



# DIY QUAD

Build Manual

V.A

2014

# Contents

Thanks for purchasing a DIY Quad!

These instructions will show you how to assemble a Quad using the Pixhawk autopilot system and ArduCopter/APM:Copter firmware. If you plan to use other components in your build, please adjust these instructions accordingly. For online instructions, visit [3dr.com/diy-quad-kit](http://3dr.com/diy-quad-kit).

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# Frame parts

	blue arms (2)		velcro strips (one pair)
	black arms (2)		velcro straps (3)
	base plate		dual lock
	top plate		zip ties
	Pixhawk plate		power distribution board
	accessory plate		15 cm four-wire cable
	leg plates (8)		15 cm six-wire cable
	leg support plates (4)		15 cm female-female servo cable
	motor plates (8)		30 cm male-female servo cable
	30 mm bolts (6)		threadlocker
	25 mm bolts (30)		
	5 mm bolts (32)		
	nylon bolts (4)		
	30 mm male-female standoffs (4)		
	19 mm hollow spacers (20)		
	18 mm female-female standoffs (12)		
	metal nuts (42)		
	nylon nuts (4)		
	thumb nuts (2)		

# Electronics



This build uses the Pixhawk autopilot system, including these components:

- Pixhawk autopilot
- u-blox GPS with Compass
- Telemetry radios
- Radio control system
- ArduCopter/APM:Copter firmware

[Click here](#) for more information about these components and to view compatible radio control systems.

# Tools

To complete this build, you will need the following tools not included with your kit:

- Phillips screwdriver
- Double-side foam tape or other mounting adhesive
- Soldering equipment

Note: The electronics for this build require soldering. If you're unfamiliar with soldering, our friends at Sparkfun have some great tutorials that can get you started, including this [comic](#). For an example of exactly what soldering you'll be doing in this build, view this [video tutorial](#).

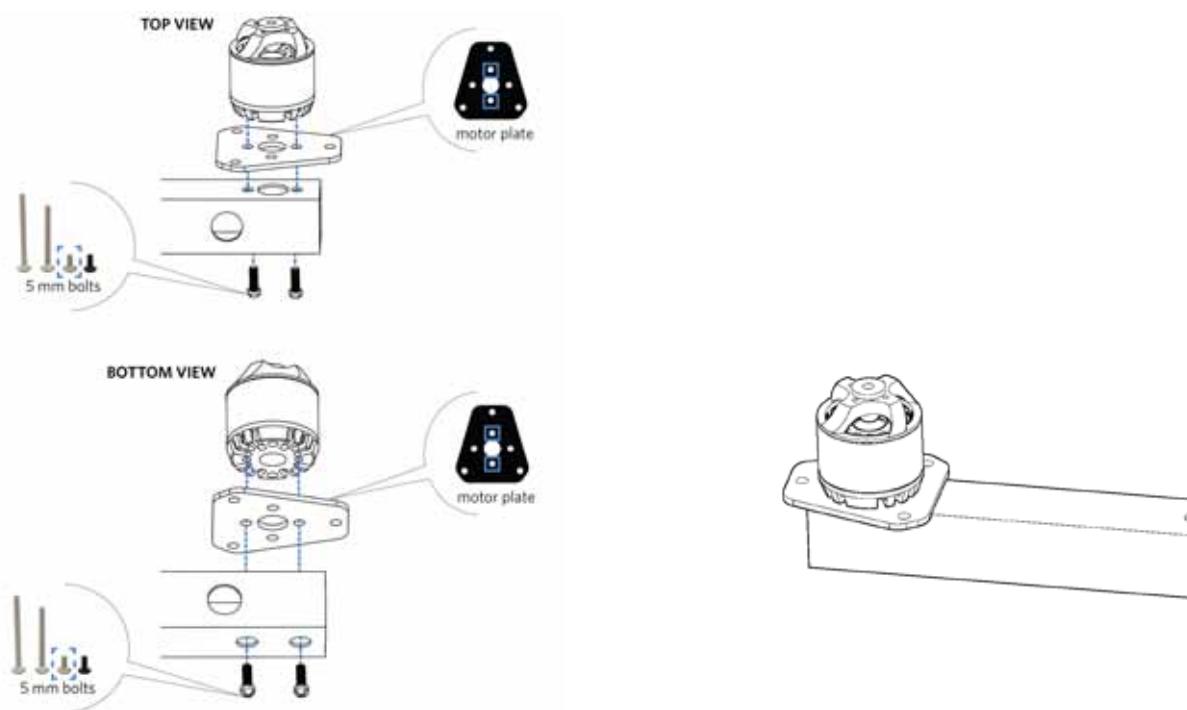
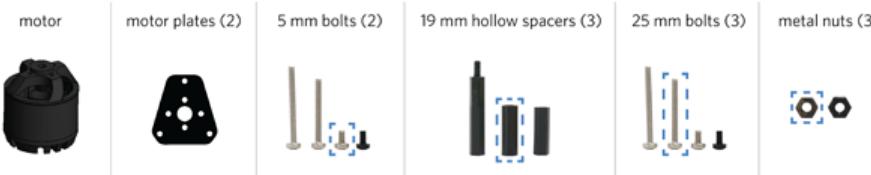
# 1 Motor assembly

Follow these instructions to assemble one motor.

## 1 Attach motor to arm

Place a motor plate on top of the arm with the short end of the plate facing towards the end of the arm. Place the motor on top of the plate, and align the two small holes in the motor, plate, and arm. Orient the motor with the cables as close as possible to the hole in the side of the arm.

Apply threadlocker to two 5 mm bolts, and secure the motor and plate to the arm from below by accessing through the two large holes in the bottom of the arm. When applying threadlocker, use less than one drop, and cover only four or five threads where the bolt connects with the motor. Make sure to insert the bolts into the holes in the bottom of the motor and not into the slots where they could interfere with the motor.



## 2 Thread motor cables through arm

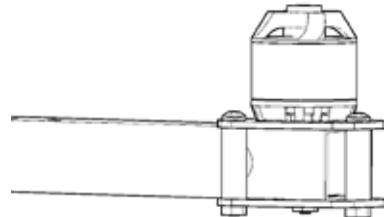
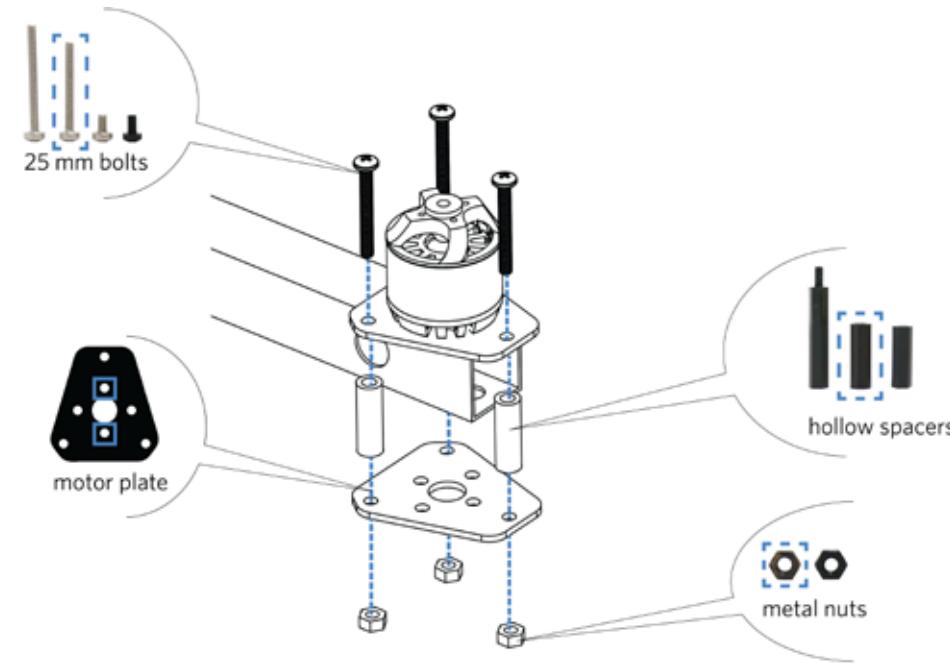
Thread the motor cables through the hole in the side of the arm.



## 3 Attach bottom plate to arm

Place a motor plate against the bottom of the arm with the short end of the plate facing towards the end of the arm. Apply threadlocker to the ends of three 25 mm bolts (less than one drop covering four or five threads at the end of the bolt). Place a 19 mm hollow spacer between each of the pairs of holes in the two motor plates. Place the bolt through the motor plates and spacer, and secure from below with a metal nut.

Repeat these instructions for all motors.



## 2 Power system wiring

Follow these instructions to connect the power system.

### 1 Solder Deans to ESCs

Solder a Deans connector to the red and black wires on each electronic speed controller (ESC). Check the Deans connectors for the + and - markings, and solder the + side to the red wire and the - side to the black wire. Don't forget to add heat shrink tubing to the wires before soldering, and shrink the tubing over the finished connections.



Deans to ESC:  
negative = black  
positive = red



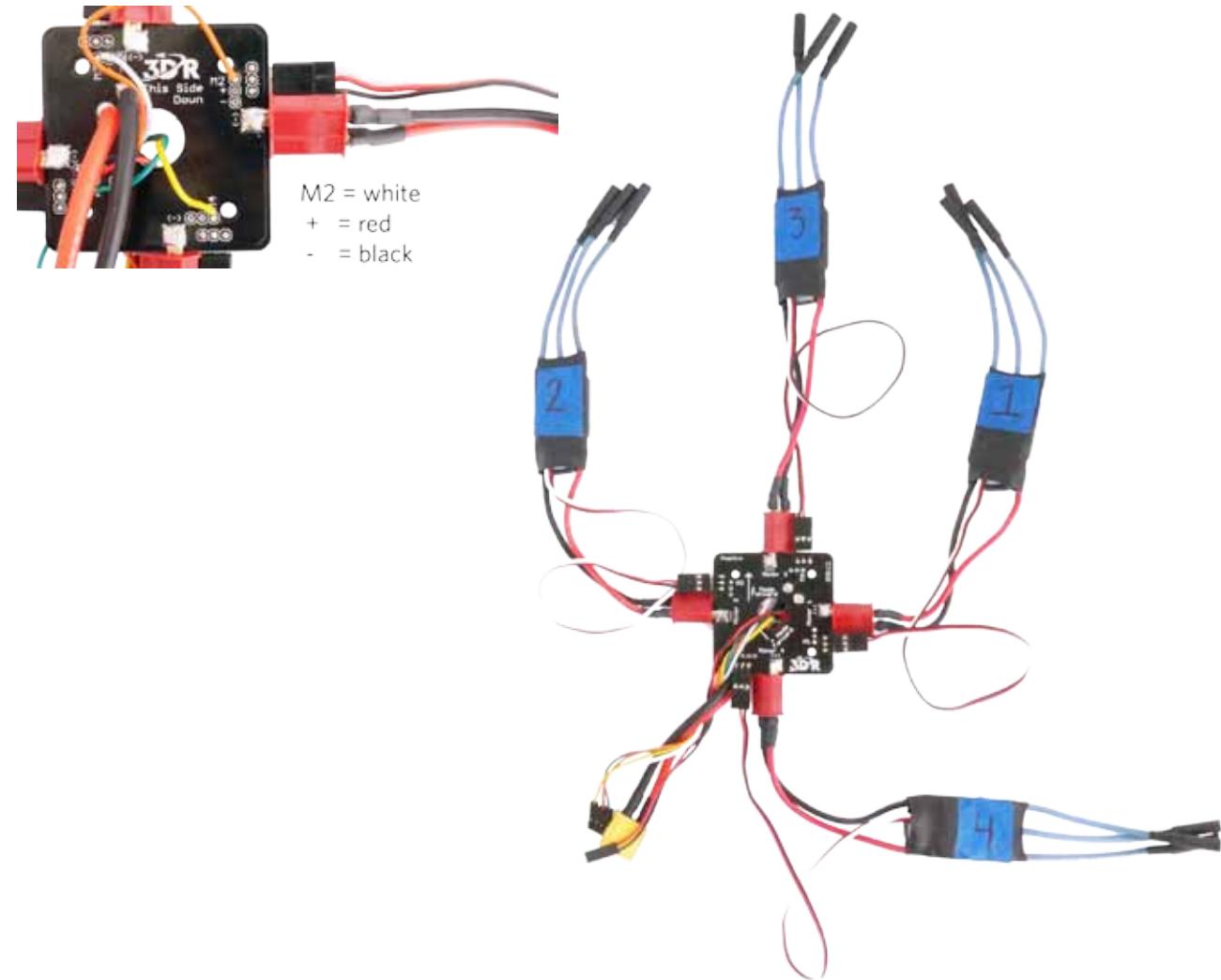
### 2 Number ESCs

Use tape (or other method) to label each ESC with a number one through four.

### 3 Connect ESCs to PDB

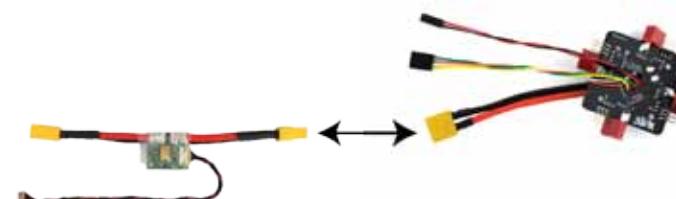
Connect the Deans connectors (red) on the ESCs to the Deans connectors on the power distribution board (PDB) in any order.

Take a look at the PDB and find the pins labelled M1 through M4 (motors 1 through 4), and make a note of which color wire connects to each. Now connect the three-wire cables from each ESC to these pins on the PDB according to the ESC numbers. This is where the order is critical. Connect the ESC that you labelled as "1" to the pins on the PDB labelled "M1", ESC 2 to PDB pins M2, ESC 3 to PDB pins M3, and ESC 4 to PDB pins M4. Connect the white wire to the signal pin (labelled "M1"), the red wire to the power pin (labelled "+"), and the black wire to the ground pin (labelled "-").



### 4 Connect PDB to power module

Attach the XT60 connector (yellow) on the PDB to the XT60 connector on the power module.

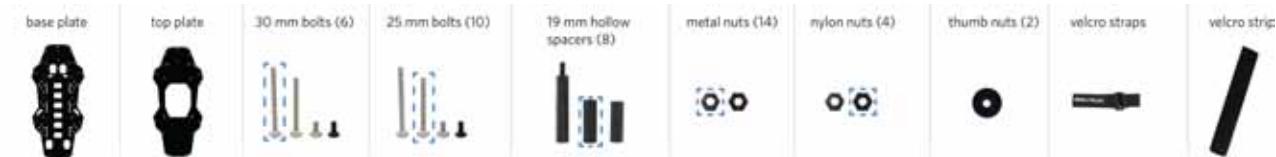


# 3 Body plate assembly

Follow these instructions to assemble the body plates.

## 1 Add velcro straps to base plate

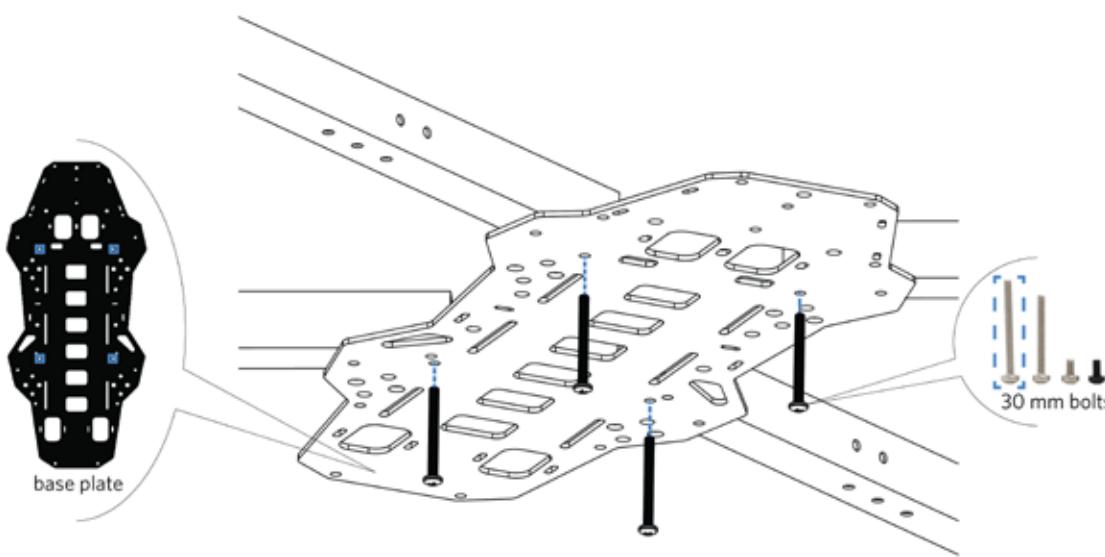
Thread the two velcro straps through the slots in the base plate. These straps will hold the battery to the bottom of your copter. The perfectly flat side of the plate (without the protruding nuts) should face down. Your kit includes two velcro strips to attach to the battery and the bottom of the copter. To install, attach the strip with loops (fuzzy) to the bottom of the plate between the straps, and attach the strip with hooks (smooth) to your battery.



[Visit the APM:Copter Wiki](#) and learn more about which batteries to use with your copter.

## 2 Attach arms to base plate

Now we'll attach the four arms with assembled motors to the base plate. Using the innermost hole in the arm and the hole in the base plate marked below, insert a 30 mm screw from the bottom, up through the plate and the arm. Attach the two black arms and two blue arms as shown in relation to the shape of the plate. (Attach the black arms to the more elongated end of the plate.)



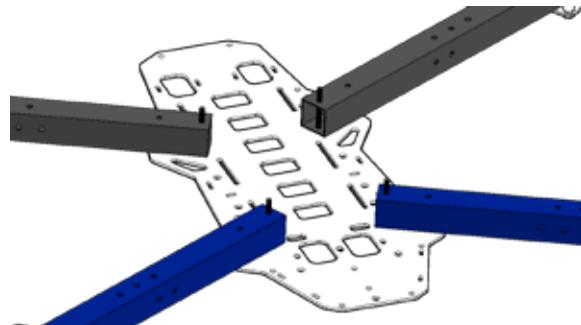
It may be helpful to secure each arm in place temporarily with a metal nut.

### 3 Label motors

Use tape (or other method) to label the motors by the numbers shown here.

### 4 Connect ESC and motor cables

Connect the motor cables to the corresponding ESC cables according to the labelled numbers (connect motor 1 to ESC 1, motor 2 to ESC 2, etc). The order of the three cables determines which direction the motors will spin and is critical for the copter to fly correctly. The diagram above shows which motors need to spin clockwise (CW) and counter-clockwise (CCW).



COUNTERCLOCKWISE (CCW) ROTATION WIRING



CLOCKWISE (CW) ROTATION WIRING

**top = blue  
center = black  
bottom = red**

**top = blue  
center = red  
bottom = black**

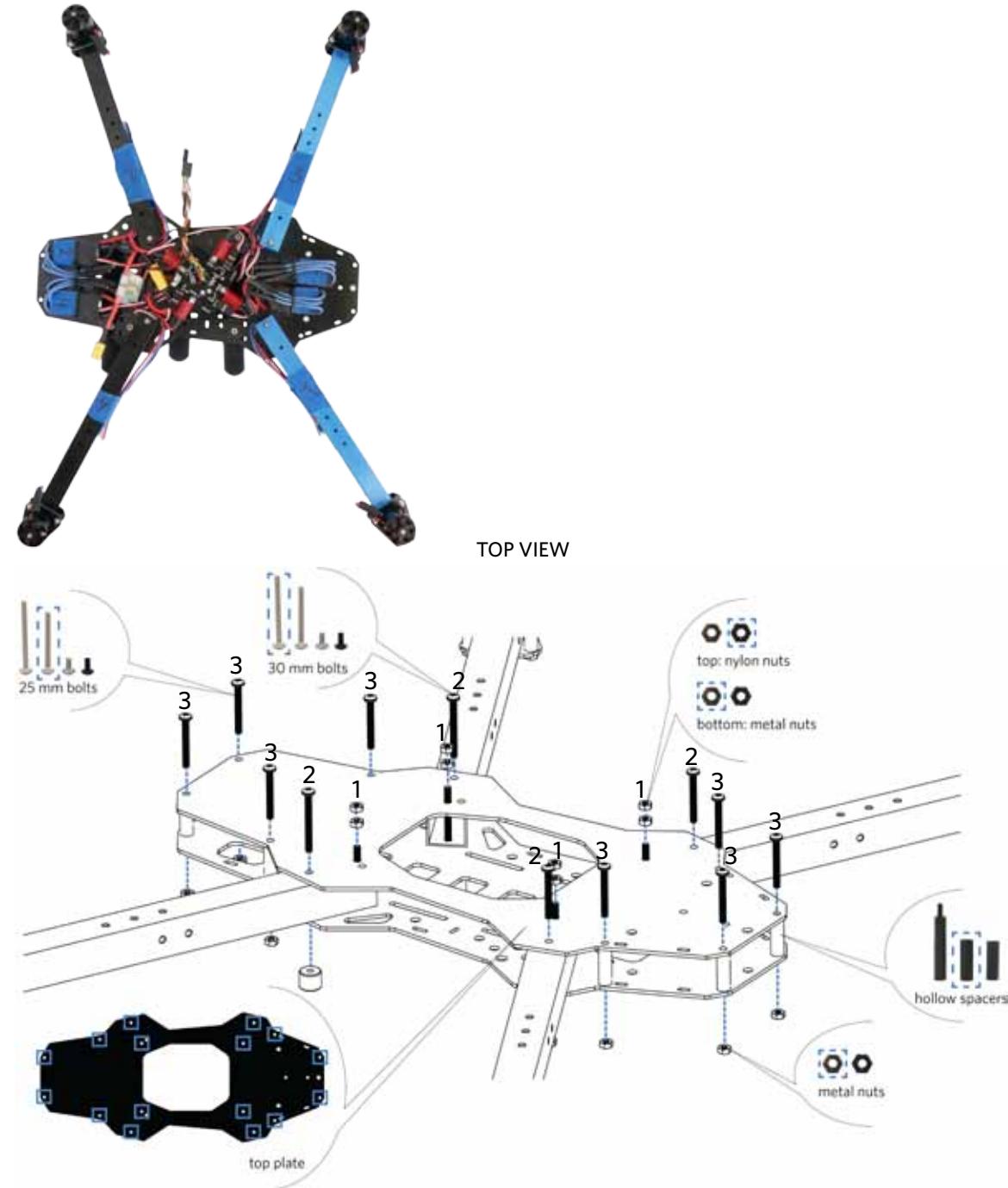
The images below show the correct wiring to produce each direction of rotation. The motor cables are differentiated by color. To differentiate the ESC cables, orient the ESC with the label facing up, and use the relation of the cables to the label.

## 5 Assemble electronics onto base plate

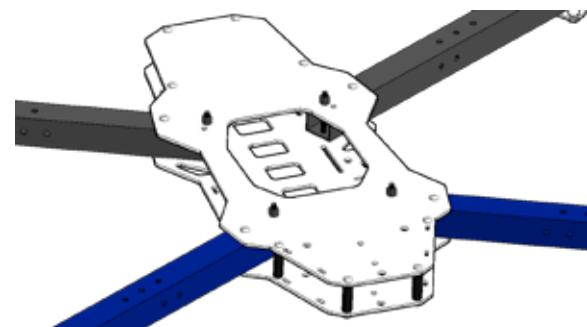
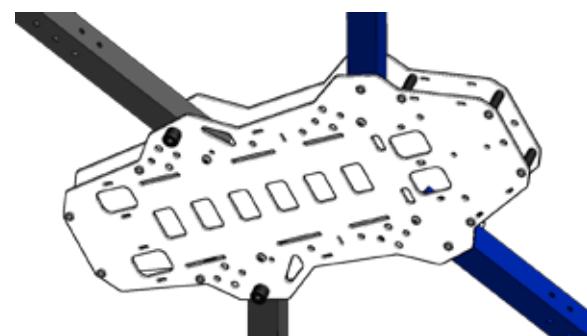
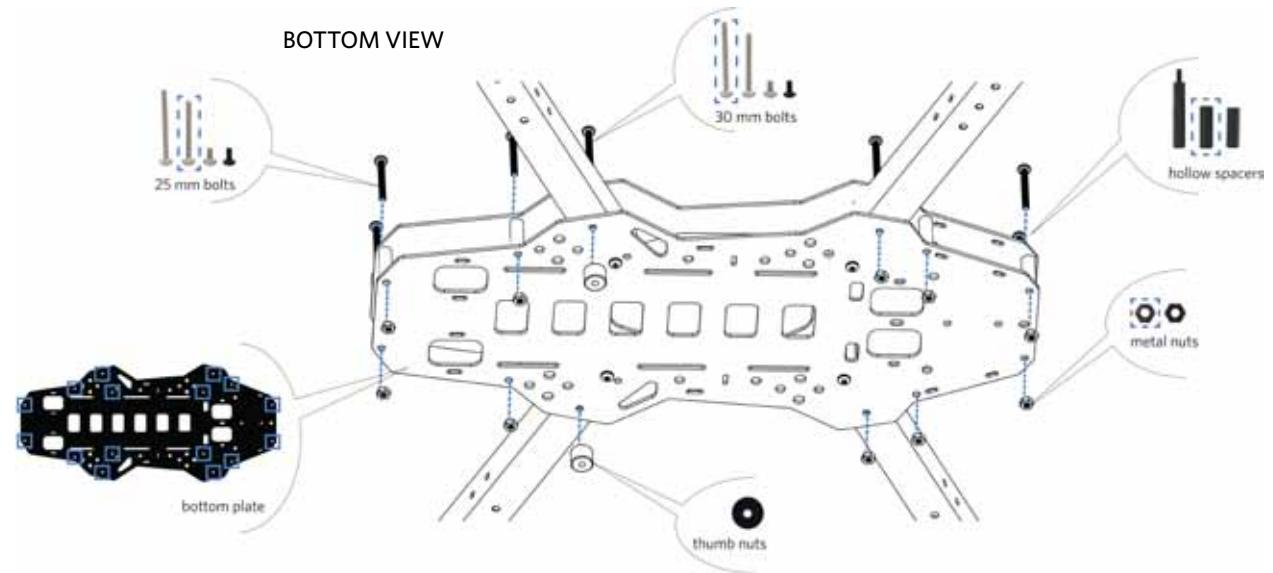
The base plate holds the power system: power distribution board (PDB), power module, and four electronic speed controllers (ESCs). Place the assembled power system onto the base plate. Attach the four ESCs to the base plate using zip ties. Orient the ESCs with the labels down into the holes in the plate. Alternatively, you can mount the ESCs to the front of the copter, perpendicular to the plates, by securing the zip ties to the small slots along the front edge of the plates. In this case, orient the ESCs with the labels facing out. Ensure that the power module XT60 connector protrudes from the back end of the copter (behind one of the black arms) where it can easily connect to the battery.

## 6 Assemble top plate

Remove any nuts that you may have used to secure the arms temporarily to the base plate, and add the top plate directly on top of the arms. Secure the four existing screws with metal nuts, and add a nylon nut on top of each metal nut.



Secure the arms to the plates through the holes in the end of the arms and the holes in the plates shown below. Use 30 mm bolts and thumb nuts to attach the black arms, and use 25 mm bolts and metal nuts to attach the blue arms. Finally, attach the base and top plates together with 25 mm bolts, 19 mm hollow spacers, and metal nuts where marked below.



## 7 Thread cables through top plate

Locate the following three cables, and thread them up through the central space in the top plate: PDB two-wire cable (red and black), PDB four-wire cable (multicolor), and power module six-wire cable (red and black). These cables will connect to Pixhawk.



# 4 Pixhawk assembly

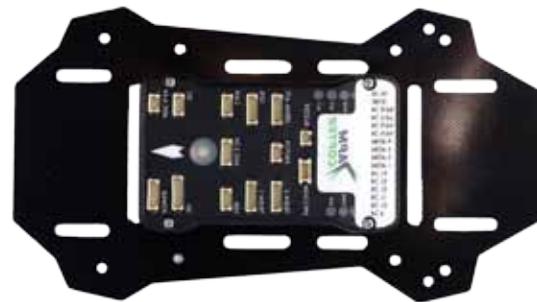
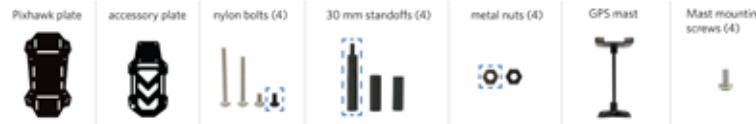
Follow these instructions to assemble the Pixhawk and accessory plates.

## 1 Mount Pixhawk

Separate the four foam pieces provided with the Pixhawk kit, and attach them to the bottom four corners of the board. Mount Pixhawk to the Pixhawk plate with the arrow facing as shown below (towards the less elongated end of the plate).

## 2 Mount buzzer and switch

The switch (button) snaps into the round hole in the accessory plate. Thread the switch cable through the hole in the accessory plate from the top, and gently pull the switch into place. Using double-sided foam tape, mount the buzzer to the underside of the accessory plate.

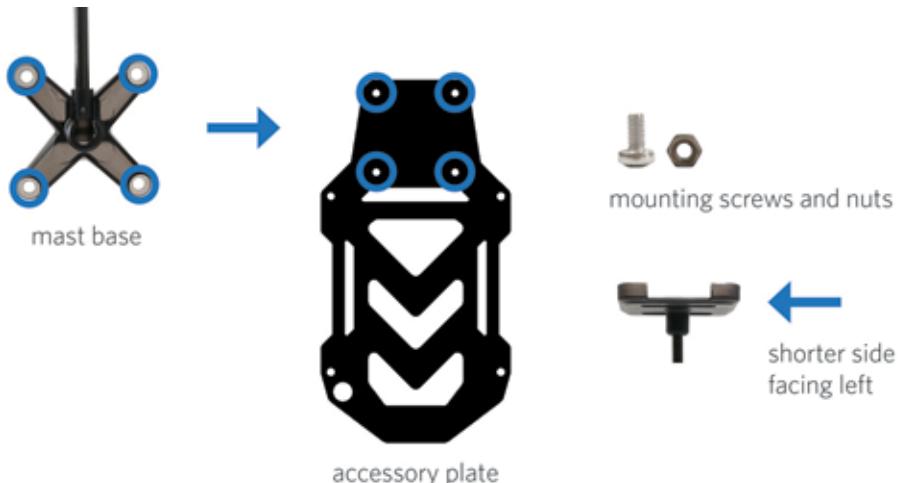


BOTTOM VIEW



### 3 Mount GPS

Place the base of the GPS mast over the four holes in the accessory plate with the shorter side of the top of the mast facing the left side of the plate (the arrow-shaped holes in the plate face forward). Add a mounting screw to each hole, and secure with nuts.



Remove the adhesive backing from the mast and place the GPS module onto the mast with the connectors facing the shorter side and the arrow on the GPS pointing in the same direction as the arrow-shaped holes in the plate.



### 4 Insert SD card

Insert the micro-SD card into the slot at the end of Pixhawk. The APM:Copter sticker can be attached to the front of Pixhawk.

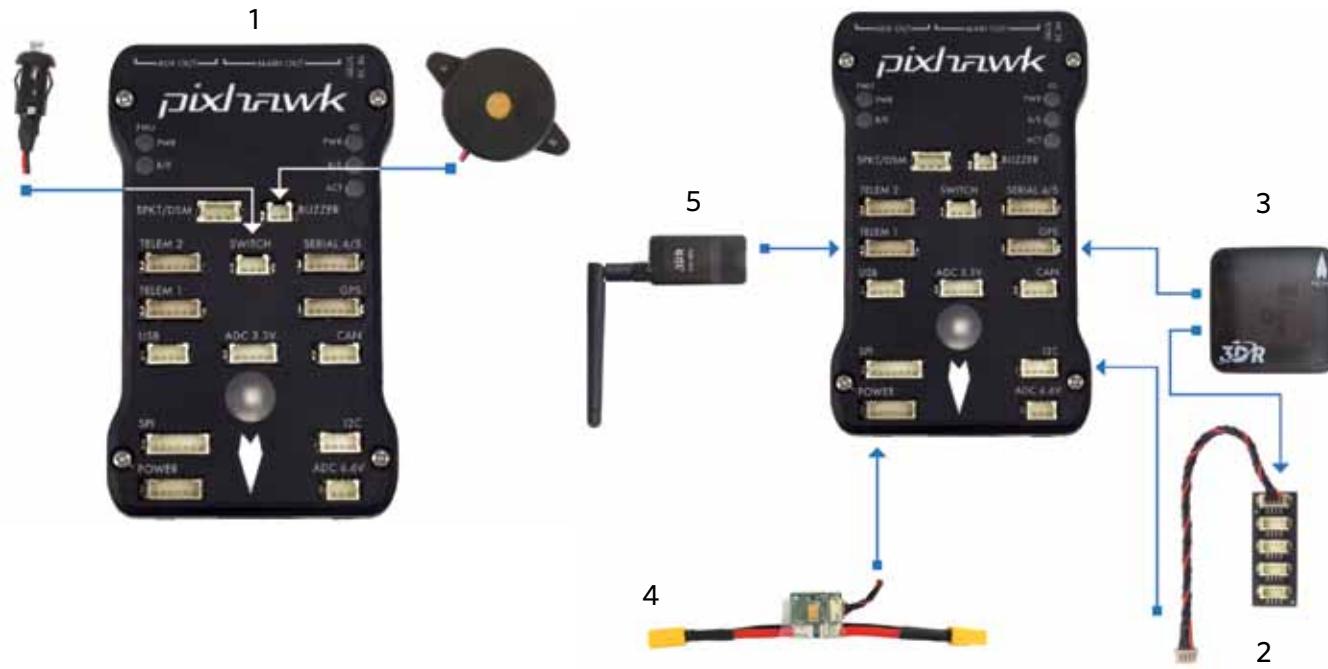


## 5 Connect modules to Pixhawk

Connect the buzzer, switch, splitter, GPS, power, and telemetry modules to Pixhawk.

To ensure the most secure cable assembly, thread the cables through the holes in the plates where possible. Where the cables dangle away from the frame, such as along the mast, use zip ties to secure the cables to the frame.

Note: Pixhawk's DF13 connectors can be fragile when disconnected and reconnected multiple times. Do not pull on the cables to disconnect, use a fingernail or small, flat tool to loosen the edges of the connector until it pops out.



- 1 Buzzer and switch: Connect the buzzer to Pixhawk's BUZZER port, and connect the switch (safety button) to the SWITCH port. These components are mandatory for Pixhawk.
- 2 I2C splitter: Connect the four-wire cable to one of the ports on the splitter and to Pixhawk's I2C port.
- 3 GPS with compass: Use the long cables provided with the GPS mast to connect the GPS with compass module to Pixhawk. Connect the four-wire cable to the GPS' MAG port and to one of the ports on the I2C splitter. Connect the six-wire cable to the GPS port on the GPS module and to Pixhawk's GPS port.
- 4 Power module: Connect the six-wire cable (red and black cable protruding from the central space in the top plate of the copter) to Pixhawk's POWER port.
- 5 Telemetry radio: Connect the six-wire cable to a telemetry radio module and Pixhawk's TELEM 1 port.

## 6 Connect RC receiver



Pixhawk is compatible with PPM RC receivers or PWM receivers with an additional PPM encoder module. Connect the three-wire cable (red, black, and white) from your PPM receiver or PPM encoder to Pixhawk's RC pins with the white wire connected to the signal (s) pin, the black wire connected to the ground (-) pin, and the red wire connected to the power (+) pin. [Click here](#) for more information on using a PPM encoder or Spektrum Satellite receiver.

## 7 Connect motor outputs



Locate the four-wire cable (multicolor) protruding from the central space in the top plate. Connect it to the main output signal (s) pins on Pixhawk according to motor number. Recall your notes from the power system wiring and see which color wire corresponds to motor 1. Ensure that that color wire is connected to the main output 1 signal (s) pin. Do not rely on the colors of the wires shown here, the accuracy of this component is critical.

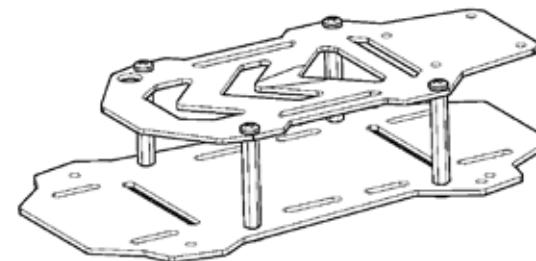
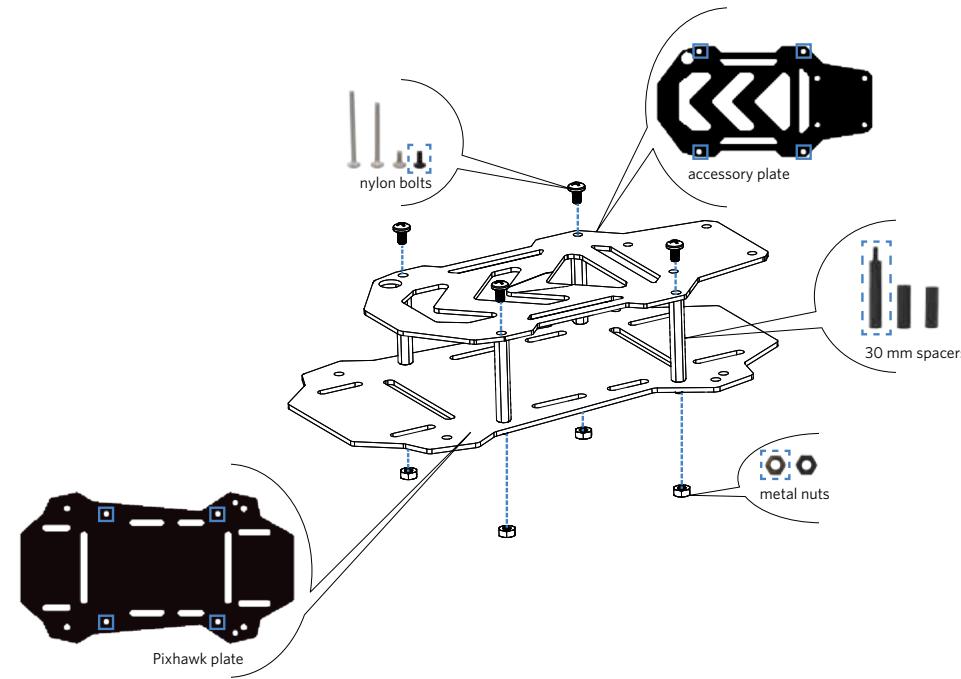
## Connect backup power (optional)



Connect the two-wire cable (red and black) protruding from the top plate to provide a backup power source for Pixhawk. Connect the black wire to any of Pixhawk's main output ground (-) pins and the red wire to any of the main output power pins (+). This configuration is best supplemented with a zener diode ([visit the APM:Copter Wiki](#) to learn more), but the backup power method can be used without implementing the additional diode. If you do not wish to connect backup power, leave the cable disconnected.

## 8 Assemble plates

Add a 5 mm nylon bolt to the four holes in the accessory plate marked below, and attach a 30 mm standoff to each one below the plate. Add the Pixhawk plate to the ends of the standoffs and secure with metal nuts.

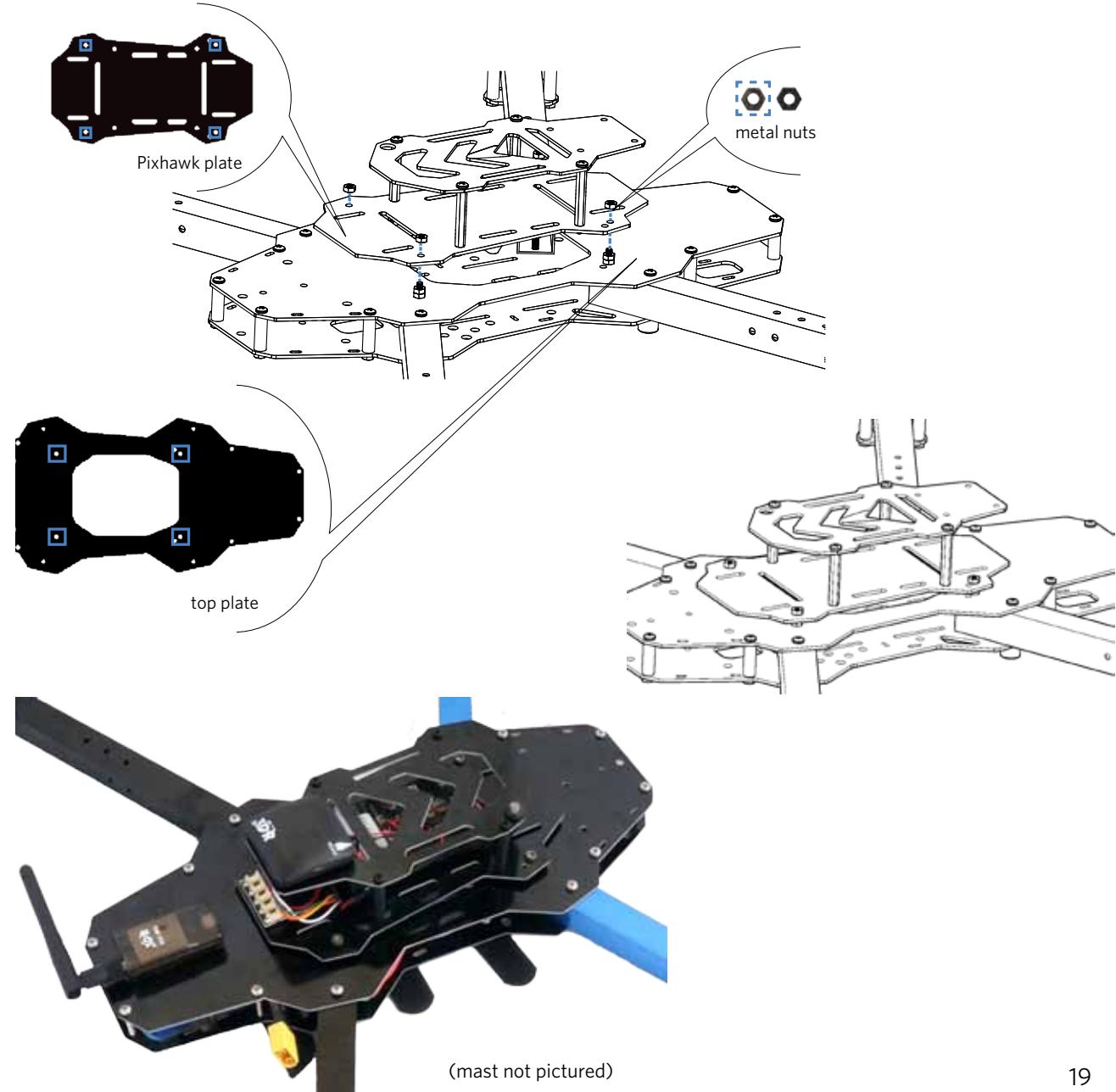


Place the assembled plates over the exposed bolts in the top plate, with the arrows facing towards the blue arms, and secure with metal nuts.

## 9 Mount remaining components

Select a location on the copter to mount the I2C splitter, telemetry radio, and RC receiver. Use dual lock or double-sided foam tape to mount the components. Check that all components are connected securely to Pixhawk.

Where you place the components on the copter is ultimately limited by the length of the cables between modules. Experiment with the different length cables provided with your kit, and find the best place for each module on your copter.



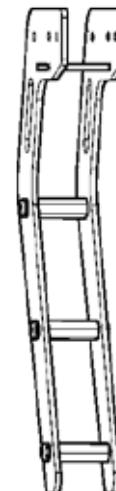
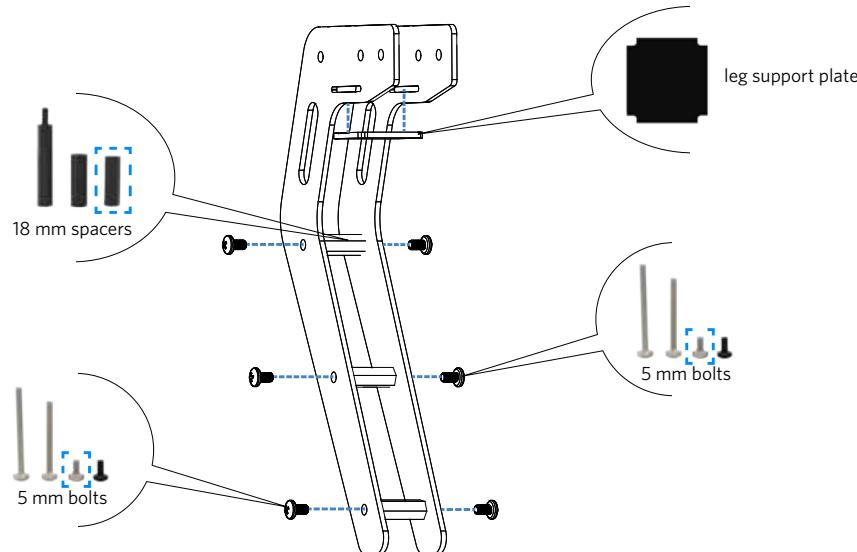
# 5 Leg assembly

Follow these instructions to assemble one leg.



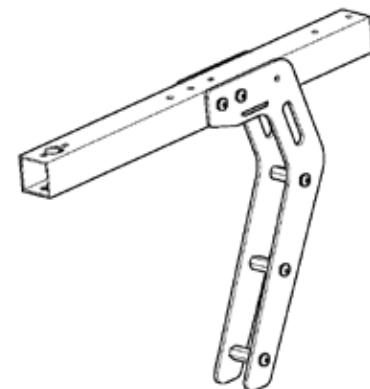
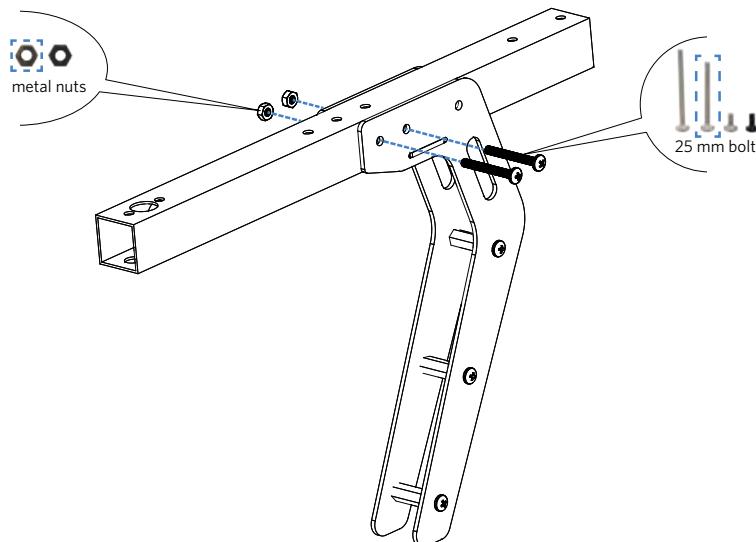
## 1 Assemble leg

Align the leg plates, and place a standoff between each of the bottom three pairs of holes in the plates. Secure each standoff to the plates with a 5 mm bolt on each end. Insert the support plate into the horizontal slots at the top of the leg.



## 2 Attach leg to arm

Align the two holes in the top of the leg with the two holes in the center of the arm. Orient the leg with the point facing towards the center of the copter. Insert two 25 mm bolts through the arm and the leg, and secure with metal nuts.



Repeat these steps for each leg of your copter.

# 6 Calibration

Your Y6 assembly is almost complete. Now it's time to go online, download software, and begin calibrating Pixhawk to work with your new frame. Do not proceed to propeller assembly with performing calibration.

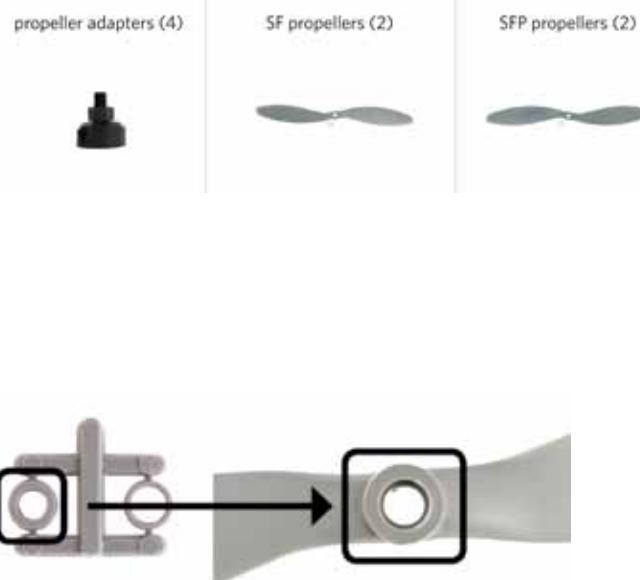
View the calibration instructions online at  
[3dr.com/diy-y6-kit](http://3dr.com/diy-y6-kit).

# 7 Propeller assembly

Follow these instructions to assemble propellers.

## 1 Assemble propellers

Remove the rings from the propeller package. Select the ring with the smaller internal diameter, and insert it into the back of the propeller hub.



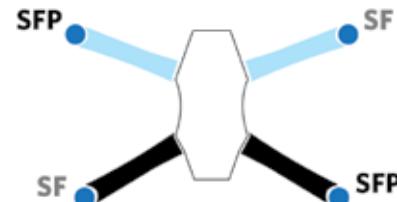
## 2 Assemble propeller adapters

Select the propeller adapters and the longer screws provided with the adapters. Do not use the x-shaped plate. Apply threadlocker to the three small screws included with the propeller adapters (less than one drop covering four to five threads). Attach an adapter to the top of each motor.



## 3 Add propellers

Your Quad uses SF and SFP propellers. These propellers are labelled on the package and on the propeller itself. Add SF and SFP propellers to the arms shown in the diagram below with the writing on the propeller facing towards the sky. The right propeller order and orientation is critical for your copter to fly correctly. Add the washer above the propeller, and secure the nut tightly on top.



Ensure that the writing on the propellers faces the sky.

Your Quad build is now complete! Before your first flight, please read all safety information and first flight instructions at [copter.ardupilot.com/wiki/table-of-contents/](https://copter.ardupilot.com/wiki/table-of-contents/).



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