

ASSEMBLY GUIDE

HPR-Q500 ARF Kit

American Made. NDAA-compliant option.

Almost-ready-to-fly 500 mm quadrotor: carbon frame with motors, 4-in-1 ESC, telemetry and optical-flow sensing fitted. Add a flight controller, receiver and battery.



The completed HPR-Q500.

This guide takes either HPR-Q500 ARF kit from the box to the aircraft shown above, ready for its first hover. The kit arrives mostly built: the arms come with motors fitted, the landing legs are assembled, and the 4-in-1 ESC is already mounted on the main plate. Every power and motor joint is a bullet or plug connector, so there is nothing to solder. The build is in two stages: a bench stage where you fit the battery plate and set up the motors while the connectors are still easy to reach, then an airframe stage where the top plate, arms, legs and sensor go on.

The Build at a Glance

Step	What you do
1	Unpack and check the kit
2	Battery plate — slide in the rail tubes and tighten the clamps
3	Motor setup over the telemetry radios — order, direction, DShot300
4	Flight controller and telemetry radio onto the top plate
5	Compute plate onto its standoffs
6	Top plate assembly onto the arms
7	Landing legs
8	Optical-flow sensor
9	Wiring and dressing
10	Configuration, props and pre-flight checks

1 • Before You Start

Two kits, one build

The build is the same for the NDAA kit and the Standard kit. Only four parts differ: motors, ESC, telemetry radio and optical-flow sensor. Where a step depends on the kit, it is marked like this:

- **NDAA kit:** the NDAA-compliant kit — Ewing motors, ARK 4IN1 ESC, RFD 900x-US telemetry, ARK Flow.
- **Standard kit:** the non-NDAA kit — EMAX motors, HGLRC ESC, MicoAir LR900-F telemetry, MicoAir MTF-01P.

The flight controller, its power module, the RC transmitter and receiver, the battery and any companion computer are integrator-supplied. The kit works with any Pixhawk-standard autopilot running ArduPilot or PX4, set up from Mission Planner or QGroundControl. The setup steps say what to do; the exact screens and parameter names depend on your firmware and ground station, so follow their documentation for those.

Fastener rules — these apply to every step

- Every screw is M3, and only three lengths are used: M3 × 6 for the compute-plate standoffs, M3 × 30 for the landing legs and M3 × 35 for the arms. Sort them by length before you begin.
- Every arm and leg screw takes an M3 nylon-insert lock nut. The only screws that don't take a nut are the eight M3 × 6 in Step 5, which thread into the standoffs.

- Snug, not tight. Carbon plates crack and printed fittings split if you overtighten. Run each lock nut down until the nylon collar engages, then tighten until the parts are just firmly together. The lock nut does the rest.
- Tighten in diagonals. Wherever a fitting has several screws, take them all to finger-tight first, then snug them in a cross pattern so the fitting pulls down evenly.

Connector rules

- Push each bullet fully home. A half-seated bullet runs hot and can drop a motor in flight.
- Pull every heat-shrink sleeve over its joint so no metal is exposed.
- Plug the battery in last, and only for the steps that call for it.
- **Props stay off until Step 10.** Fit them only after motor order and direction are confirmed, and never with a battery connected.

Tools

- 2.5 mm hex key or driver (all screws)
- 5.5 mm spanner or nut driver (M3 lock nuts)
- Wrench or socket to fit your motor's prop nut
- Side cutters and cable ties
- Laptop with Mission Planner or QGroundControl, and a USB cable for loading firmware

Orientation

Front is the end that carries the optical-flow sensor. The XT90 battery lead exits at the rear. The ESC is on the underside of the main plate, and the battery plate hangs below it.

2 • Parts List

Check everything off before you start. Quantities are for one complete aircraft.

Kit contents

Item	Qty	NDAA kit	Standard kit	As shipped
Main plate with 4-in-1 ESC	1	ARK 4IN1 ESC	HGLRC 60 A 4-in-1 BLHeli_S ESC	ESC mounted; motor bullets and XT90 battery lead fitted; rail clamps pre-installed
Motor arm with motor	4	Ewing EM3115 860 KV	EMAX ECO II 3115 640 KV	Built; motor leads end in bullet connectors
Landing leg	2	Same	Same	Built
Battery plate	1	Same	Same	Rod clamps and clamping screws pre-installed
Rail tube (carbon)	2	Same	Same	Loose
Top plate (carbon)	1	Same	Same	Loose
Compute plate (carbon)	1	Same	Same	Loose
Standoff, M3	4	Same	Same	Loose, with 8 M3 × 6 screws
Optical-flow sensor mount	1	Same	Same	Loose; clamps onto the rail tubes
Optical-flow sensor	1	ARK Flow (flow + rangefinder, DroneCAN)	MicoAir MTF-01P (flow + laser ToF, UART)	Loose, with cable
Telemetry radio pair (air + ground)	1	RFDDesign RFD 900x-US, with all cables	MicoAir LR900-F 500 mW, with antennas and JST-GH cables	Loose
ESC signal cable, JST-SH to 4-pin Dupont	1	Same	Same	Loose
XT90 to XT60 adapters	1 set	Same	Same	Connect an XT60 power module between the XT90 battery and ESC leads
Double-sided tape	1	Same	Same	For the flight controller, radio and flow sensor
Battery strap	1	Same	Same	Threads through the slots in the battery plate

Item	Qty	NDAA kit	Standard kit	As shipped
Propeller, Master Airscrew MR 10×4.5	4	Same	Same	2 CW, 2 CCW
Prop adapter rings	4	Same	Same	On a sprue

Hardware

All screws are M3 socket-head cap screws (2.5 mm hex). All nuts are M3 nylon-insert lock nuts.

Item	Qty	Used in
M3 × 6 socket head	8	Step 5 — compute-plate standoffs (no nuts)
M3 × 30 socket head	6	Step 7 — landing legs (3 per leg)
M3 × 35 socket head	16	Step 6 — arms (4 per arm)
M3 nylon-insert lock nut	22	Steps 6 and 7

Tip Lay the hardware out in labelled piles by length now. Every step tells you exactly which screws it uses, and a wrong length is the most common build mistake.

Not included — you supply these

Item	Notes
Flight controller	Any Pixhawk-standard autopilot (Cube, Pixhawk 6C/6X, CUAV or similar) running ArduPilot or PX4. It needs four DShot-capable outputs, a serial port for telemetry, and a CAN port (NDAA kit) or a second serial port (Standard kit) for the flow sensor.
Power module	XT60, 6S-rated, matched to your flight controller. The kit's adapters connect it to the XT90 leads.
RC transmitter and receiver	Needs a spare channel for the motor-interlock / kill switch.
Battery	6S 5000 mAh LiPo with XT90. NDAA kit: use a pack of verified origin.
Companion computer and payload	Optional. Mounts on the compute plate.
Ground station laptop	Mission Planner or QGroundControl. The ground-side radio is in the kit.

3 • Assembly — Part A: Bench Setup

Do these three steps before any of the airframe goes together. Step 3 is the one that matters: the motor bullets are easy to swap now and hard to reach later.

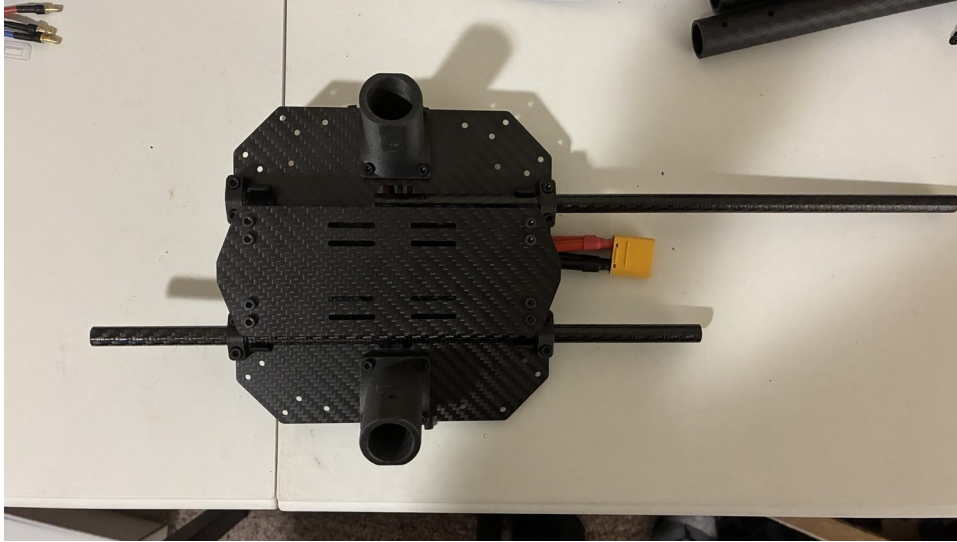
STEP 1

Unpack and check

1. Lay out every item and tick it off against the parts list.
2. Inspect the main plate and ESC. Look for cracked carbon, loose ESC screws or bent bullet connectors.
3. Check each arm. The motor should spin freely by hand, and the three motor bullets should be undamaged and fully sleeved.
4. Sort the screws by length: M3 × 6, M3 × 30 and M3 × 35.

STEP 2

Battery plate

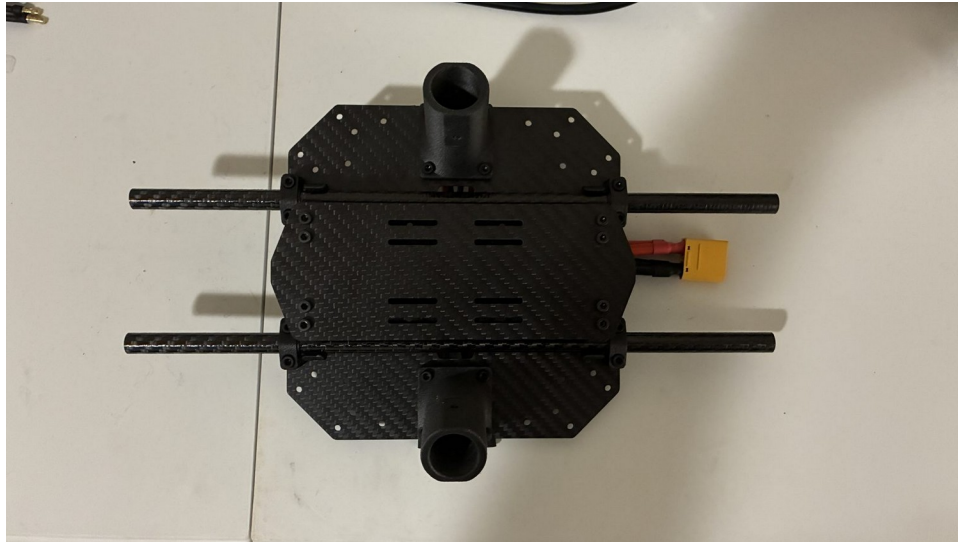


Rail tubes through the main-plate clamps, with the battery plate's clamps on the tubes below; XT90 lead at the rear.

Parts: main plate, battery plate, 2 rail tubes.

Hardware for this step: none — the clamps and their screws come pre-installed on both plates.

1. The rail tubes clamp to the ESC side of the main plate, and the battery plate clamps to the tubes below that. Work with the main plate whichever way up gives you the easiest reach to the clamps.
2. Slide each rail tube through its pair of clamps on the main plate, running front to back, parallel to where the skids will go.
3. Slide the battery plate's clamps onto the tubes, with the plate centred under the ESC and the tubes overhanging equally at each end. The optical-flow sensor mount clamps onto the front ends in Step 8.
4. Square the battery plate to the main plate, then tighten all the clamp screws evenly. Snug only — overtightening crushes the tubes.
5. Check that the XT90 battery lead exits at the rear.

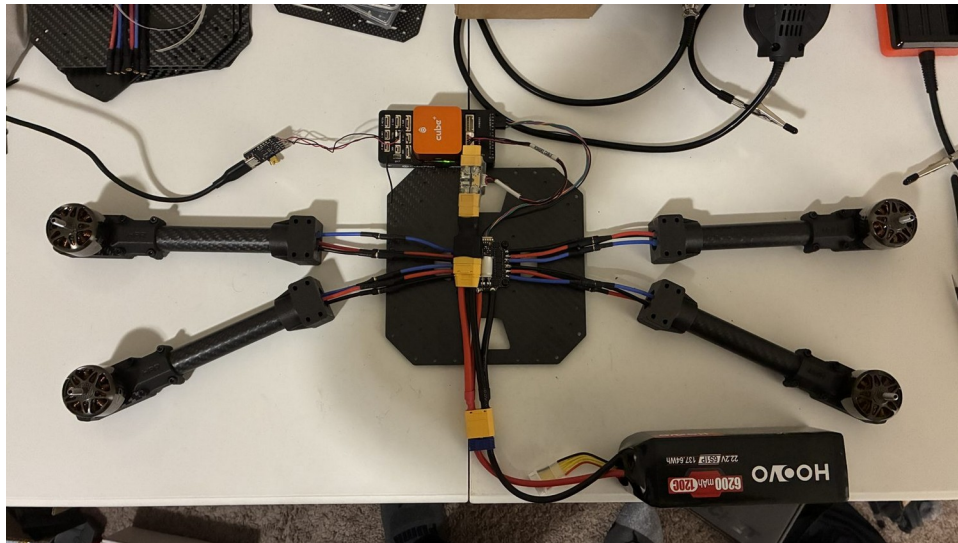


The completed battery plate assembly: both rail tubes through the clamps with equal overhang, XT90 lead exiting at the rear. The legs are already on in this photo.

STEP 3

Motor setup over the telemetry radios (props off)

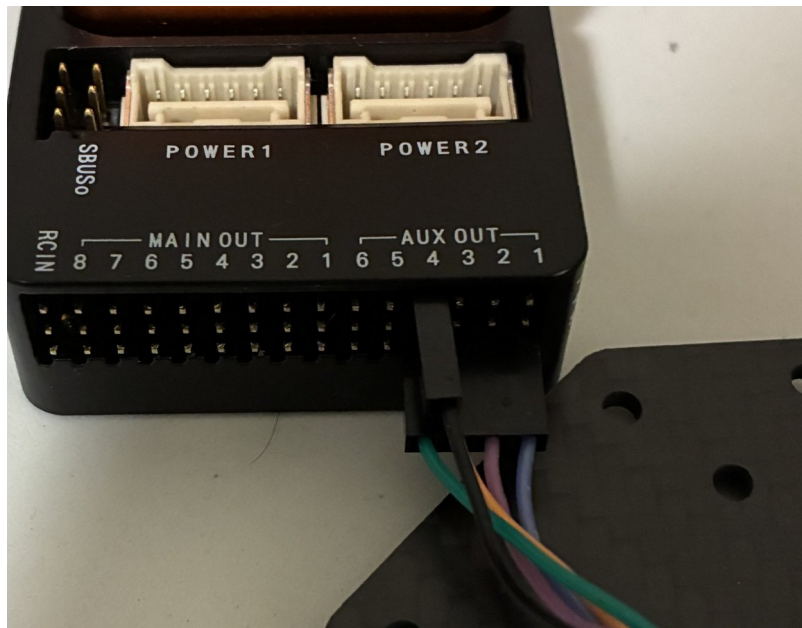
Set motor order and direction now. Each motor's direction is set by the order of its three bullets, and they are hard to reach once the arms are in their mounts. The flight controller is powered from the battery and talks to your ground station through the kit's telemetry radios.



Bench layout: the arms in their final positions around the main plate, plugged into the ESC, with the power module and flight controller connected (Standard kit shown).

Parts: the battery plate assembly from Step 2, 4 motor arms, ESC signal cable, XT90 to XT60 adapters, telemetry radio pair; your flight controller, power module and battery.

1. Set the assembly ESC side up, resting on the battery plate. Set the four arms around it in their final positions: front-right, rear-right, rear-left, front-left.
2. Connect each arm's three bullets to the ESC lead set on that corner.
3. Plug the ESC into the flight controller with the JST-SH to Dupont cable. The JST-SH end goes into the ESC. The 4-pin Dupont plug goes on the signal row of **AUX OUT 1-4**, and the black ground lead goes on the ground (-) row, as in the photo below. The plug fixes the motor order, so motors 1-4 are always AUX 1-4.



ESC cable on a Cube-style autopilot: the 4-pin Dupont plug sits on the AUX OUT 1-4 signal row, with the black ground lead on the ground row.

4. Power the flight controller through your power module, using the included XT90 to XT60 adapters: battery XT90 to the module's XT60 input, and the module's XT60 output to the ESC XT90. Plug the module's cable into the flight controller's power port.
5. Plug the air-side telemetry radio into the flight controller's telemetry port, and the ground-side radio into your laptop's USB port.
6. If the flight controller has no firmware yet, load ArduPilot or PX4 over USB from your ground station, then unplug the USB cable.
7. Plug in the battery and connect your ground station over the radio link at 57600 baud.
8. Select a generic quadcopter X airframe and apply it.

9. Set the ESC protocol to **DSHOT300** on the AUX outputs, with motor 1–4 on AUX 1–4.
10. Run your ground station's motor identification or motor test, one motor at a time at low throttle.
11. Check each motor's spin direction against the table below. If one spins the wrong way, unplug the battery, swap any two of that arm's three bullets, and test again.

Position	Motor	Direction from above
Front-right	1	Counter-clockwise
Rear-left	2	Counter-clockwise
Front-left	3	Clockwise
Rear-right	4	Clockwise

12. Unplug the battery. Mark each arm with its position (FR, RR, RL, FL), and leave the arms connected to the ESC.
13. Unplug the ESC cable, power module and radio from the flight controller so it can be mounted in Step 4.

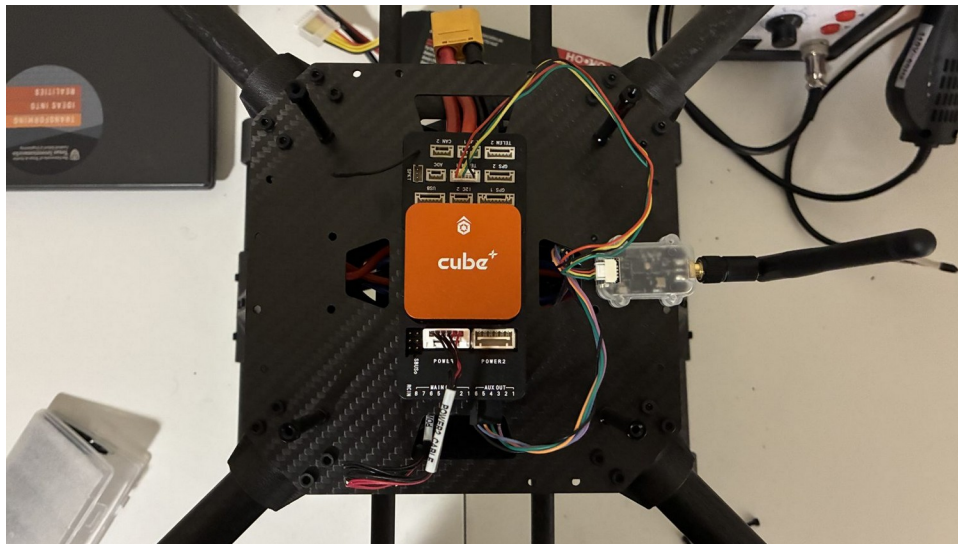
Tip The settings stay on the flight controller. You will not need to repeat any of this after the airframe is built.

3 • Assembly — Part B: The Airframe

Everything now goes together around the main plate. Steps 4 and 5 build the top plate assembly on the bench; Step 6 joins it to the arms and main plate; Steps 7 to 9 finish the aircraft.

STEP 4

Flight controller and telemetry radio onto the top plate



Flight controller taped to the centre of the top plate, with the telemetry radio beside it and its cable to the telemetry port.

Parts: top plate, your flight controller, air-side telemetry radio.

Hardware for this step: the double-sided tape supplied.

1. Wipe the top plate clean where the parts will sit, so the tape grips.
2. Stick the flight controller to the centre of the top plate with double-sided tape, arrow pointing forward.
3. Stick the air-side telemetry radio anywhere on the top plate that suits your layout. Keep its antenna vertical and clear of the carbon.
 - **NDAA kit (RFD 900x-US):** fit both antennas, at 90° to each other if you can. All cables are included.
 - **Standard kit (LR900-F):** use the JST-GH cable supplied.
4. Plug the radio into the flight controller's telemetry port.

STEP 5

Compute plate

Parts: 4 standoffs, compute plate.

Hardware for this step

Item	Per standoff	Total
M3 × 6 socket head	2	8
M3 lock nut	none	none

1. Stand the four standoffs on the top plate at the holes that match the compute plate's corners. Fix each with an M3 × 6 driven up from the underside of the top plate. Hold the standoff so it doesn't spin — these screws thread straight into the standoffs, no nuts.
2. Sit the compute plate on the standoffs and fix it with the other four M3 × 6 from above. Snug is enough.

STEP 6

Top plate assembly onto the arms

Parts: the main plate assembly with its 4 arms still connected, and the top plate assembly from Steps 4–5.

Hardware for this step

Item	Per arm	Total (4 arms)
M3 × 35 socket head	4	16
M3 lock nut	4	16

1. Seat each arm at its corner of the main plate, matching the position marks from Step 3, with the motors facing up.
2. Lower the top plate assembly onto the arms, flight controller arrow pointing forward. Before it closes, feed the ESC cable and the power-module cable up through the main-plate cut-outs.
3. Line up the holes. At each corner, push four M3 × 35 down through the top plate, the arm mount and the main plate, and fit a lock nut to each under the main plate.
4. Take every screw to finger-tight, then snug each arm's four in a cross pattern. Sight across the frame: all four motors should be level and at the same height.

Tip Start all sixteen screws before tightening any of them. The top plate will not seat flat if one corner is pulled down first.

STEP 7

Landing legs

Parts: 2 landing legs.

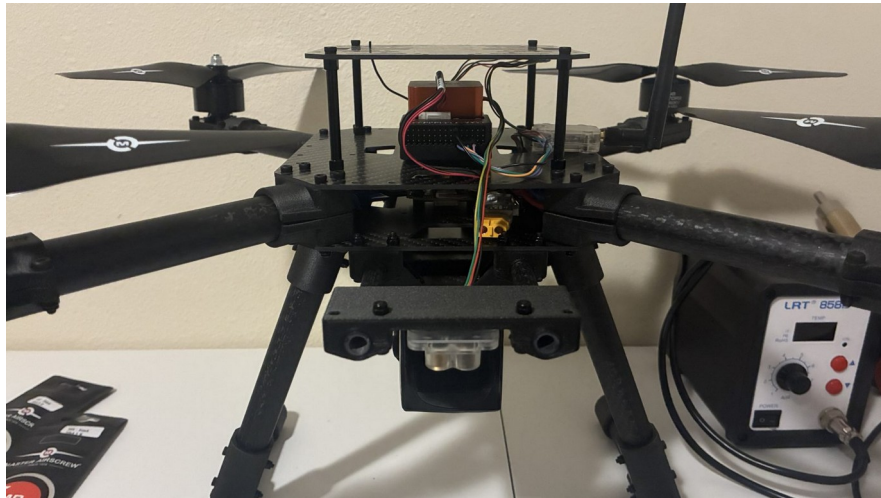
Hardware for this step

Item	Per leg	Total (2 legs)
M3 × 30 socket head	3	6
M3 lock nut	3	6

1. Turn the frame upside down.
2. Fit each landing leg at its position on opposite sides of the underside, splayed outward. Fix it with three M3 × 30 and lock nuts, snugged evenly.
3. Check that the skids are parallel and at the same height. Then turn the frame over and stand it on its legs.

STEP 8

Optical-flow sensor



Front view: the optical-flow sensor in its mount on the rail tube ends, lens pointing straight down (Standard kit MTF-01P shown).

Parts: flow-sensor mount, optical-flow sensor and its cable.

Hardware for this step: the mount's own clamp screws and the double-sided tape.

1. Slide the flow-sensor mount onto the front ends of the two rail tubes and tighten its clamp screws, so the sensor will have a clear, level view of the ground.

2. Stick the sensor to the mount with double-sided tape, lens facing straight down.
 - **NDAA kit (ARK Flow):** point the sensor's connectors toward the rear of the aircraft.
 - **Standard kit (MTF-01P):** note which way the sensor faces. You will set its orientation in Step 10.
3. Route the sensor cable up to the flight controller.

STEP 9

Wiring and dressing

Connection	Flight controller port	NDAA kit	Standard kit
ESC (JST-SH to Dupont cable)	AUX OUT 1-4	ARK 4IN1 ESC	HGLRC 4-in-1
Power module	Power port	—	—
Telemetry radio	Telemetry serial port	RFD 900x-US	LR900-F
Optical-flow sensor	NDAA: CAN port · Standard: a spare serial port	ARK Flow, 4-pin JST-GH, DroneCAN	MTF-01P, UART, MAVLink
RC receiver	RC input (SBUS) or a spare serial port	Your choice	Your choice

1. Reconnect the ESC to the flight controller with the JST-SH to Dupont cable, on AUX OUT 1-4 as in Step 3, ground wire on the ground (–) row.
2. Refit the XT60 power module between the battery and ESC XT90 leads with the included adapters, and plug its cable into the flight controller's power port.
3. Plug in the flow-sensor cable for your kit, as in the table.
4. Mount the RC receiver away from the ESC. Run its antennas out past the carbon, then plug it into the RC input.
5. Tie down every loose wire with cable ties. Keep all leads clear of the props and the motor bells, and check every bullet joint is seated and sleeved.
6. Thread the strap through the battery plate slots and strap the battery on. Slide it fore or aft until the centre of gravity sits at the frame centre.



The built airframe before props: compute plate on its standoffs above the flight controller, arms level, legs splayed.

4 · Configuration and First Flight

STEP 10

Configuration, props and pre-flight checks

Motor order, direction and ESC protocol are already set from Step 3. The steps below are the same for ArduPilot and PX4; use your firmware's documentation for the exact parameter names and screens.

Telemetry

The radio link runs at 57600 baud. Both ArduPilot and PX4 run MAVLink on the main telemetry port by default, so once the air radio is on that port the ground station should connect with no changes. Both radio pairs ship matched.

Optical flow and rangefinder

	NDAAs kit (ARK Flow)	Standard kit (MTF-01P)
Interface	DroneCAN on the flight controller's CAN port	MAVLink over UART on a spare serial port, 115200 baud
Sensor prep	None	In MicoAssistant, before wiring, set the sensor's output protocol to match your firmware
Flight controller setup	Enable DroneCAN on that port, then enable the DroneCAN optical-flow and rangefinder drivers	Set that serial port to MAVLink at 115200, then enable the MAVLink optical-flow and rangefinder drivers
Vendor docs	docs.arkelectron.com	micoair.com

Then, for either kit:

1. Enable optical-flow and rangefinder fusion in the estimator.
2. Enter the sensor's offset from the frame centre, in metres.
3. If the sensor isn't mounted in its default orientation, set the flow-rotation parameter to match.
4. Reboot, then check in your ground station that flow quality and the distance reading are live and non-zero.
5. Hold the aircraft level, then tilt and move it by hand. The flow readings should follow the motion. **A wrong flow orientation can cause a flyaway.** Do not fly a position-hold mode on flow until this check passes.

Calibrations and safety

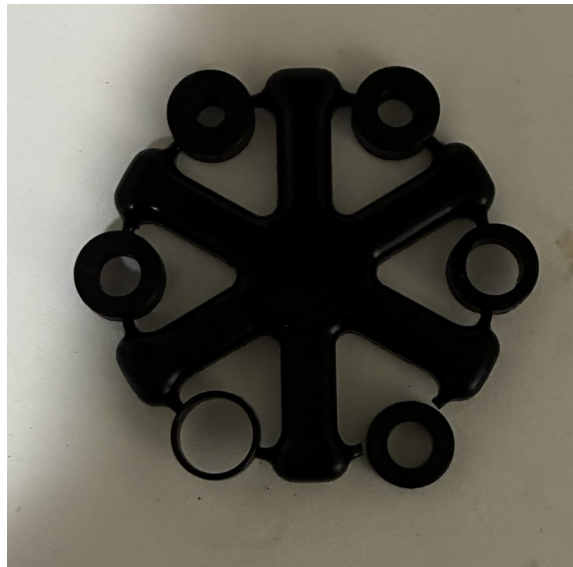
1. Calibrate the compass, gyroscope, accelerometer and level horizon.
2. Calibrate the RC transmitter and assign flight modes to a switch.

3. Assign a kill switch or motor emergency stop to a spare RC channel, then test on the bench that it stops the motors.
4. Set the battery monitor for a 6S pack and your power module. Calibrate voltage and current against a meter.
5. Set the low-battery and link-loss failsafe actions you want.
6. Set a starting hover throttle of about 0.30 and let the firmware learn the rest.

Fit the props — battery unplugged

Counter-clockwise props go on front-right and rear-left. Clockwise props go on front-left and rear-right.

1. Press an adapter ring from the sprue into each prop hub, so the prop fits the motor shaft snugly. This applies to both kits.
2. Fit each prop with the lettering facing up. The leading edge should rise in the direction the motor spins.
3. Tighten each prop nut firmly, holding the motor bell so it does not turn.



The included prop adapter rings, supplied on a sprue.



An adapter ring seated on the motor shaft, ready for the prop.

Pre-flight checks

Go over the whole aircraft once before the first hover:

- **Every screw has its lock nut.** 16 on the arms, 6 on the legs, each showing a thread or two through the nylon. The eight standoff screws have none.
- **Arms.** Fully home, all four motors level.
- **Connectors.** Every bullet joint seated and sleeved; no wire within reach of a prop.
- **Sensors.** Flight controller arrow points forward; flow sensor lens clear and pointing down.
- **Props.** On the right motors, nuts tight.
- **Battery.** Strapped, centre of gravity at the frame centre.
- **Kill switch.** Tested.
- **First hover.** In a stabilised mode at base weight, with no payload.

5 • Reference

Kit specifications

Spec	NDAA kit	Standard kit
Motor	Ewing EM3115, 860 KV	EMAX ECO II 3115, 640 KV
Propeller	Master Airscrew MR 10×4.5 with adapter ring	Master Airscrew MR 10×4.5 with adapter ring
ESC	ARK 4IN1, 50 A cont / 75 A burst per motor	HGLRC 60 A 4-in-1 BLHeli_S, 2–6S
ESC protocol	DSHOT300	DSHOT300
Telemetry	RFD 900x-US, 902–928 MHz	MicoAir LR900-F, 500 mW, 915 MHz
Optical flow	ARK Flow, DroneCAN	MicoAir MTF-01P, UART
Base airframe (with autopilot, no payload)	1625 g	1578 g
AUW with 410 g reference payload and 6S 5000	2815 g	2768 g
MTOW	4000 g	4000 g
Thrust margin, reference payload	2.84:1	3.47:1 (11×4.5 basis)
Endurance, base weight, 6S 5000	15.0 min	17.4 min (11×4.5 basis)
Endurance, reference payload, 6S 5000	12.0 min	13.7 min (11×4.5 basis)
Payload headroom to MTOW, 6S 5000	1185 g	1232 g (11×4.5 basis)

Figures are from the Hardpoint Robotics product specifications. The Standard kit's performance figures were modelled on an 11×4.5 propeller; with the 10×4.5 now supplied, expect roughly 10% less endurance and a slightly lower thrust ceiling.

Troubleshooting

Symptom	Likely cause	Fix
No motor spins in motor test	ESC cable reversed or on the wrong output row; protocol not set	Check ground is on the – row, the outputs are set to DShot300, and motors 1–4 are on AUX 1–4 (Step 3)
One motor spins the wrong way	Bullet order on that arm	Swap any two of its three bullets
Ground station won't connect over the radio	Wrong COM port or baud rate	Connect on the ground radio's COM port at 57600; check the air radio is on the flight controller's telemetry port
Flow quality or rangefinder reads zero	Port or protocol not set, or sensor not prepared	Recheck the Step 10 flow table, then reboot
Aircraft drifts or speeds up in a flow mode	Flow orientation wrong	Land. Redo the flow check in Step 10 and correct the flow-rotation parameter
Prop wobbles on the shaft	Adapter ring missing or not seated	Press the adapter ring fully into the hub

Contact

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