory):
- Can store data from flights in the memory card.

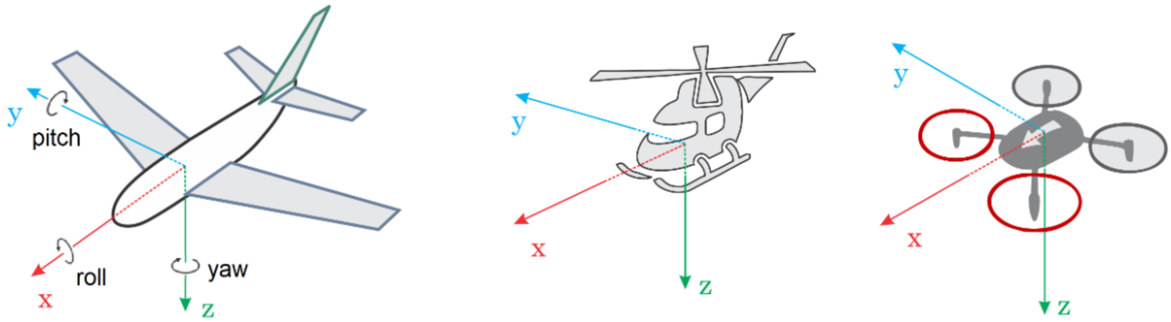
Arming and Disarming:
- 3 Power States:
    - **Disarmed**: All motors and actuators are unpowered.
    - **Prearmed**: Motors are unpowered, but actuators are not (allowing non-dangerous actuators to be bench-tested).
    - **Armed**: Motors and other actuators are powered, and propellers may be spinning.
- By default:
    - Vehicles are disarmed (unpowered) when not in use, and must be explicitly armed before taking off.
    - Vehicles automatically disarm if a pilot does not take off quickly enough (the disarm time is configurable).
    - Vehicles automatically disarm after landing (the disarm time is configurable).
    - Arming is prevented if the vehicle is not in a "healthy" state.
    - Arming is prevented if a VTOL vehicle is in fixed-wing mode (by default).
    - Pre Arming may be used safely with bench-test actuators, while still keeping motors unpowered.

Flight Modes:
- Autonomous Modes:
    - Common tasks:
        - takeoff
        - returning to the home position
        - landing
    - Preprogrammed missions
    - **Accept Commands from an offboard computer**
- Manual Modes:
    - Via RC controller
    - With assistance from the autopilot

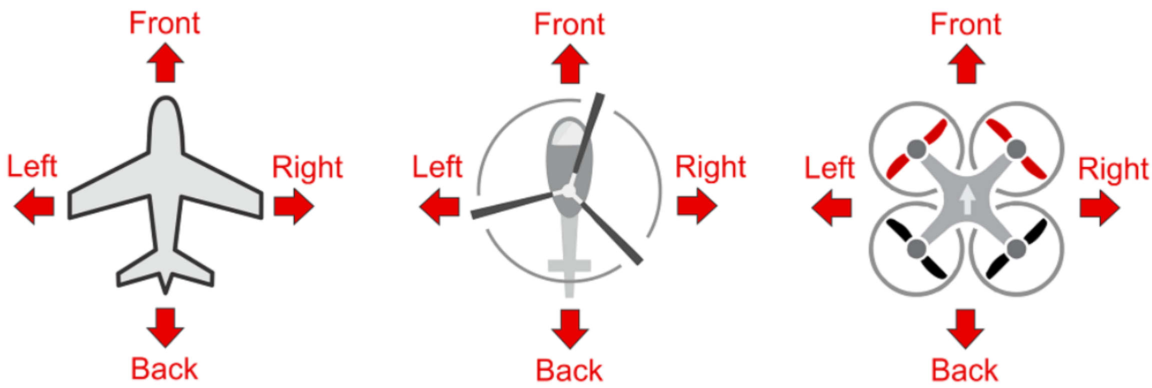
Safety Settings (FailSafe):
- Default and configurable Conditions under which the drone will perform “emergency stop”:
    - Low Battery
    - Remote Control (RC) Loss
    - Position Loss (global position estimate quality is too low).
    - Offboard Loss (e.g. lose connection to companion computer)
    - Data Link Loss (e.g. lose telemetry connection to GCS).
    - Geofence Breach (restrict vehicle to flight within a virtual cylinder).
    - Mission Failsafe (prevent a previous mission being run at a new takeoff location).
    - Traffic avoidance (triggered by transponder data from e.g. ADS B transponders).

Heading and Directions:

- Most vehicles have their directions based on the "front" of the vehicle

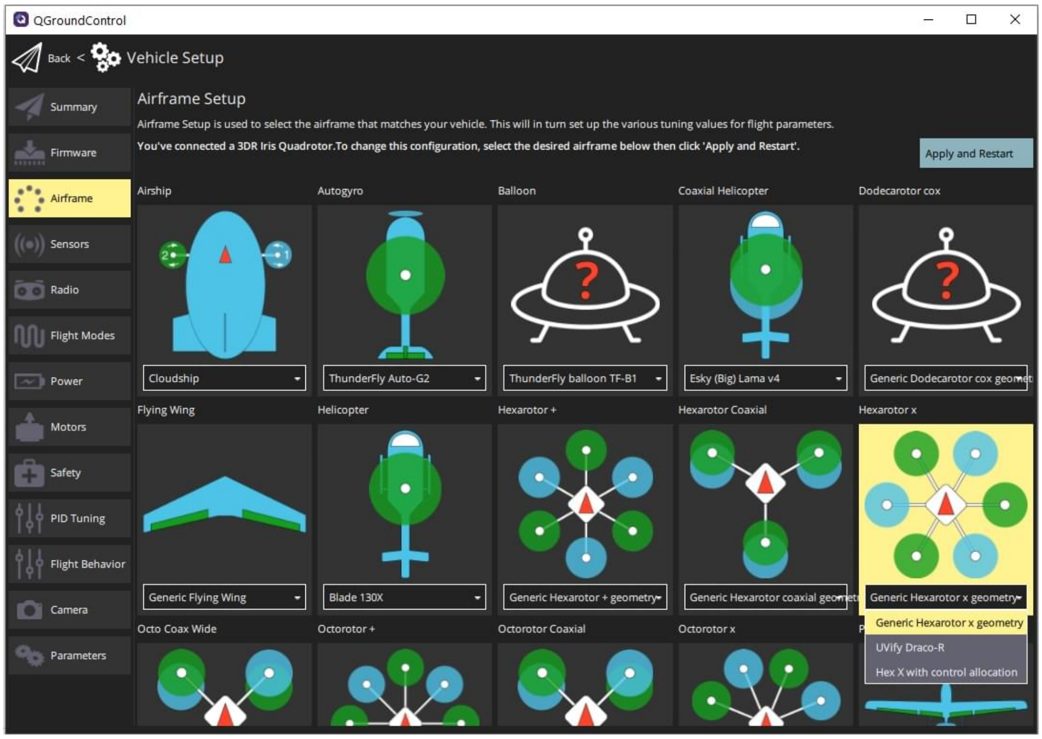


- Drones will have coloured propellers to determine the front



Vehicle Selection/Flight Controller Selection:

- **Multicopters** offer precision hovering and vertical takeoff, at the cost of shorter and generally slower flight. PX4 has modes that make them easy to fly, and they are the most popular type of flying vehicle.
- **Helicopters** are similar to Multicopters, mechanically more complex, but more efficient.
- **Fixed wing aeroplanes** offer longer and faster flight, and hence better coverage for ground surveys etc. However they are harder to fly and land than multicopters, and aren't suitable if needed to hover or fly very slowly (e.g. when surveying vertical structures).
- **VTOL (Vertical Takeoff and Landing) aircraft** come in a number of types: tiltrotors, tailsitters, quad planes etc. They offer the best of both worlds: take off in vertical mode like a multicopter and then transition in forward flight like an aeroplane. They are often more expensive than either multicopters and fixed wing aircraft, and harder to build and tune.
- **Airships/Balloons** are lighter-than-air vehicles that typically offer high altitude long duration flight, often at the cost of having limited (or no) control over speed and direction of flight.
- **Rovers** are car-like ground vehicles. They are simple to control and often fun to use.
- **Boats** are water-surface vehicles.
- **Submersibles** are underwater vehicles.



- For flight controller, the “brains”, of the vehicle, see *Pixhawk section*

***Sensors (TBD):**

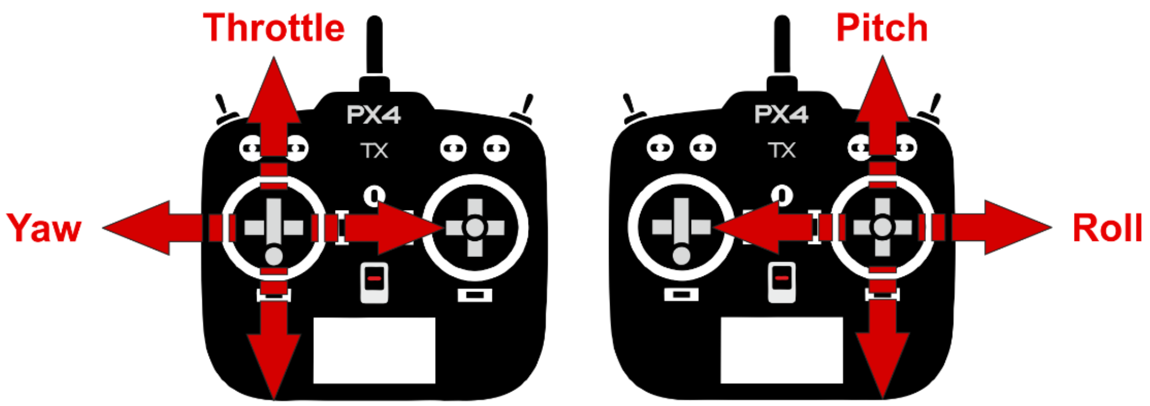
- PX4-based systems use sensors to determine vehicle state (needed for stabilisation and altitude-control).
- Vehicle states include:
    - Position/altitude
    - Heading
    - Speed
    - Airspeed
    - Orientation (attitude)
    - Rates of rotation in different directions
    - Battery level

- Minimum Requirements:
    - Gyroscope
    - Accelerometer
    - Magnetometer (compass)
    - Barometer
    - Positioning System (for automatic system)

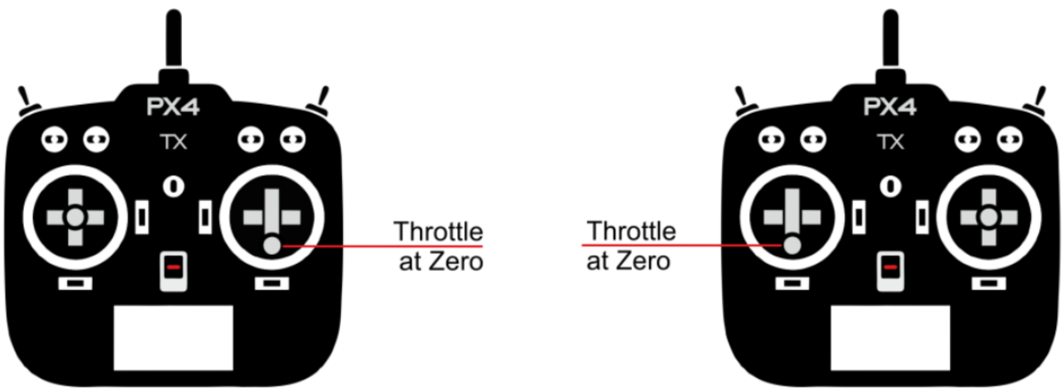
Radio Control Systems:

How do RC Systems Work?

- Has a ground-based remote control unit that is used by the operator to command the vehicle.
    - Physical controls (specify vehicle movement (e.g. speed, direction, throttle, yaw, pitch, roll, etc.))
    - Enable autopilot mode (e.g. takeoff, land, return to land, mission etc.).
    - Telemetry-enabled RC systems (Receive and display information from the vehicle)
- The remote control unit contains a radio module that is bound to, and communicates with, a (compatible) radio module on the vehicle.
- The ground- and vehicle- based radio modules are referred to as the transmitter and receiver respectively (even if they support bidirectional communication) and are collectively referred to as a transmitter/receiver pair.
- An aircraft must use a system that supports at least 4 channels (for roll, pitch, yaw, thrust).



MODE 2 MODE 2



MODE 1 MODE 2

As general guidance, receivers connect to the flight controller using the port appropriate to their supported protocol:

- **Spektrum and DSM receivers** must connect to a SPKT/DSM input.
- **Graupner HoTT receivers:** SUMD output must connect to a SPKT/DSM input.
- PPM-Sum and S.BUS receivers must connect directly to the RC ground, power and signal pins (typically labelled RC or RCIN)
- **PPM receivers** that have an individual wire for each channel must connect to the **RCIN channel** via a PPM encoder like this one (opens new window)(PPM-Sum receivers use a single signal wire for all channels).

Binding Transmitter/Receiver:
- Before calibrating/using a radio system must bind the transmitter and receiver.
- The process for binding a transmitter and receiver pair is hardware specific (see manual for instructions).

Set Signal-Loss Behaviour
- RC receivers have different ways of indicating signal loss:
  - Output nothing (automatically detected by PX4)
  - Output a low throttle value (can configure PX4 to detect this).
  - Output the last received signal (PX4 cannot handle this case!)

Flight Mode Systems:

- Flight modes define how the autopilot responds to remote control input, and how it manages vehicle movement during fully autonomous flight.
- Pilots can transition between flight modes using switches on the remote control or with a ground control station (see Flight Mode Configuration).

Manual and Autonomous Modes:

Key

The icons below are used within the document:

Icon	Description
	Manual mode. Remote control required.
A	Automatic mode. RC control is disabled by default except to change modes.
	Position fix required (e.g. GPS, VIO, or some other positioning system).
ALT	Altitude required (e.g. from barometer, rangefinder).
	Flight mode difficulty (Easy to Hard)

Manual Modes

Position Mode (MC)

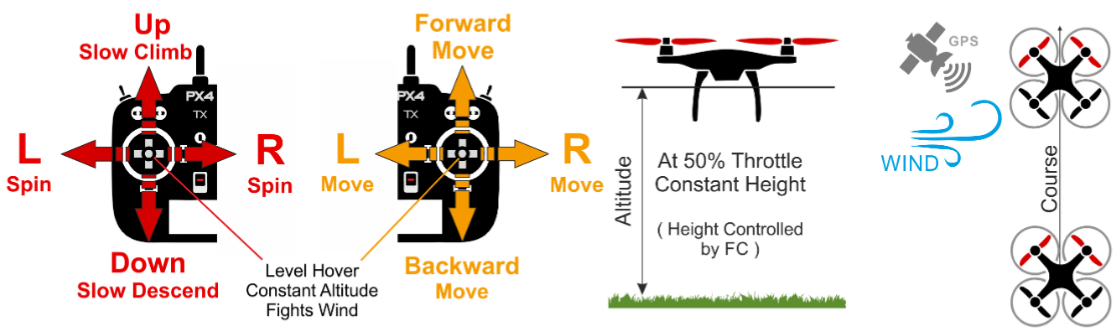
Altitude Mode (MC)

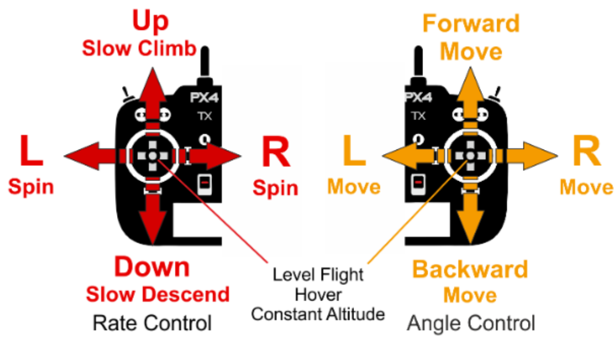
ALT

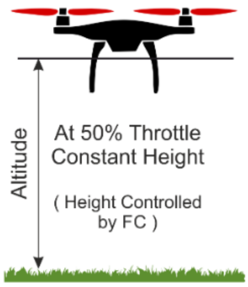
Manual/Stabilized Mode (MC)

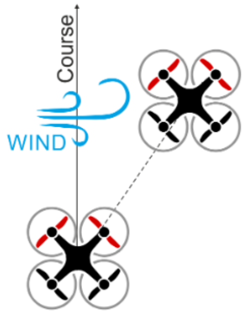
Acro Mode (MC)

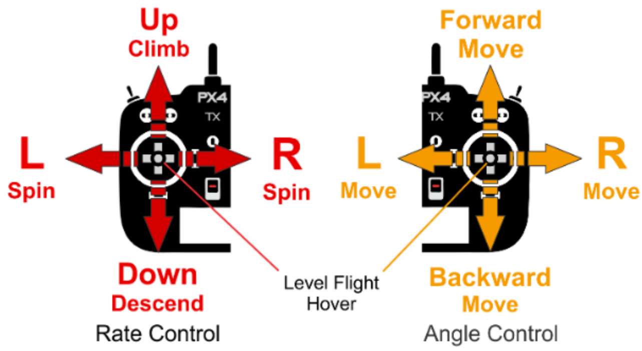
Orbit Mode (MC)

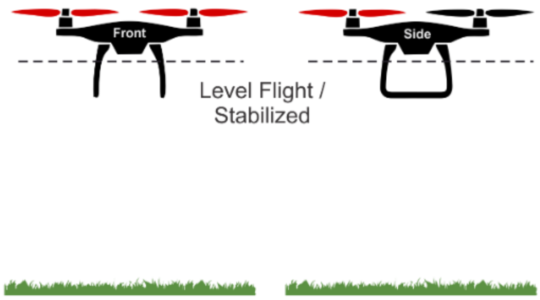


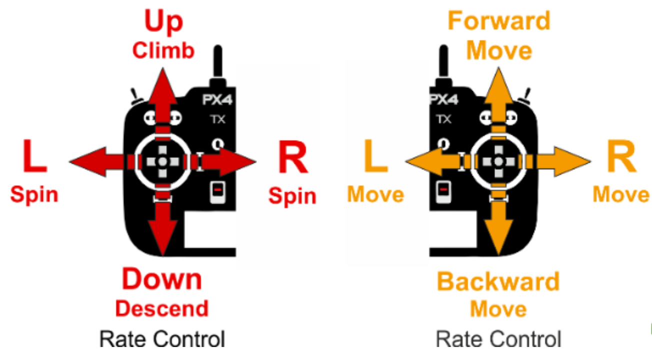


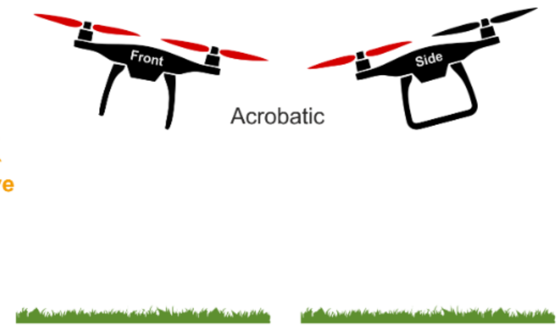


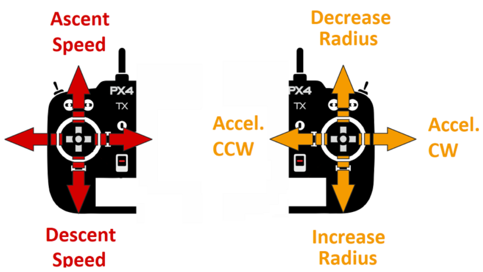












Automatic Modes

Return Mode (MC)

Hold Mode (MC)

Mission Mode (MC)

Takeoff Mode (MC)

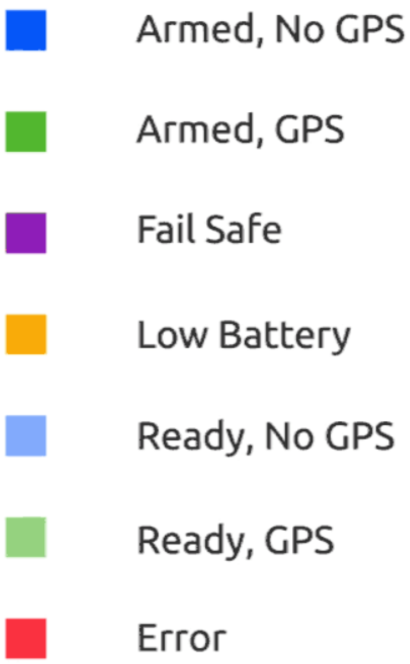
Land Mode (MC)

Follow Me Mode (MC)

Offboard Mode (MC)

Vehicle Status Notifications:

- PX4 provides vehicle-based visual (LED) and audible (Buzzer) notifications of "high level" vehicle status and readiness to fly.



Color	Label	Bootloader usage	APP usage
Blue	ACT (Activity)	Flutters when the bootloader is receiving data	Indication of ARM state
Red/Amber	B/E (In Bootloader / Error)	Flutters when in the bootloader	Indication of an ERROR
Green	PWR (Power)	Not used by bootloader	Indication of ARM state

For further details on signals, tunes, etc., see guide.

Payloads and Flight Reporting

For further details on payloads and flight reporting options, see guide.

Section 2: Assembly and Basic Configuration of the Drone System

Introduction:

This section will split into two parts: configuration and assembly. Note that this section is based on QGroundControl. Further analysis on how to integrate ROS into the system will be discussed in section 3.

Basic Assembly:

- The multicopter used is the: Holybro X500 V2 + Pixhawk 6C (PX4 Dev Kit). A description of this model can be found in the link below: https://holybro.com/collections/x500-kits/products/px4-development-kit-x500-v2?variant=42765381959869
- Note that when building the drone - refer to the manual provided first. Refer to this section only if there is clarification or specification needed regarding the building of the drone not included in the manual.

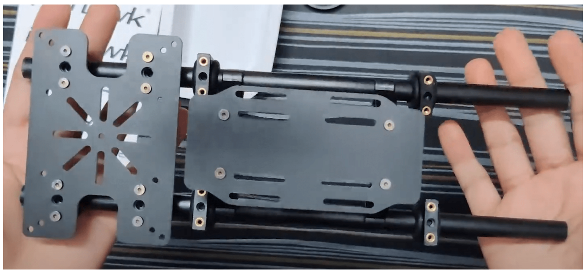
1. Payload and Battery Holder

- Screw- Sunk Screw M2.5*6 12pcs

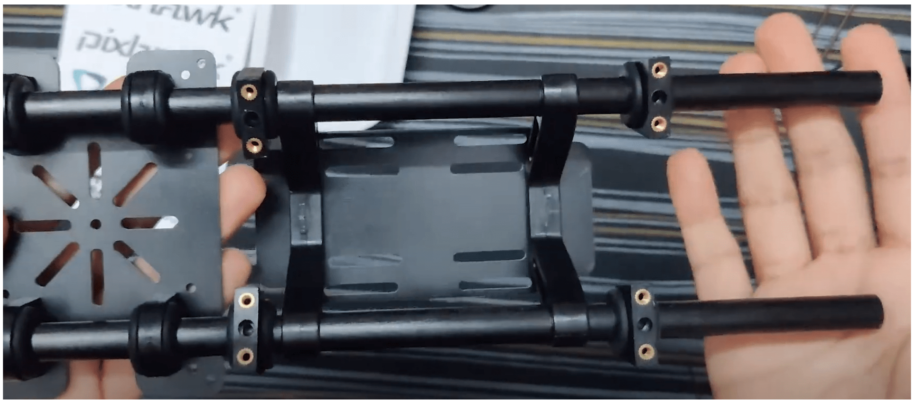
1. Insert the hanger rubber ring gasket in each of their respective hangers. Do not use sharp objects to press the rubbers inside.

2. Take the battery mounting board and screw it with the slide bar clip using the Sunk Screw M2.5*6

3. Screw 4 hangers to the Platform Board using Sunk Screw M2.5*6.



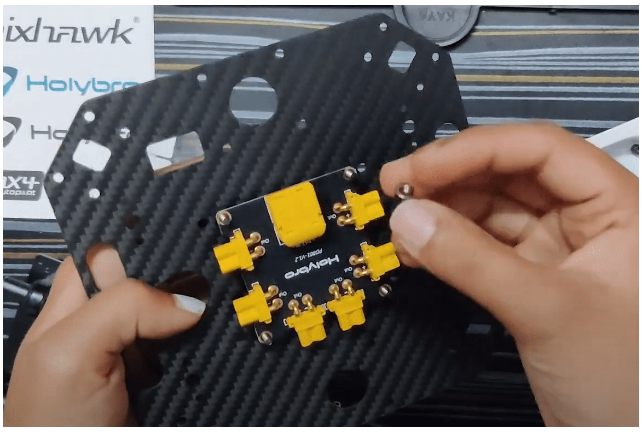
4. Take the slide bar and insert 4 hangers to screw to the bottom plate later.



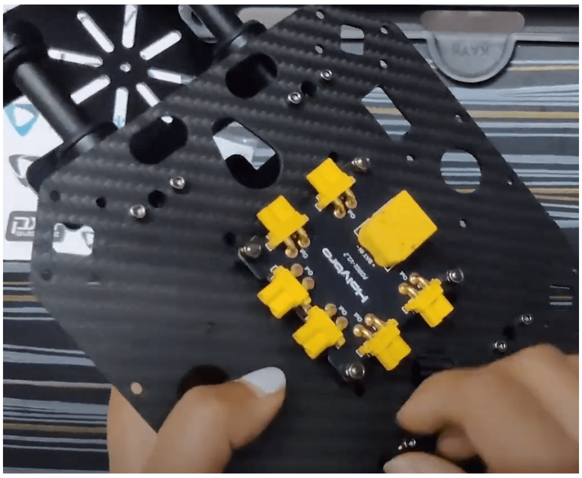
5. Now insert the battery holder and payload holders assembled in step 2 & 3

2. Payload and Battery Holder

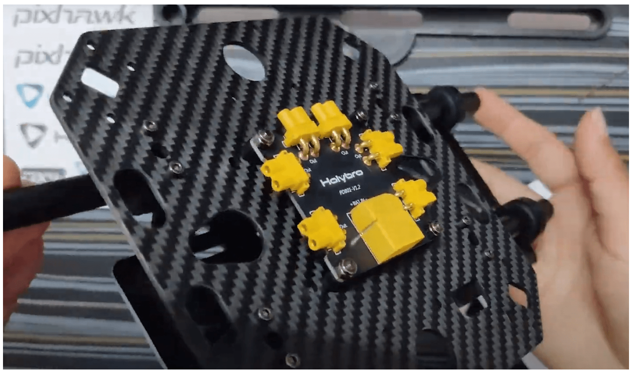
- Screw- Socket Cap Screw M2.56 8pcs | Locknut M3 4pcs |Nylon Standoff M35 4pcs | Screw M3*14 4pcs



1. Take the bottom plate and insert 4 M3*14 screws and fasten the nylon standoffs on the same.



2. Place the Power distribution board and use the locknuts to assemble them. The power module PM02 (for Pixhawk 6C) would power this board

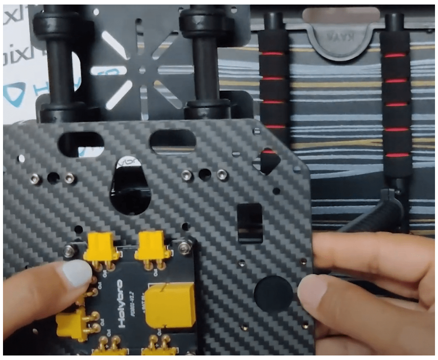
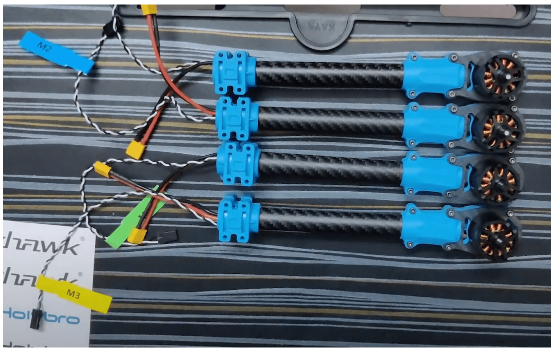


3. Use Socket Cap Screws M2.5*6 and screw the bottom plate on the 4 hangers (that we inserted in the 2 bars on the 3rd step of the payload holder assembly)

3. Landing Gear

1. To assemble the landing gear, loosen the pre-assembled screws of the Landing Gear-Cross Bar and insert the Landing Gear-Vertical Pole and fasten the same.

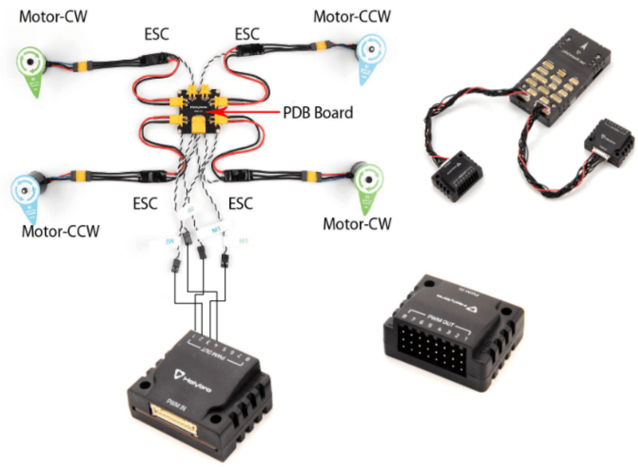

2. Use the Socket Cap Screw M3*8 to screw the landing gears to the bottom plate

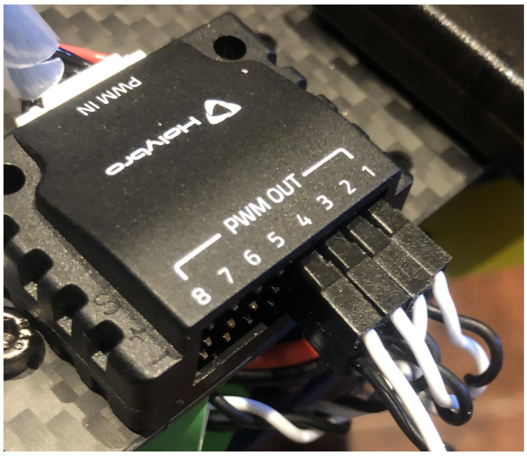



- Because it’s cumbersome to insert the wires once the top plate is assembled, do the wiring beforehand. Although the design is well built such that it can be done later as well.

4. Power

- The Pixhawk 6C gets powered by a power module PM02 (in this case). This power module is supplied by a battery (4S 16.8V 5200 mAh)
- The motors are powered through the power distribution board, as shown in the diagram below.

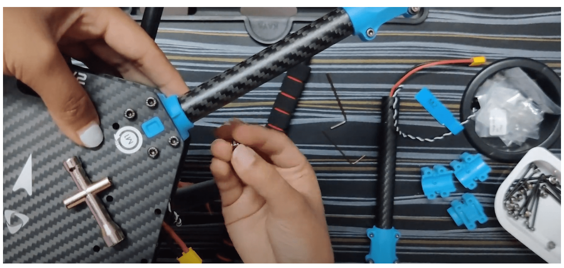




- Note that the ESC connectors are colour-coded and must be inserted in the PWM out such that the white cable faces up.

5. Arms

- Screw- Socket Cap Screw M3*38 16 pcs | Flange Lock Nut M3 16pcs



1. Putting the arms is quite simple as the motors come pre-assembled.
    a. Ensure that there is the right numbered arm with its motor on the respective side.
2. Take one arm and insert the rectangle extrusion inside the rectangular hollow on the bottom plate.

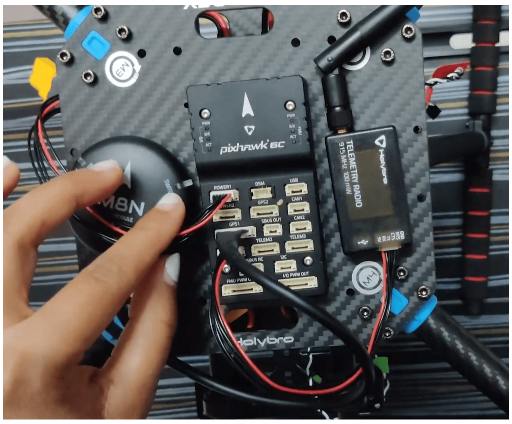
3. While inserting the top plate on top of this the 3 piece assembly (bottom plate, top plate & arms) have to screwed using Socket Cap Screw M3*38 and Flange Lock Nut M3.
4. Hold one side using the mini cross wrench provided in the developer kit.
5. Do not fasten any screws before all 3 motors are in place as this might make it difficult while assembling the 3rd and 4th motor.

6. Propellers:

- The bottom plate indicates the direction of the motor.
- The propellers that have a white/silver coating go on that respective motor with the similar coat.
- The unlocking and locking of the propeller is indicated on the propeller itself.
- Use the 4 propellers and insert them on the motors keeping the above 3 points in mind.
- The following parts can be placed as per usual.

7. Pixhawk 6C:

- The wire from the PM02 goes to POWER1 in Pixhawk
- The telemetry goes to TELEM1
- The GPS to GPS1



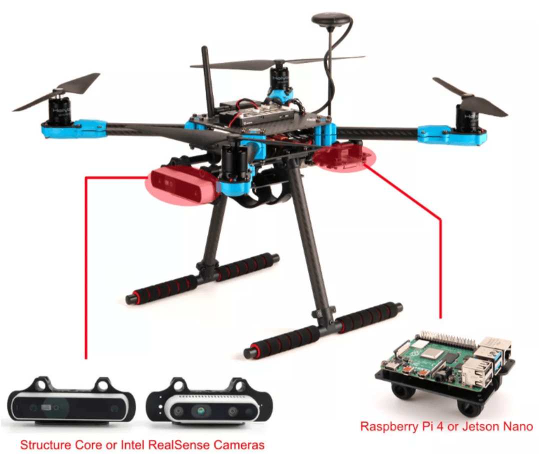
8. *Companion Computer:

- Screw- Socket Cap Screw M2.512 4pcs | Nylon Standoff M2.55 4pcs Locknut M2.5 4pcs
- The X500 kit provides space for a companion computer, such as Raspberry Pi or Jetson nano can be placed here [TBD].
- Insert 4 Socket Cap Screw M2.5*12 and put the standoffs on the same.
- Now place the companion computer and assemble it using Lock Nut M2.5

9. Camera

- Cameras such as Intel Realsense depth/ tracking camera or Structure Core can be mounted using the Depth Camera Mount
- Simply insert the mount inside the 2 bars and use the screws according to the camera used.

Depth Camera & Companion Computer
Mounting Example



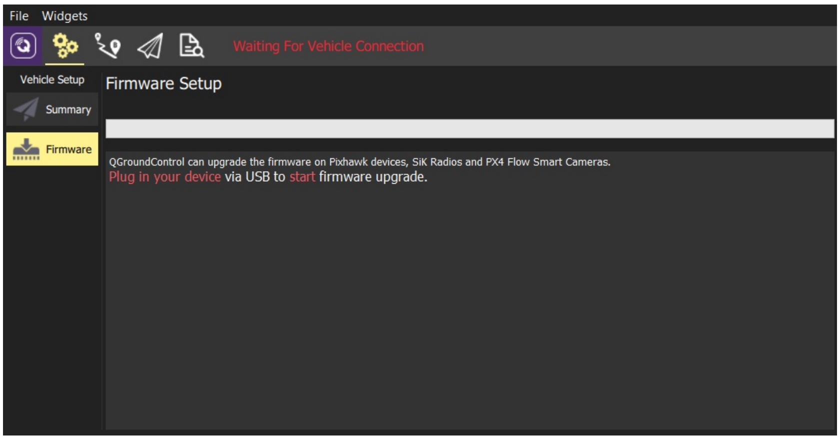
10. Install/Configure PX4:

See the next section for details.

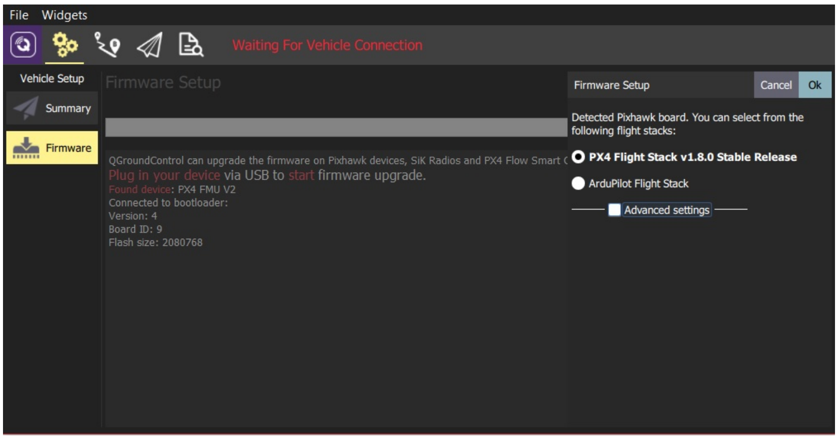
Basic Configuration:

1. Loading Firmware:

- QGroundControl desktop versions can be used to install PX4 firmware on Pixhawk-series flight-controller boards.
    1. Start QGroundControl and connect the vehicle.
    2. Select "Q" icon > Vehicle Setup > Firmware (sidebar) to open Firmware Setup.



    3. Connect the flight controller directly to the computer via USB.
    4. Select the PX4 Flight Stack X.x.x Release option to install the latest stable version of PX4 for hardware (autodetected).

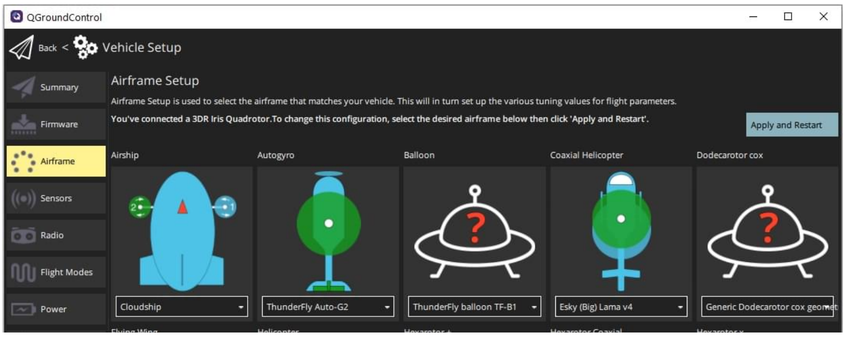


    5. Click the OK button to start the update.
    The firmware will then proceed through a number of upgrade steps (downloading new firmware, erasing old firmware etc.). Each step is printed to the screen and overall progress is displayed on a progress bar.
    6. For installing PX4 Master, Beta or Custom Firmware, see guide.
    7. For FMUv2 Bootloader Update, see guide.

2. AirFrame Setup:

- After installing firmware, need to select the vehicle frame configuration that best matches the vehicle.
    1. Start QGroundControl and connect the vehicle.
    2. Select "Q" icon > Vehicle Setup > Airframe (sidebar) to open Airframe Setup.

3. Select the broad vehicle group/type that matches the airframe and then use the dropdown within the group to choose the airframe that best matches the vehicle.

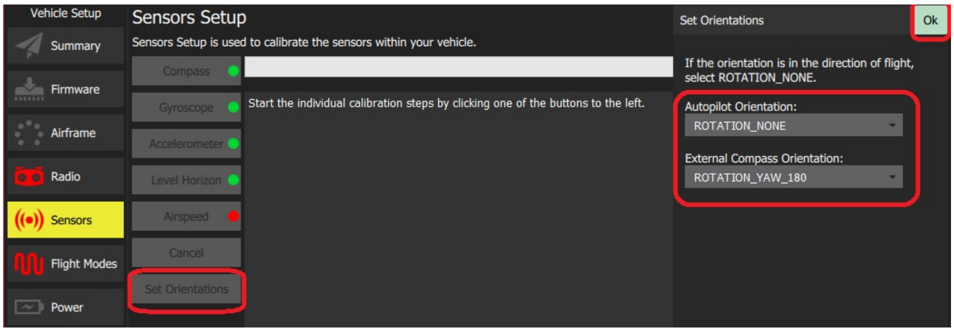


4. Click Apply and Restart. Click Apply in the following prompt to save the settings and restart the vehicle.

3. Sensor Orientation:

- By default the flight controller (and external compass(es), if present) should be placed on the frame top-side up, oriented so that the arrow points towards the front of the vehicle.

1. Start QGroundControl and connect the vehicle.
2. Select the Gear icon (Vehicle Setup) in the top toolbar and then Sensors in the sidebar.
3. Select the Set Orientations button.

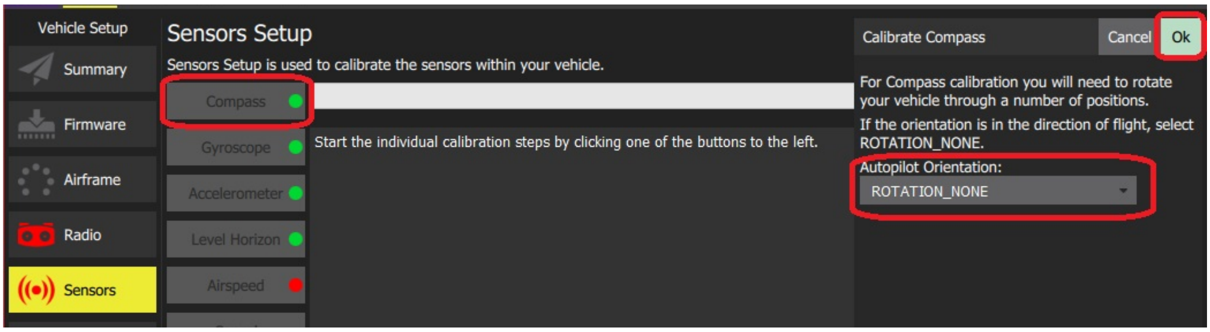


4. Select the AutoPilot Orientation.
5. Select the External Compass Orientation in the same way (this option will only be displayed if the vehicle has an external compass).
6. Press OK.

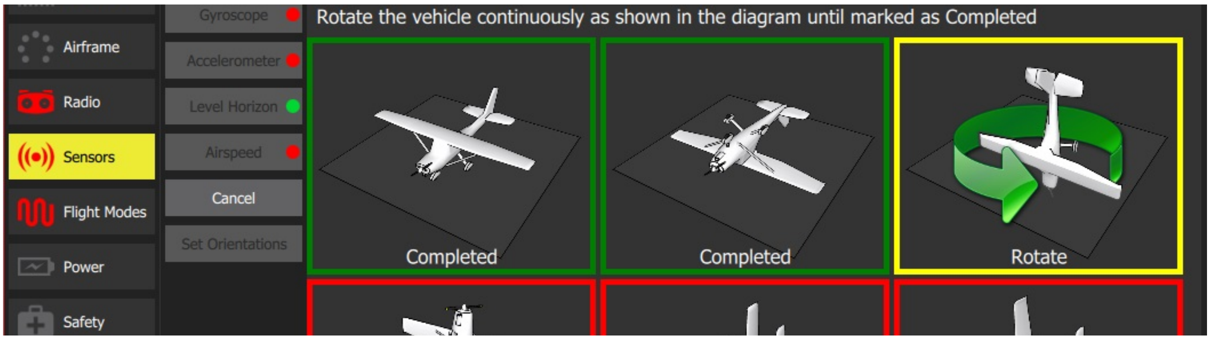
4. Compass Calibration:

- The compass calibration process configures all connected internal and external magnetometers.
- Two types of compass calibration are available:
    1. **Complete:** This calibration is required after installing the autopilot on an airframe for the first time or when the configuration of the vehicle has changed significantly.
    2. **Partial ("Quick Calibration"):** This calibration can be performed as a routine when preparing the vehicle for a flight, after changing the payload, or simply when the compass rose seems inaccurate.
- **Indications of a poor compass calibration include:**

  - circling during hover
  - toilet bowling (circling at increasing radius/spiralling-out, usually constant altitude, leading to fly-way)
  - veering off-path when attempting to fly straight.
- **Complete Calibration:**
  1. Choose a location away from large metal objects or magnetic fields
  2. Start QGroundControl and connect the vehicle.
  3. Select the Gear icon (Vehicle Setup) in the top toolbar and then Sensors in the sidebar.
  4. Click the Compass sensor button.



  5. Click OK to start the calibration.
  6. 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 for the current orientation the associated image on the screen will turn green.



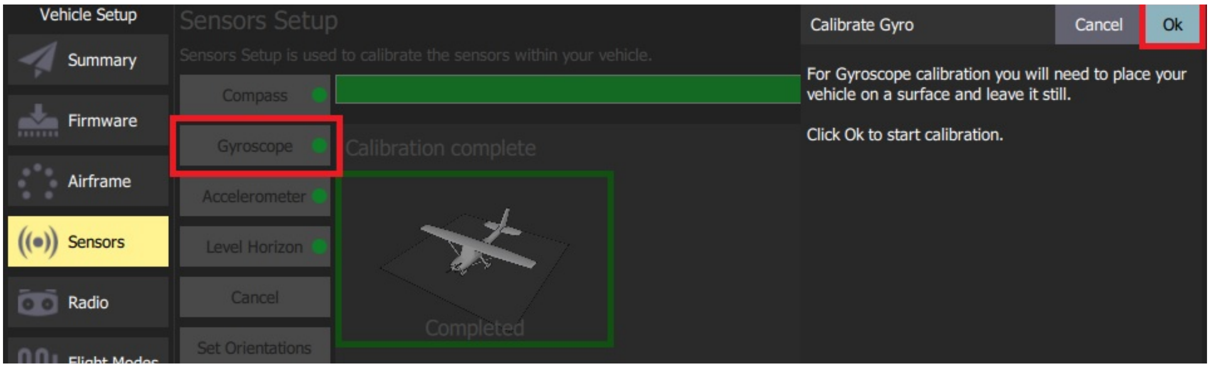
  7. Repeat the calibration process for all vehicle orientations.

- **Partial "Quick" Calibration:**
  1. Hold the vehicle in front and randomly perform partial rotations on all its axes.
  2. Wait for the heading estimate to stabilise and verify that the compass rose is pointing to the correct direction (this can take a couple of seconds).

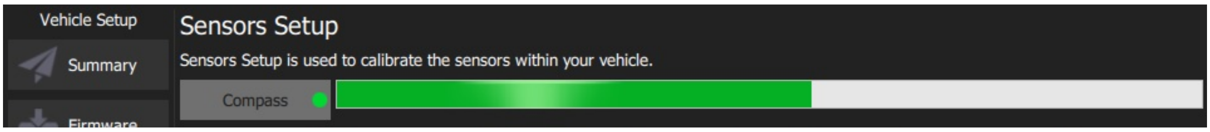
5. Gyroscope Calibration:

- QGroundControl will explain how to place the vehicle on a flat surface and keep it still.

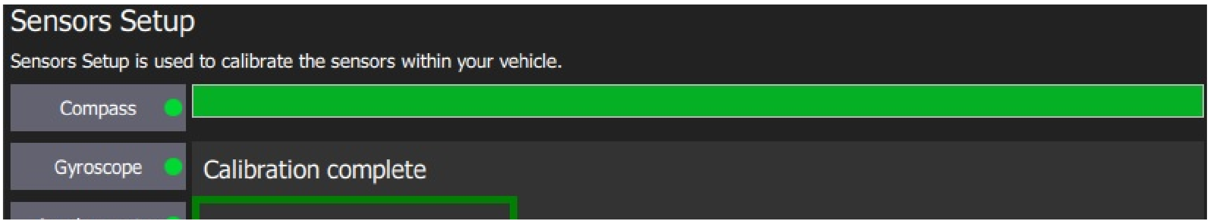
1. Click the Gyroscope sensor button



2. Place the vehicle on a surface and leave it still.
3. Click Ok to start the calibration.
   The bar at the top shows the progress:



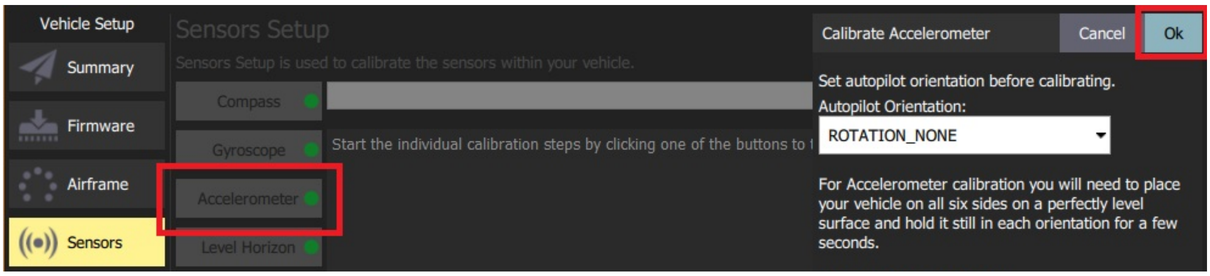
4. When finished, QGroundControl will display a progress bar Calibration complete.



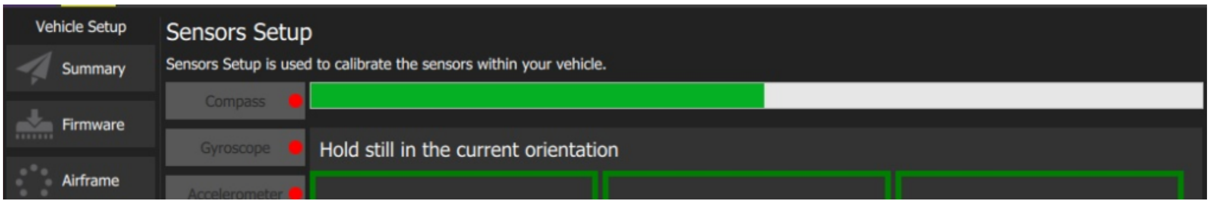
6. Accelerometer Calibration:

- Poor accelerometer calibration is generally caught by preflight checks and arming-denied messages (QGC warnings typically refer to "high accelerometer bias" and "consistency check failures").

1. Start QGroundControl and connect the vehicle.
2. Select the Gear icon (Vehicle Setup) in the top toolbar and then Sensors in the sidebar.
3. Click the Accelerometer sensor button.



4. Click OK to start the calibration.
5. Position the vehicle as guided by the images on the screen. Once prompted (the orientation-image turns yellow) hold the vehicle still. Once the calibration is complete for the current orientation the associated image on the screen will turn green.



6. Repeat the calibration process for all vehicle orientations.

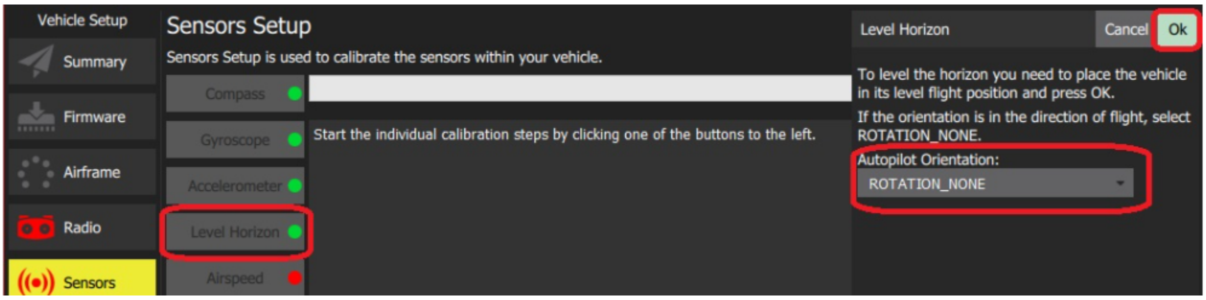
7. Airspeed Calibration:

Not necessarily required for copter drone - see guide for further details if necessary

8. Level Horizon Calibration:

- Levelling the horizon is highly recommended, and will result in the best flight performance. This process can also be repeated if there is a constant drift during flight.

1. Start QGroundControl and connect the vehicle.
2. Select the Gear icon (Vehicle Setup) in the top toolbar and then Sensors in the sidebar.
3. Click the Level Horizon button.

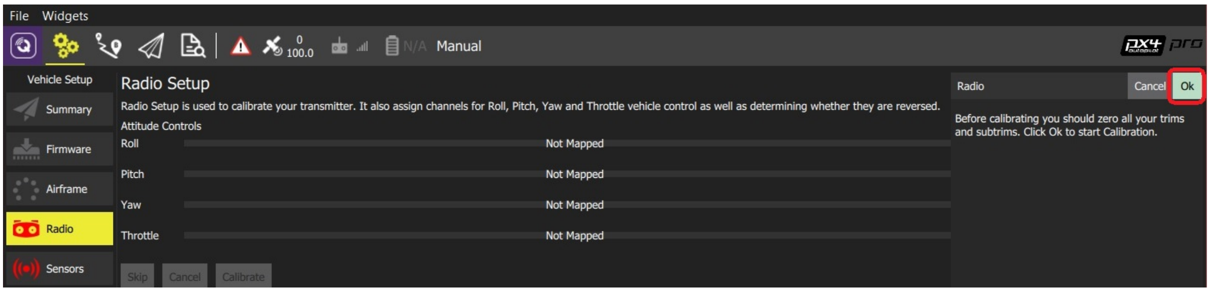


4. Place the vehicle in its level flight orientation on a level surface: (For copters this is the hover position.)
5. Press OK to start the calibration process.
6. Wait until the calibration process is finished.

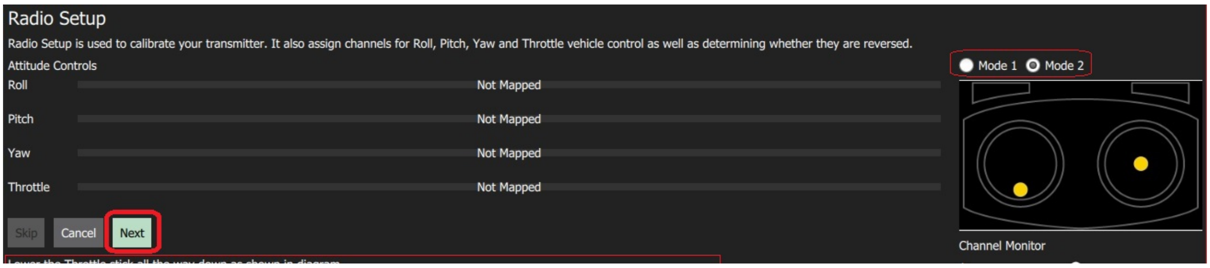
9. Radio (Remote Control) Setup:

- The Radio Setup screen is used to configure the mapping of the remote control unit's main 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.
- **Binding the receiver**: Before calibrating the radio system the receiver and transmitter must be connected/bound. The process for binding a transmitter and receiver pair is hardware specific.
- **RC Loss Detection:**
  - Output nothing (automatically detected by PX4)
  - Output a low throttle value (can configure PX4 to detect this).
  - Output the last received signal (cannot be detected by PX4 as it looks like valid input).
- **Performing the Calibration:**
  1. Turn on the RC transmitter.
  2. Start QGroundControl and connect the vehicle.

3. Select the Gear icon (Vehicle Setup) in the top toolbar and then Radio in the sidebar.
4. Press OK to start the calibration.



5. Set the transmitter mode radio button that matches the transmitter (this ensures that QGroundControl displays the correct stick positions for user to follow during calibration).



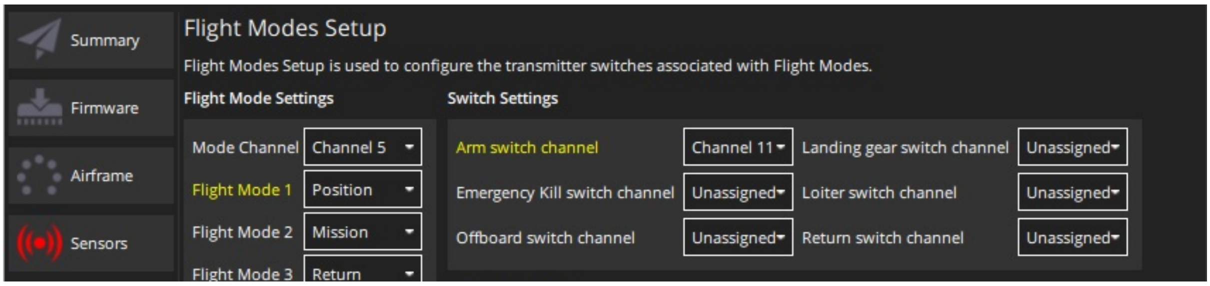
6. Move the sticks to the positions indicated in the text (and on the transmitter image). Press Next when the sticks are in position. Repeat for all positions.
7. When prompted, move all other switches and dials through their full range (will be able to observe them moving on the Channel Monitor).
8.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

- **Additional Radio Setup:**
    - As well as calibrating the control sticks and other transmitter controls, there are a number of additional radio setup options that may be useful on this screen. See guide for further details

10. Flight Mode Configuration:

- Flight Modes provide different types of autopilot-assisted flight, and fully autonomous flight. Most users should set the following functions, as these make the vehicle easier and safer to fly:
    - **Position mode** (multicopter, fixed-wing) - Easiest and safest mode for manual flight.
    - **Return mode** - Return to launch position by safe path and land (by default).
    - **Mission** - This mode runs a pre-programmed mission sent by the ground control station.
    - **Kill Switch** - Immediately stops all motor outputs (the vehicle will crash, which may in some circumstances be more desirable than allowing it to continue flying)
- PX4 allows user to specify a "mode" channel and select up to 6 flight modes that will be activated based on the PWM value of the channel. User can also separately specify channels for mapping a kill switch, return to launch mode, and offboard mode.

1. Start QGroundControl and connect the vehicle.
2. Turn on the RC transmitter.
3. Select QGroundControl icon > Vehicle Setup, and then Flight Modes in the sidebar.



4. Specify Flight Mode Settings:
    a. Select the Mode channel (above this shown as Channel 5, but this will depend on the transmitter configuration).
    b. Move the transmitter switch (or switches) that is set up for mode selection through the available positions. The mode slot matching the current switch position will be highlighted (above this is Flight Mode 1).
    c. Select the flight mode that is triggered for each switch position.
5. Specify Switch Settings:
    a. Map the channels to specific actions - e.g.: Return mode, Kill switch, offboard mode, etc. (if there are spare switches and channels on the transmitter).
6. Test that the modes are mapped to the right transmitter switches:
    a. Check the Channel Monitor to confirm that the expected channel is changed by each switch.
    b. Select each mode switch on the transmitter in turn, and check that the desired flight mode is activated (the text turns yellow on QGroundControl for the active mode).

11. IMU Factory Calibration

1. Set the parameter SYS_FAC_CAL_MODE to 1.
2. Perform all IMU calibrations: accelerometer, gyroscope and magnetometer.
3. Reboot the vehicle. This will write all CAL_ACC*, CAL_GYRO* and CAL_MAG* parameters into /fs/mtd_caldata.
4. Set the parameter SYS_FAC_CAL_MODE back to 0 (default).

12. Battery/Safety/Actuator/Auto Tune Set-ups/ Flying…..:

- The process for these types of set-up is similar to above - refer to the guide for further information.