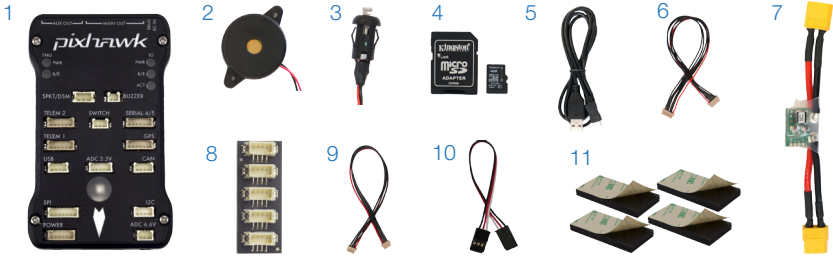# pixhawk

AUTOPILOT

QUICK START GUIDE

3DRobotics

PARTS

1 Pixhawk
2 Buzzer
3 Safety switch
4 Micro-SD card and adapter
5 Micro-USB cable
6 Six-wire cable x2

7 Power module
8 I²C splitter module
9 Four-position I²C splitter cable
10 Three-wire servo cable
11 Mounting foam

GETTING STARTED

With the help of APM firmware, Pixhawk turns any RC plane, copter, or rover into a full-featured personal drone. Once you have a fully-assembled frame, follow this guide to install Pixhawk.

1 Mount
2 Connect
3 Load firmware
4 Calibrate

① MOUNT

Use the provided foam to mount Pixhawk as close as possible to your vehicle's center of gravity. Make sure to orient the board with the arrow pointing forward.
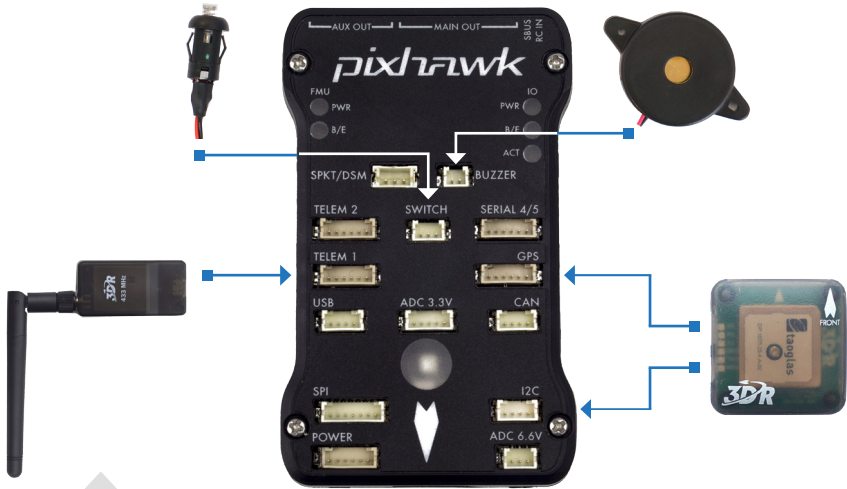

Attach the foam squares to the corners of the board.

Vehicle front

② CONNECT

(Required) Connect the buzzer and safety switch.

pixhawk

(Optional) Connect a 3DR Radio to Pixhawk's Telem port using the 6-wire cable provided with your 3DR Radio Kit to receive data and communicate with the autopilot in flight.

(GPS or GPS+Compass required) Connect a 3DR GPS+Compass to provide the autopilot with positioning data during flight. This kit includes a 6-wire cable to connect the GPS ports. Connect the MAG to the I^2C port using the 4-wire cable provided with the 3DR GPS+Compass.

(Required) Connect the 3DR Power Module to the Power port using the 6-wire cable to direct power from your lithium polymer (LiPo) battery to the autopilot.

(Optional) The I^2C splitter expands the I^2C port to allow up to four additional peripherals to connect to Pixhawk. Use the 4-wire cable to connect the I^2C splitter and add a compass module, external LED, digital airspeed sensor, or other peripherals to your vehicle.
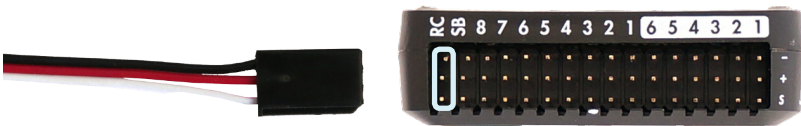
LOAD SD CARD INTO PIXHAWK

If the SD card is not preloaded into Pixhawk, insert the micro-SD card into the slot at the bottom end of the board.

CONNECT RADIO CONTROL

FOR PPM RC RECEIVERS AND FUTABA S.BUS RECEIVERS

Connect the ground (-), power (+), and signal (S) wires to the RC pins using the provided 3-wire servo cable.
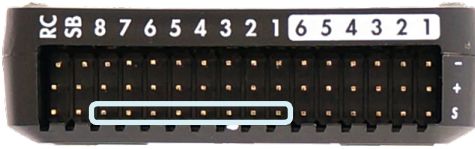
FOR SPEKTRUM SATELLITE RECEIVERS

For a Spektrum DSM, DSM2, or DSM-X Satellite RC receiver, connect to the SPKT/DSM port.

For a complete list of RC systems compatible with Pixhawk, visit the APM wiki page here.

FOR PWM RECEIVERS

Purchase a PPM Encoder module to connect a PWM RC receiver to Pixhawk at store.3dr.com.

CONNECT OUTPUTS

FOR COPTERS

Connect each signal wire from the PDB to the main output signal (S) pins by motor number. Connect one wire for each motor to the corresponding pin.

Pin 1 = Motor 1   Pin 5 = Motor 5
Pin 2 = Motor 2   Pin 6 = Motor 6
Pin 3 = Motor 3   Pin 7 = Motor 7
Pin 4 = Motor 4   Pin 8 = Motor 8

FOR PLANES

For planes, connect the control channel wires to the main output signal pins.
Pin 1 = Aileron
Pin 2 = Elevator
Pin 3 = Throttle
Pin 4 = Rudder

FOR ROVERS

For rovers, connect the throttle and steering wires to the main output signal pins.
Pin 3 = Throttle
Pin 4 = Steering

③ LOAD FIRMWARE

APM firmware is the brains of your autopilot operation and must be installed before using Pixhawk.
To load firmware onto Pixhawk, install a mission planner application on your ground station computer. Choose either Mission Planner (Windows) or APM Planner for (Windows, OS X, and Linux).
Both applications are available for free download from ardupilot.com.

Mission planner

Download Mission Planner (Windows)

Ardupilot.com ➝ Downloads ➝ Mission Planner

Mission Planner   « Downloads

Sort by: Title | Hits | Date

- MissionPlanner - Installer ....▶ Select the installer package to download.

Download APM Planner (Windows, OS X, and Linux)

Ardupilot.com ➝ Downloads ➝ APM Planner 2.0

APM Planner 2.0   « Downloads

Sort by: Title | Hits | Date

- APM Planner 2.0 Mac ....▶ Select your platform to download.
- APM Planner 2.0 Windows
- APM Planner 2.0 Linux

INSTALL PLANNER

After selecting the correct file, read the safety information and select Download.

Open the file to run the setup wizard. Proceed through any security warnings, and install all suggested drivers. When the installation is complete, open the application, and connect Pixhawk to your computer using the micro-USB cable.

Your computer will automatically install the correct drivers. Do not select Connect at this time; Pixhawk can only load firmware while unconnected to Mavlink.

Select Initial Setup, Install Firmware, and select your vehicle.
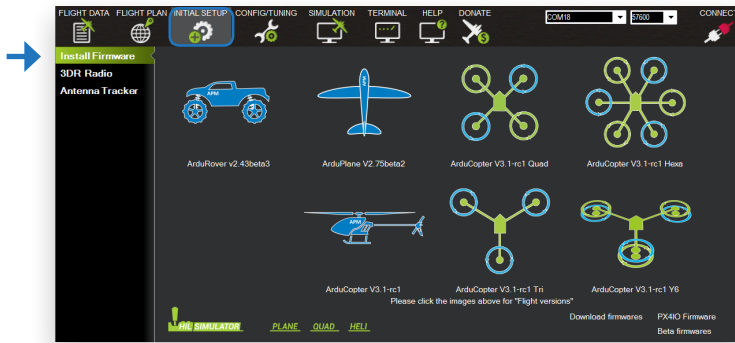
When prompted, follow the directions to load the firmware. Once the status bar shows that the download is complete, power cycle the board by disconnecting and reconnecting the USB.

If you hear a musical tone, your firmware installation is complete. If you hear a series of tones followed by three beeps, disconnect the USB and reconnect while holding down the safety button. Upon restart, listen for a series of tones followed by two beeps indicating that your firmware has loaded successfully.

Everything is OK:
musical tone

Pixhawk needs your attention:
beep BEEP beep... BEEP BEEP BEEP

beep BEEP beep...
BEEP BEEP

④ CALIBRATE

With Pixhawk connected to your computer, select the communication option from the drop-down menu for PX4 FMU, set the rate to 115200, and select the Connect icon. Select Initial Setup and Mandatory Hardware to access the calibration wizards.
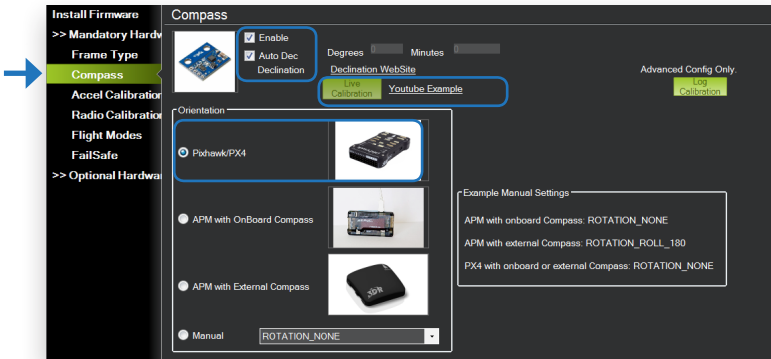

Remove propellers before performing calibration.

SELECT FRAME TYPE (COPTERS ONLY)
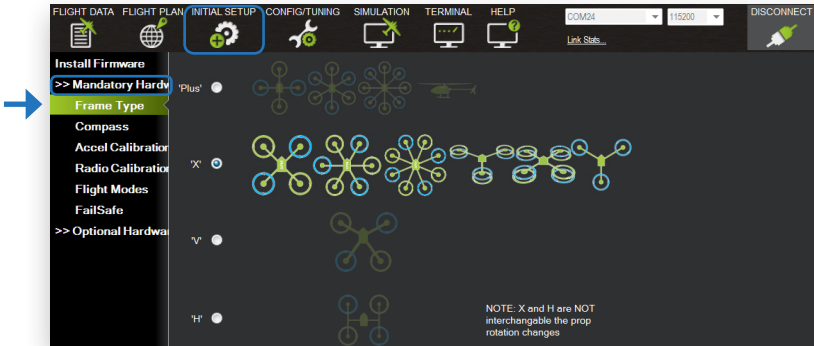
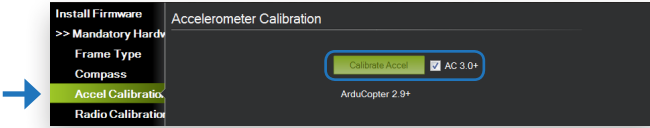For copter, select your frame orientation.

CALIBRATE COMPASS

Select the options to enable the compass; to allow automatic declination calculation; and to specify Pixhawk. Select Live Calibration to launch the wizard, and follow the prompts.
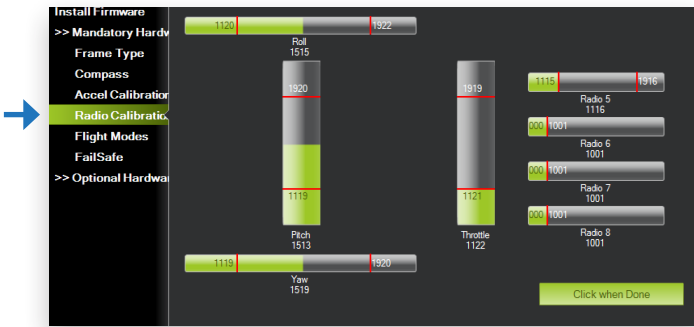
Show Me
videos demonstrating live calibration techniques at 3dr.com/learn.

CALIBRATE ACCELEROMETER

Select Accel Calibration, check the box for AC 3.0+, select Calibrate, and follow the prompts to calibrate Pixhawk's accelerometer. Make sure to wait a couple of seconds before and after changing the positions of the vehicle.

RC CALIBRATION

left stick

right stick

Select Radio Calibration to teach Pixhawk to work with your RC transmitter. Turn on your transmitter, select Calibrate Radio, and move all sticks and switches to their extreme positions. Select Click when Done once the red bars are set for all available channels.

SELECT FLIGHT MODES
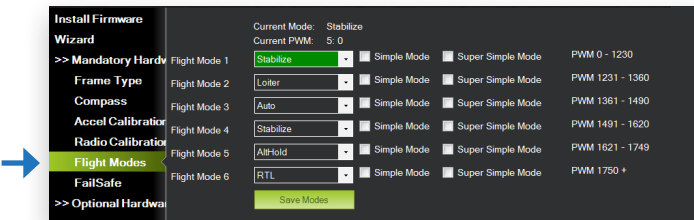
Move each switch on your transmitter to its available positions. The mission planner will indicate the currently selected position with green highlighting. Select a mode for each switch position, and select Save Modes to assign.

LED MEANINGS

Flashing red and blue: initializing. Please wait.

Double flashing yellow: error. System refuses to arm.

Flashing blue: disarmed, searching for GPS. Autonomous, loiter, and return-to-launch modes require GPS lock.

Flashing green: disarmed, GPS lock acquired. Ready to arm. Quick double tone when disarming from the armed state.

Solid green plus single long tone: armed and ready to fly!

Flashing yellow: RC failsafe activated.

Flashing yellow plus quick repeating tone: battery failsafe activated.
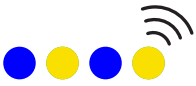
Flashing yellow and blue plus high-high-high-low tone: GPS glitch or GPS failsafe activated.

SAFETY SWITCH MEANINGS

Quick, constant blinking: performing system check. Please wait.

Intermittent blinking: system ready. Press the safety button to activate.

Solid: ready to arm. Proceed to the arming procedure.

Learn more
about LED meanings and buzzer tones at 3dr.com/learn.

PORTS

1. Spektrum DSM receiver
2. Telemetry (radio telemetry)
3. Telemetry (on-screen display)
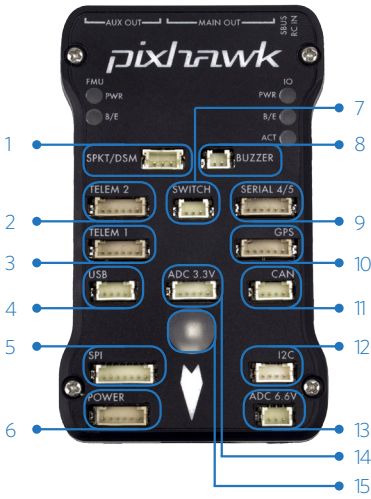4. USB
5. SPI (serial peripheral interface) bus
6. Power module
7. Safety switch button
8. Buzzer
9. Serial
10. GPS module
11. CAN (controller area network) bus
12. I²C splitter or compass module
13. Analog to digital converter 6.6 V
14. Analog to digital converter 3.3 V
15. LED indicator

1 Input/output reset button
2 SD card
3 Flight management reset button
4 Micro-USB port
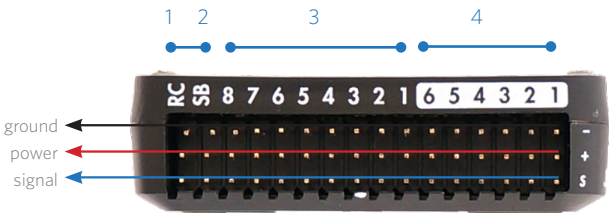
1 Radio control receiver input
2 S.Bus output
3 Main outputs
4 Auxiliary outputs

IMPORTANT NOTE

Please note that these instructions describe basic setup for Pixhawk and do not represent the complete set of configuration procedures required to build a copter, plane, or rover.

For more information on ESC calibration, battery monitoring, failsafes, mode descriptions, and more, visit ardupilot.com. Do not operate your vehicle without a complete understanding of the online instructions.

SPECIFICATIONS

Processor
32-bit ARM Cortex M4 core with FPU
168 Mhz/256 KB RAM/2 MB Flash
32-bit failsafe co-processor

Sensors
ST Micro 16-bit gyroscope
ST Micro 14-bit accelerometer/magnetometer
MEAS barometer
MPU6000 accelerometer/magnetometer

Power
Ideal diode controller with automatic failover
Servo rail high-power (7 V) and high-current ready
All peripheral outputs over-current protected, all inputs ESC protected

Interfaces
5x UART serial ports, 1 high-power capable, 2x with HW flow control
Spektrum DSM/DSM2/DSM-X Satellite input
Futaba S.BUS input and output
PPM sum signal
RSSI (PWM or voltage) input
I^2C, SPI, 2x CAN, USB
3.3 and 6.6 ADC inputs

Dimensions
Weight 38 g (1.3 oz)
Width 50 mm (2.0")
Height 15.5 mm (.6")
Length 81.5 mm (3.2")

SUPPORT

For more information about Pixhawk and other documentation, visit 3dr.com/learn. For more instruction on using APM firmware and planner software, visit ardupilot.com.

For customer support, contact us at help@3dr.com or call our support line at +1 (858) 225-1414 Monday through Friday, 8 am to 5 pm, PST.

SAFETY

Operating a powered vehicle of any kind can be a lot of fun, but it carries certain inherent risks. Regulations governing the use of powered vehicles, including aircraft, vary from locale to locale, even within the same country or district. It is your responsibility to ensure that you understand and comply with all local laws and regulations.

Safety basics:
- Never operate the vehicle or software in a way that could be dangerous to you, other people, or property.
- Always keep propeller arcs free of objects and body parts while the vehicle is live.
- Keep in mind that software and hardware failures happen. Although we design our products to minimize such issues, you should always operate with the understanding that a failure could occur at any time and without warning. Accordingly, you should take the appropriate precautions to minimize danger in case of product failure.
- Never use the software or hardware for manned vehicles.
- Always operate within local laws and regulations.
- Do not operate the aircraft if you are under the age of 18.

Additional safety information:
- Be sure to maintain safe distances between people and your aircraft.
- Never operate your aircraft if your ability to do so with the utmost attention to safety is impaired in any way. Do not operate your aircraft while tired, under the influence of drugs or alcohol, or otherwise unable to operate it with the highest attention to safety.
- Environment conditions can change rapidly and can make operation difficult. If this occurs, land your aircraft and discontinue use immediately. Do not operate your aircraft if operating conditions are not ideal. This includes, but is not limited to, rain, snow or excessive wind.
- Always ensure the battery cable is disconnected from the aircraft until you are ready to fly, and ensure that your batteries are fully charged prior to use.
- Always turn on the transmitter and ensure the throttle stick is all the way down before connecting the battery.
- After landing, disarm your vehicle immediately and disconnect the battery cable.
- Do not turn off the transmitter until after you have disconnected the battery.
- Always remove the propellers while testing the motors.
- When the battery is connected, always assume the vehicle is live and the motors are armed.
- Do not attempt to fly longer than the battery's safe capacity.
- Do not operate the vehicle with excess weight attached.
- Ensure that all vehicle components are well maintained before each flight. Ensure that components are firmly attached and operating properly.
- Replace any worn or damaged components before each flight. Never operate with any damaged or worn components.
- SAFETY IS THE FIRST PRIORITY. Take all precautions necessary to ensure your own safety as well as the safety of other people and property.

DISCLAIMER

THE LIMITED WARRANTIES APPLICABLE TO 3D ROBOTICS-BRANDED HARDWARE CAN BE FOUND AT WWW.3DROBOTICS.COM/TERMS/ AND CAN BE REFERENCED IN FULL AT THAT URL. 3D ROBOTICS RESERVES THE RIGHT TO UPDATE THE WARRANTIES AT ANY TIME WITHOUT EXPRESS NOTICE. 3D ROBOTICS MAKES NO OTHER WARRANTIES FOR 3D ROBOTICS-BRANDED PRODUCTS, AND MAKES NO WARRANTIES WHATSOEVER FOR SERVICE, SOFTWARE, MAINTENANCE OR SUPPORT FOR NON-3D ROBOTICS-BRANDED PRODUCTS. SUCH PRODUCTS, SOFTWARE, SERVICES, MAINTENANCE OR SUPPORT IS PROVIDED BY 3D ROBOTICS "AS IS" AND ANY THIRD-PARTY WARRANTIES, PRODUCTS, SOFTWARE, SERVICES, MAINTENANCE OR SUPPORT ARE PROVIDED BY THE ORIGINAL MANUFACTURER OR SUPPLIER, NOT BY 3D ROBOTICS. 3D ROBOTICS MAKES NO EXPRESS WARRANTIES EXCEPT THOSE STATED IN 3D ROBOTICS' APPLICABLE WARRANTY IN EFFECT ON THE DATE OF THE INVOICE, PACKING SLIP OR ACKNOWLEDGEMENT.

3D ROBOTICS OFFERS THE HARDWARE AS-IS AND MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND CONCERNING THE HARDWARE, EXPRESS, IMPLIED, STATUTORY OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF TITLE, MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT, OR THE ABSENCE OF LATENT OR OTHER DEFECTS, ACCURACY, OR THE PRESENCE OF ABSENCE OF ERRORS, WHETHER OR NOT DISCOVERABLE. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES, SO SUCH EXCLUSION MAY NOT APPLY TO YOU.

EXCEPT TO THE EXTENT REQUIRED BY APPLICABLE LAW, IN NO EVENT WILL 3D ROBOTICS BE LIABLE TO YOU ON ANY LEGAL THEORY FOR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL, PUNITIVE OR EXEMPLARY DAMAGES ARISING OUT OF THE USE OF THE HARDWARE.

3D ROBOTICS ACCEPTS NO LIABILITY FOR DAMAGE(S) OR INJURIES INCURRED DIRECTLY OR INDIRECTLY FROM THE USE OF THIS PRODUCT.

SOFTWARE IS SUBJECT TO THE SEPARATE SOFTWARE LICENSE AGREEMENT ACCOMPANYING OR MADE AVAILABLE TO YOU IN CONNECTION WITH THE SOFTWARE. A PORTION OF THE SOFTWARE MAY CONTAIN OR CONSIST OF OPEN-SOURCE SOFTWARE, WHICH YOU MAY USE UNDER THE TERMS AND CONDITIONS OF THE SPECIFIC LICENSE UNDER WHICH THE OPEN-SOURCE SOFTWARE IS DISTRIBUTED. YOU AGREE THAT YOU WILL BE BOUND BY ANY AND ALL SUCH LICENSE AGREEMENTS, AND THAT YOUR USAGE OF THIS PRODUCT INDICATES YOUR ACCEPTANCE OF THOSE AGREEMENTS. TITLE TO SOFTWARE REMAINS WITH THE APPLICABLE LICENSOR(S). IN NO EVENT WILL 3D ROBOTICS BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE SOFTWARE.