3DR

DIY KITS

QUAD

Thank you for purchasing a 3DR Quad DIY Kit!

These instructions will guide you through assembling and wiring your new autonomous multicopter.

CONTENTS

Your 3DR Quad Kit contains:


30 mm steel bolts (4)


25 mm steel bolts (12)


30 mm threaded spacers (4)


18 mm threaded spacers (12)


8 mm threaded spacers (4 plus 4 spare)


5 mm steel bolts (8 plus 2 spare)


5 mm nylon bolts (28 plus 4 spare)


Metal nuts (16)


Nylon nuts (8 plus 8 spare)

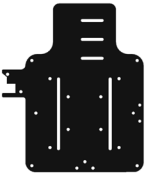

Metal lock washers (8)

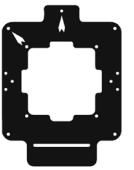

Rubber washers (4)


Zip ties (8)


Black arm (3)


Blue arm (2)


Bottom plate


Top plate


APM plate


Accessory plate


Landing gear pieces (8)


Electronic speed controllers (4)


Power distribution board


850 kV motors with bullet connectors (4)


Power module with XT60 connectors


Motor collets (4)


Battery strap


6-position power module cable


XT60 connector - male


Deans to XT60 adapter


Heat shrink tubing


Double-adhesive mounting foam


Deans connectors - male (4)


Five-wire RC receiver cable


Two-wire RC receiver cable


10 x 4.7 SFP (pusher) propellers (2)


10 x 4.7 SF (normal) propellers (2)

Threadlocking compound

These instructions require some minor soldering. If you're unfamiliar with soldering, our friends at Sparkfun have some great tutorials that can get you started, including this comic: learn.sparkfun.com/curriculum/42.

For an example of exactly what you'll be doing for this assembly (soldering Deans connectors to ESCs), check out this video: youtu.be/3LJIQeKuLLU.

You will also need:

- Phillips screwdriver (small)
- 5.5 mm (7/32) wrench
- Double-sided foam mounting tape
- 2 mm (5/64) hex wrench
- Soldering equipment

You may have opted to also receive:

3DR APM 2.6:

3DR APM 2.6

4 mm JP1 jumper connector

6 mm PPM jumper connector

Micro USB cable

Telemetry adapter cable

3DR Radio:

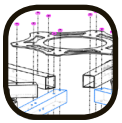
Radios (2)
Antennas (2)
Micro-USB cable
Android OTG cable
Autopilot connectors

3DR uBlox GPS+Compass:

3DR uBlox GPS board with compass

6-position to 5-position GPS cable

4-position compass cable



FRAME ASSEMBLY

1 Choose + or x

x (cross) configuration

+ (plus) configuration

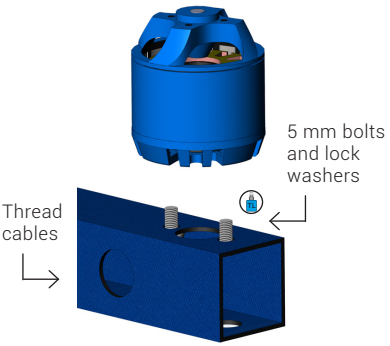
Your 3DR Quad can be flown in both + (plus) and x (cross) configurations. A plus-configured copter flies with one arm forward, while a cross-configured copter flies with two arms forward. While both configurations provide excellent performance, cross is standard and recommended for new fliers. For plus, use three black arms and one blue arm when assembling your copter, and remember to specify plus when choosing your frame orientation during software configuration. These instructions will continue assembling a Quad in cross orientation.

2 Attach motors to arms

Each arm of your Quad will have a motor attached to the top of the arm using two 5 mm steel bolts and two metal lock washers. To ensure motors are securely bolted to arms, apply a small amount of threadlock to each bolt before fastening.

Threadlocking compound is an important component to ensure your motors remain firmly attached! For application tips, check out this video: goo.gl/bM3MA.

Position holes in the bottom of the motor over the two small holes on either side of the larger hole in top in the of the arm. Secure with two 5 mm steel bolts (with a metal lock washer on each bolt) by accessing through the two large holes in the bottom of the arm. Thread the motor cables through the arm using the hole in the side of the arm. Repeat for all four arms.

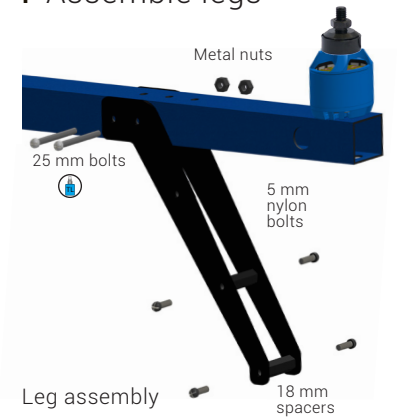


3 Install motor collets

Attach a threaded collet to the top of each motor using the four small screws included with collets. Apply threadlock to each screw before fastening. Repeat for all four motors.

Motor collet assembly

4 Assemble legs



Leg assembly

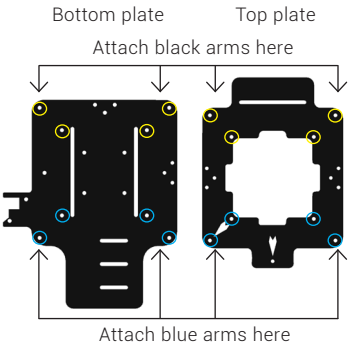
Your Quad has four legs, each comprised of two landing gear pieces. To assemble each leg, align two landing gear pieces and attach through the three bottom holes using three 18 mm spacers and six 5 mm nylon bolts.

For each hole, position spacer between holes, and secure from each side with nylon bolts. Repeat for all four legs.

Attach legs to arms with leg pointing toward motors. Align the two top holes in the leg with the two holes in the center of the arm. Insert two 25 mm bolts and secure with metal nuts.

5 Attach top and bottom plates

The top and bottom plates will form the main frame by attaching to your copter's arms. Align plates in the orientation show below, and attach two blue arms to one end and two black arms to the other using the four pairs of holes as shown.



Place the arm between the two plates so the two holes in the arm align with the holes in the plates. Insert a bolt into each hole and secure with nuts. For inner holes use 30 mm bolts and metal nuts; for outer holes use 25 mm bolts and metal nuts. Add a rubber washer on top of the nut on the inner holes.

For plus configuration: Attach a blue arm to only the position on the plate marked with an arrow.

Inner holes use:

30 mm bolt + arm + metal nut + rubber washer

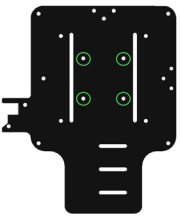
Outer holes use:

25 mm bolt + arm + metal nut

Next add the spacers that will hold the power distribution board in place. Using the four holes in the bottom plate shown across, align four 8 mm spacers, and secure from the bottom using four 5 mm nylon bolts.

5 mm nylon bolt + 8 mm spacer

Bottom plate



Slide the battery strap through the two slots in the bottom plate.

POWER WIRING

1 Place power distribution board

The power distribution board (PDB) allocates power to your copter's motors. Place the PDB in the center of your copter through the hole in the top plate. Align the PDB so the four 8 mm spacers insert into the four holes in the PDB. Secure with four nylon nuts.

2 Solder connectors to electronic speed controllers

Electronic speed controllers (ESCs) regulate how much power is applied to each motor. To connect the four ESCs to the PDB, you will need to solder the provided Deans connectors to the ESCs' black and red wires.

Solder Deans connectors to ESCs:

Add a half-inch length of heat shrink tubing onto each ESC red wire and black wire. Solder the positive Deans connector plug to the red wire and the negative Deans connector plug to the black wire. Shrink tubing over connections.

Add heat shrink and align wires to correct plugs.

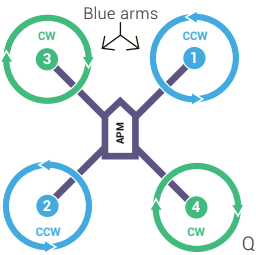
Soldered connectors

3 Connect ESCs to motors and PDB

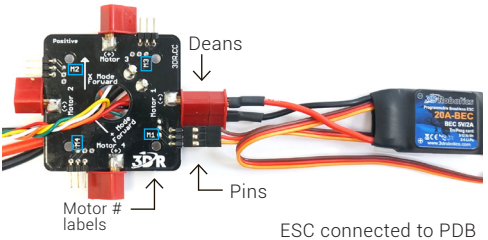
Connect motor cable bullet connectors to ESC bullet connectors. Each ESC should connect to only one motor.

Motor connected to ESC

The diagram below indicates the number of each motor. Starting with the motor labeled 1, connect the ESC three-wire cable to the corresponding position on the PDB pins (M1 for motor 1, M4 for motor 4, etc) with the orange wire positioned farthest from the adjacent Deans connector. Connect ESC Deans connector to PDB Deans connector for that motor. Repeat for all motors and ESCs.



Quad motor order

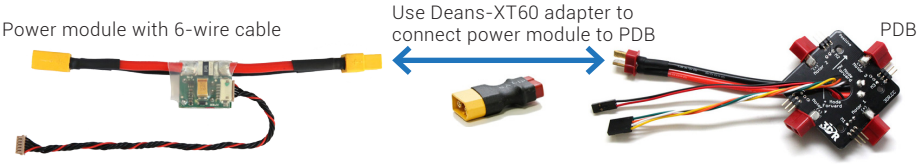


ESC connected to PDB

Don't secure the ESCs to the frame until you have confirmed that each motor spins in the direction specified in the diagram above (see motor setup instructions at copter.ardupilot.com).

4 Connect power module to PDB

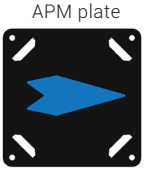
Connect power module 6-position cable to the power module 6-position port. Place power module in the center of your copter near the PDB. Connect PDB red and black cable (with Deans) to power module Deans connectors. Use the provided Deans-to-XT60 adapter plug to connect the power module to the PDB.



INSTALL APM

1 Mount APM

Place the APM 2.6 in the center of the APM plate with the **arrow on the case facing as shown**. Use the mounting foam to secure the APM to the plate.



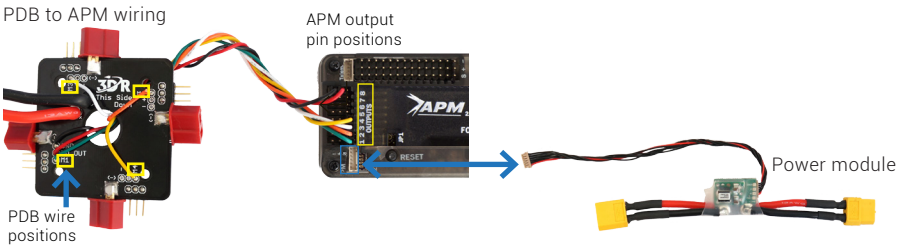
Ensure mounting tape is firmly attached so the position of the APM doesn't shift during flight.

For APM 2.5: Mount the APM to the top of the accessory plate.

For plus configuration: Mount the APM with arrow pointing toward blue arm.

2 Connect APM to power module and PDB

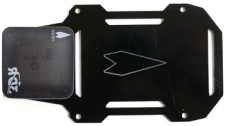
Connect the power module six-position cable (red and black) to the APM PM port. Connect the PDB four-wire cable (multicolored) to the APM Outputs signal pins (top row). Ensure that the wire originating in the position on the PDB pins labeled M1 connects to the APM Output signal pin labeled 1, the M4 wire connects to position 4, etc.



3 Mount GPS

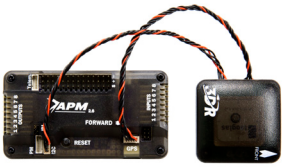
Place the GPS module onto the square end of the accessory plate with the **arrow pointing towards the center of the plate.** Use double-sided foam tape to secure case to plate.

Accessory plate



Ensure arrow on GPS points forward!

4 Wire additional components to APM

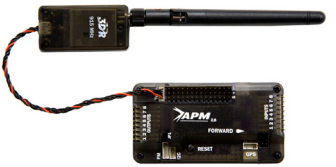


3DR uBlox GPS with Compass:

Connect the 6-position to 5-position cable to the GPS 6-position port and to the APM GPS port (use top-entry port not side-entry port). Connect the 4-position cable to the GPS 4-position port and to the APM I²C port.

3DR Radio air module:

Attach antenna to 3DR Radio air module. Connect telemetry cable to the air module and to the APM Telem port.

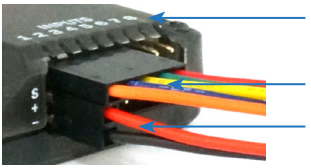


Radio control (RC) receiver:

To connect an RC receiver to APM, use the five-wire and two-wire cables provided with your copter.

Note: APM also supports one-wire PPM connection with supported receivers. See copter.ardupilot.com for instructions.

Use the five-wire cable to connect the receiver's signal pins to APM's input signal pins. Use the two-wire cable to connect power and ground pins between APM and the receiver.



APM input pin numbers

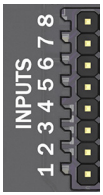
Connect five-wire cable to signal pins (top row, "S").

Connect red wire to power pin (center row, "+") and black wire to ground pin (bottom row, "-").

APM inputs wiring

After connecting to APM, connect the five-wire cable to the receiver's signal pins (usually marked "S", see channel diagram below), connect the two-wire cable red wire to a power pin (usually marked "5V" or "+") on the receiver, and connect the two-wire cable black wire to a ground pin (usually marked "-") on the receiver.

APM Input Signal Pins



6 AUX 2 (OPTIONAL)
5 AUX 1 (MODE SWITCH)
4 YAW / RUDDER
3 THROTTLE
2 PITCH / ELEVATOR
1 ROLL / AILERON

Match the correct control channel signal pin on the receiver with its corresponding APM input signal pin.

5 Attach APM plate to top plate

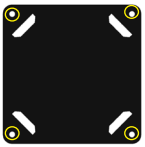
Locate the PDB four-wire cable (multicolored) and the power module six-position cable (red and black); thread these cables up through the slots in the APM plate where they can connect to the APM.

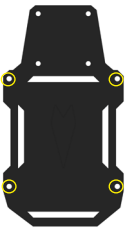
Now we'll attach the APM plate to the top plate. The APM plate connects to the ends of the four 30 mm bolts securing the inside holes of the arms. Place the four holes in the APM plate over the exposed 30 mm bolts on the top plate and secure with 30 mm threaded spacers.

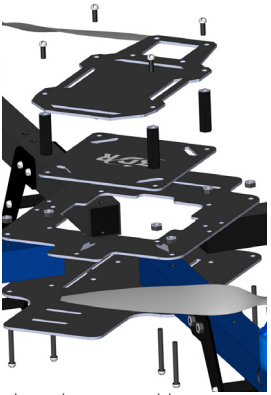
6 Attach accessory plate to APM plate

Place accessory plate on top of APM plate, and align the four 30 mm spacers with the four holes in the accessory plate. Secure accessory plate to spacers using four 5 mm nylon bolts.


30 mm spacer + nylon nut


APM plate


Accessory plate


Complete plate assembly

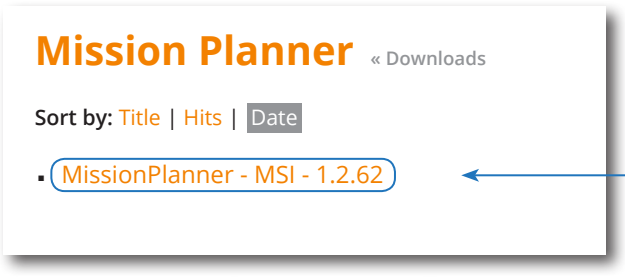
Your Quad assembly is now complete! The following steps will get you started configuring your copter.

INSTALL SOFTWARE

Mission Planner is free, open-source software providing multiplatform configuration and full-featured waypoint mission scripting for autonomous vehicles.

To install Mission Planner on your ground station computer (Windows only), visit ardupilot.com/downloads, select Mission Planner, and select sort by date (short link: goo.gl/Si5grC). Select the MissionPlanner - MSI (Microsoft installer package). For the same features as Mission Planner for Mac, download APM Planner from ardupilot.com.

Mission Planner Downloads Screen



Select MSI to download most recent version.

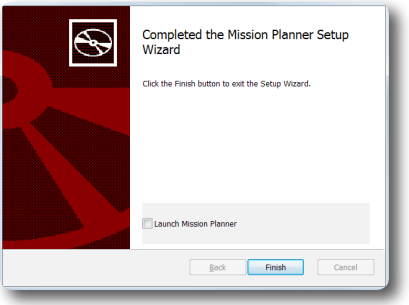
After selecting the MSI, read the safety information and select Download:

Open the downloaded file to run the Mission Planner Setup Wizard. Select the option to proceed if prompted with a security warning.

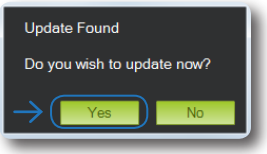
Device Driver Installation Wizard

Mission Planner Setup Wizard will automatically install the correct device drivers.

Mission Planner Setup Wizard



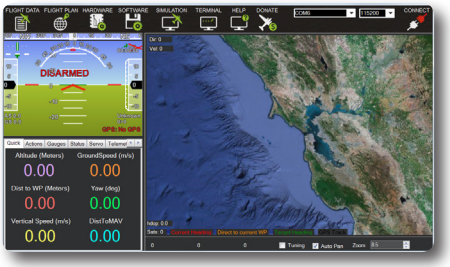
Launch Mission Planner to explore the capabilities of your autonomous vehicle!



Mission Planner will notify you when an update is available; please always run the most current version of Mission Planner.

Mission Planner: Update Message

Mission Planner: Flight Data Screen



Before flying, complete Mission Planner's configuration utilities, including RC (shown on the next page), compass, accelerometer, frame type, and flight mode calibrations. Visit planner.ardupilot.com for complete Mission Planner instructions.

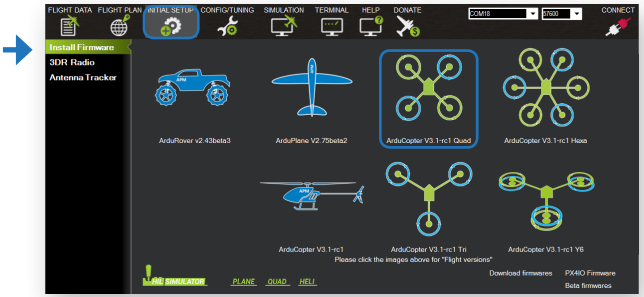
CALIBRATION

Mission Planner's mandatory hardware calibration steps allow you to program and configure the APM autopilot for your copter.

Connect APM to your computer using the provided micro-USB cable. Windows will automatically install the correct drivers for APM.

APM USB port

Select Initial Setup, Install Firmware, and Quad to install flight code firmware onto APM.



Now you can connect APM to Mission Planner.

Connect APM to Mission Planner:

1 Select Arduino Mega.

2 Select 115200.

3 Select Connect.

On the left side of the Initial Setup screen, select Mandatory Hardware. You will need to perform each of the calibration procedures listed under this menu.

Frame Type: Select your configuration: Plus or X (cross).

Compass: Select the options to enable the compass, to allow automatic declination, and to select your autopilot type. Select Live Calibration to launch the wizard, and follow the prompts.

Accel Calibration: Check the box for AC 3.0+, select Calibrate, and follow the prompts to calibrate the autopilot's accelerometer. Make sure to wait a couple of seconds before and after changing the positions of the copter.

Radio Calibration: Turn on your RC 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.

Flight Modes: Move each switch on your transmitter to its available positions. Mission Planner will indicate the currently selected position with green highlighting. Select a mode for each switch position, and select Saves Modes to assign.

Failsafes: Failsafes are advanced safety precautions that can be very useful for your copter. Consult the online documentation at copter.ardupilot.com to learn more about configuring and testing failsafes.

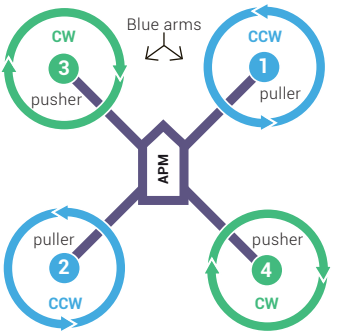
Show me! Watch videos demonstrating live calibration techniques at 3DRobotics.com/learn.

Complete all configuration procedures as described at copter.ardupilot.com before attempting your first flight.

MOTORS & PROPELLERS

The diagram across shows the correct rotation directions for your Quad's four motors: motors one and two should rotate counterclockwise, motors three and four should rotate clockwise.

The rotation direction for each motor is determined by the connections between the motor and the ESC. To reverse the rotation direction for a motor, switch two of the three wires connecting the motor and the ESC.



Quad motor order

1. Connection between motor and ESC

2. Switch two wires to reverse motor rotation.

Your copter includes puller propellers (unmarked or marked “SF”) and pusher propellers (marked “SFP” or “P”). The direction of each motor is shown above: add pusher propellers to motors marked clockwise, add puller propellers to motors marked counterclockwise.

COUNTERCLOCKWISE ROTATION: USE PULLER PROPELLER

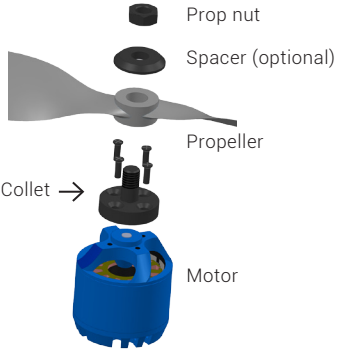
CLOCKWISE ROTATION: USE PUSHER PROPELLER

Remove plastic rings from propeller package, select the one with the larger internal diameter, and insert it into the back of the propeller hub.

Add propeller to motor collet with writing facing up in relation to the sky. Add metal spacer and prop nut; tightly fasten prop nut to threaded collet.

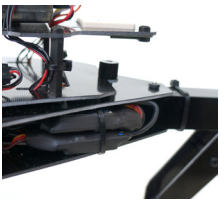
We recommend inserting a hex wrench (2 mm) into the hole in the side of the prop nut to get better leverage when tightening prop nuts.

Safety Check! Ensure writing on props faces up.



SECURE WIRING

Before flying, use zip ties to secure ESCs to the frame. Ensure that all wires are secured so they will not become entangled in spinning propellers, are not too tight around corners (no hard 90-180 degree bends), and do not pull on the APM or other components. Always complete the pre-flight checklist before takeoff (copter.ardupilot.com/wiki/checklist).



ESCs and wiring secured with zip ties

Visit copter.ardupilot.com to learn about multicopter safety, hardware and software configuration, using autonomous flight modes, tuning, designing missions with waypoints and events, troubleshooting, and more. Happy flying!

SUPPORT

For more information about software, firmware, and flight behaviors, visit the APM Copter community documentation project at copter.ardupilot.com.

For customer support, contact us at help@3DRobotics.com or call our support line at +1 (858) 225-1414. For more assembly instructions and information about building and configuring your copter, visit 3DRobotics.com/learn.