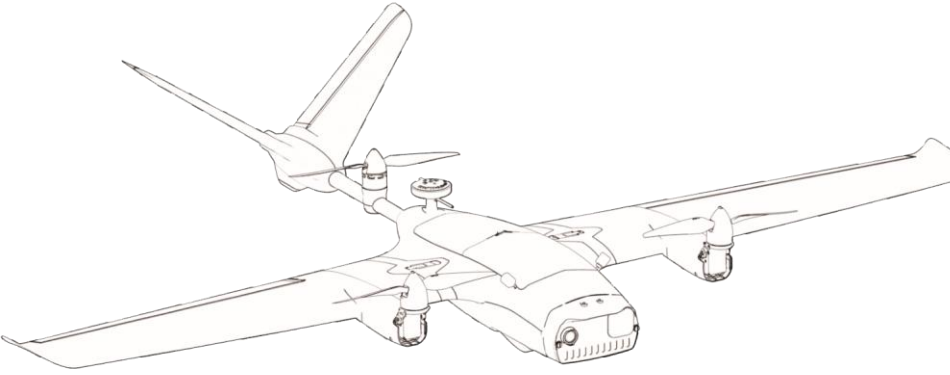
User Manual for ZMO V2 VTOL Fixed-Wing UAV



Foreword: The ZMO V2 VTOL fixed-wing UAV is a highly integrated system requiring no complex parameter tuning by users.

Note for BNF/PNP versions (non-RTF): Users must configure remote control channels and perform calibration procedures.**

Critical Notice: VTOL Fixed-Wing Fundamentals for Beginners

While VTOL fixed-wing models simplify takeoff/landing compared to traditional fixed-wing aircraft, safe operation requires mastery of:

Basic RC Operation

Understand channel functions: (Throttle, Pitch, Roll, Yaw)to avoid unintended maneuvers.

Master attitude correction (e.g., wind compensation, balance adjustments).

Aerodynamic Principles

Comprehend lift, thrust, and aerodynamicsto prevent stalls or crashes. High wind area warning: Due to large frontal cross-section, strictly prohibit

QStabilize mode with throttle at minimum (risk of dive/flip).

Tailwind hover maneuvers in Multirotor mode (winds >6 m/s).

Blocking pitot tube.

Emergency Response

Recognize low voltage, signal loss, and execute RTL (Return-to-Launch) or emergency landing.

Site & Regulatory Compliance

Operate in open areas, avoid crowds/NFZs, comply with local UAV regulations.

Pro Tip:VTOLs lower barriers but remain precision aircraft. New pilots should train via simulators or with mentors.

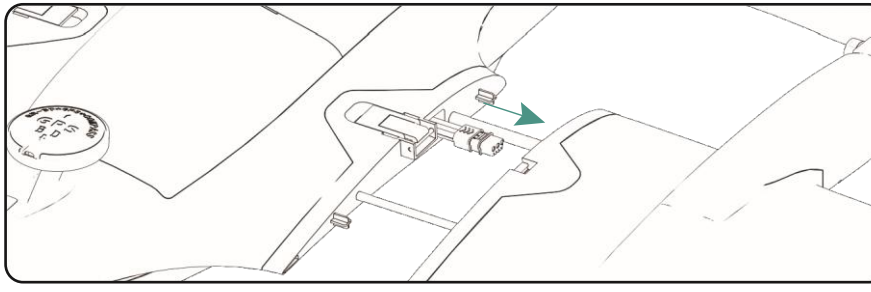
Product Overview

Recommended Software: Mission Planner/QGroundControl (QGC)

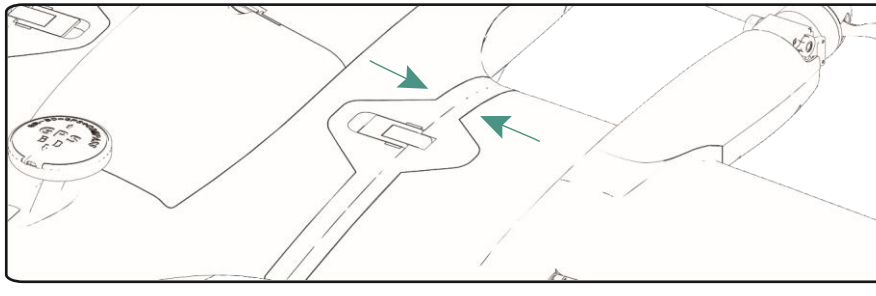
Download: ArduPilot firmware : /Tools/MissionPlanner

Aircraft Assembly

Unbox components, install left/right wings, connect wing-body wiring.

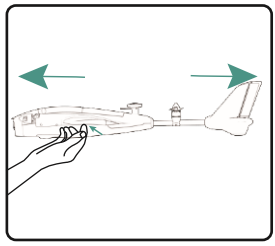


Insert connectors

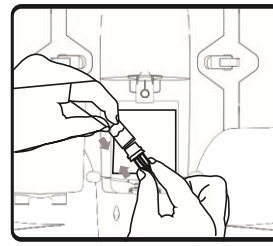


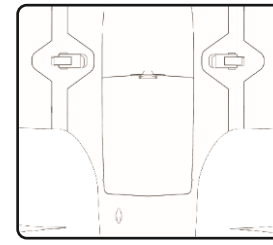
Align wings and Secure

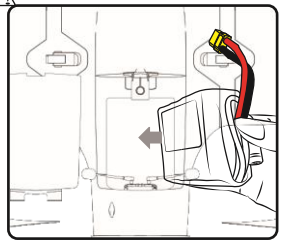
Battery Installation:Position battery to balance CG (check via wing protrusions).



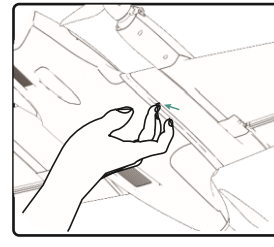
CG adjustment critical



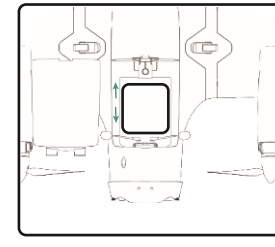




Battery Installation



Position battery to balance CG



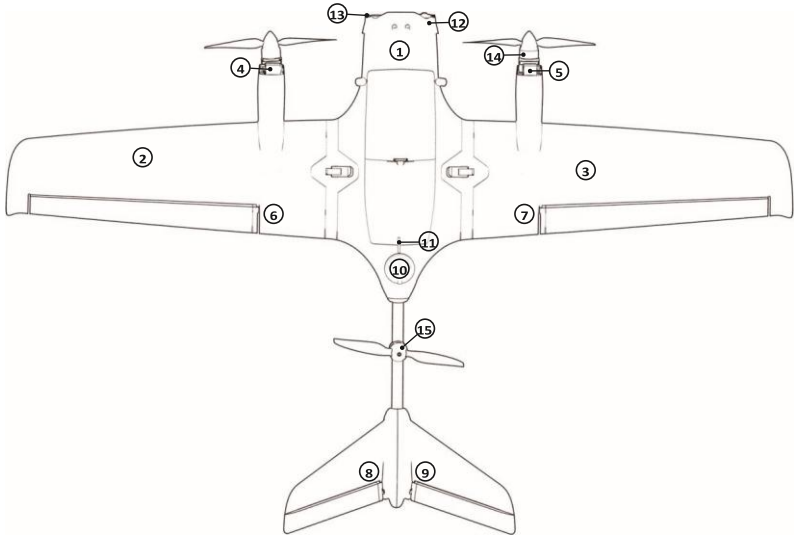
check via wing protrusions

Ensure front motors are level during balancing.

Secure battery, close compartment.

CG adjustment critical:Ensure front motors are level during balancing.

Components



1.Fuselage
2.Left Wings
3.Right Wings
4.Left Tilt Servos
5.Right Tilt Servos
6.Left Aileron Servos
7.Right Aileron Servos
8.Left Elevator Servos
9./Right Elevator Servos
10.GPS
11.Pitot Tube
12.Nose Cone
13.M3 Plastic Screws
14.Front VTOL Motors (2310 KV900 x2)
15.Tail Motor (2310 KV1060)

Remote Control Configuration

(RTF version pre-configured; customize BNF/PNP per requirements)

Channel 5 (3-pos switch): QStabilize → QLoiter → FBWA

Channel 6 (3/2-pos switch): Cruise → RTL

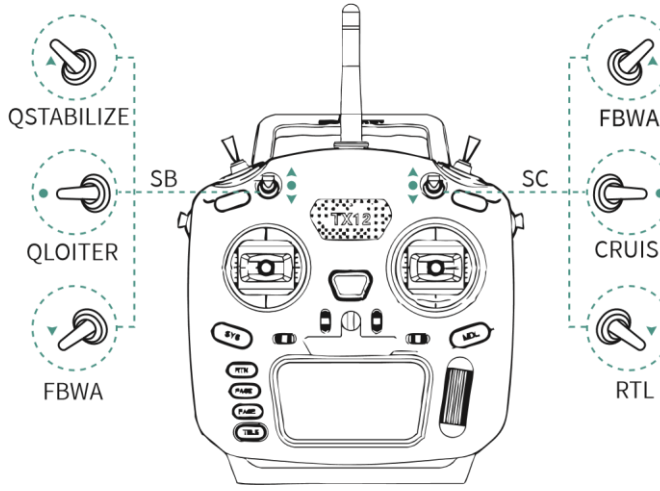
Channel 7 (3/2-pos switch): Loiter

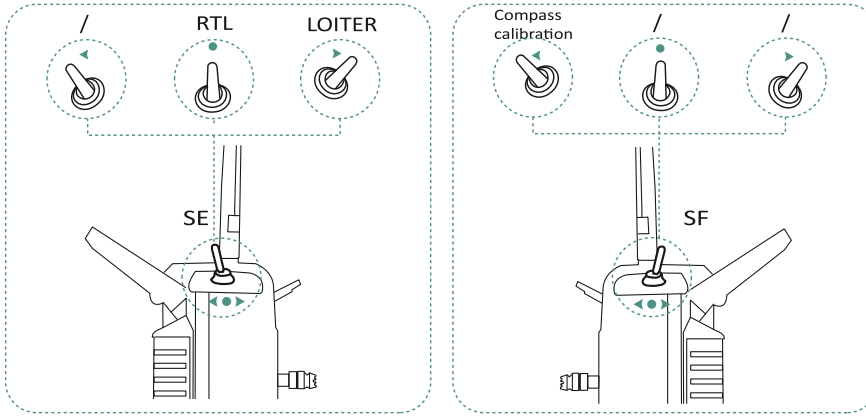
Channel 8 (3/2-pos switch): Compass Calibration

(In the event of insufficient number of transmitter channels, the desired flight modes can be manually configured and assigned through the customized selection interface.)

Transmitter Switch Function Assignment Configuration

RTF Example (TX12 CC2500)





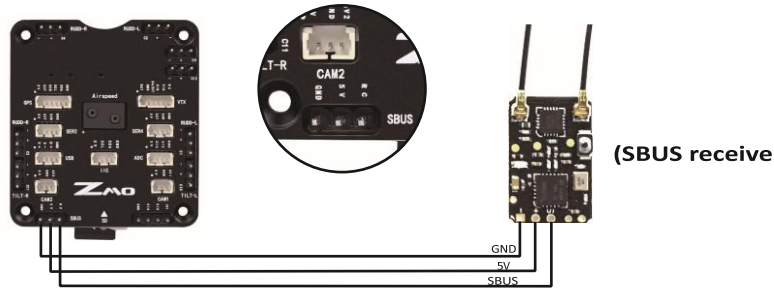
SB： QStabilize/QLoiter/FBWA
SC： FBWA/Cruise/RTL
SE： RTL/Loiter
SF： Compass Calibration

Flight Controller (FC) & Receiver Wiring

Three Connection Methods

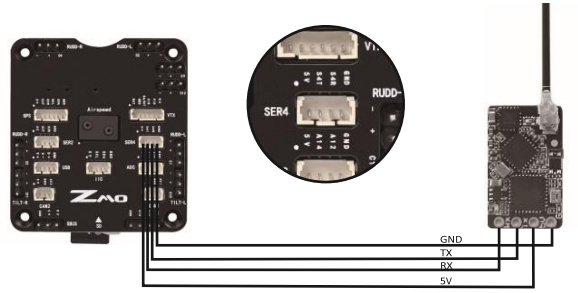
Method 1

Connect SBUS-type receiver to the flight controller's SBUS interface, which provides 5V power to the receiver. Wiring as shown below:



Method 2

Connect an ELRS receiver by plugging it into the SER4 interface of the flight controller following the wiring sequence shown in the figure below, and modify the SER4 serial port parameters to SERIAL4_PROTOCOL=23 , SERIAL4_OPTIONS=0 , RSSI_TYPE=3 .



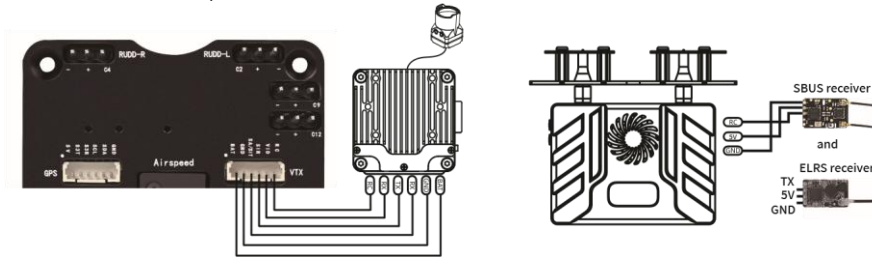
(ELRS receiver)

When using this method, the ELRS version remote controller's Channel 5 will only be recognized by the flight controller as a 2-position switch. Modify the flight controller parameters:

Modify the flight mode control channel parameter to FLTMODE_CH=8 , disable the original compass calibration channel by setting RC8_OPTION=0 , and set Channel 9 as the compass calibration channel by setting RC9_OPTION=171 .After modification, Remote Controller Channel 8 will be used for multirotor stabilization (Qstabilize), multirotor GPS mode (Qloiter), and fixed-wing FBWA mode. A new 9-channel switch must be defined on the remote controller for compass calibration, while other channel definitions remain unchanged.

Method 3

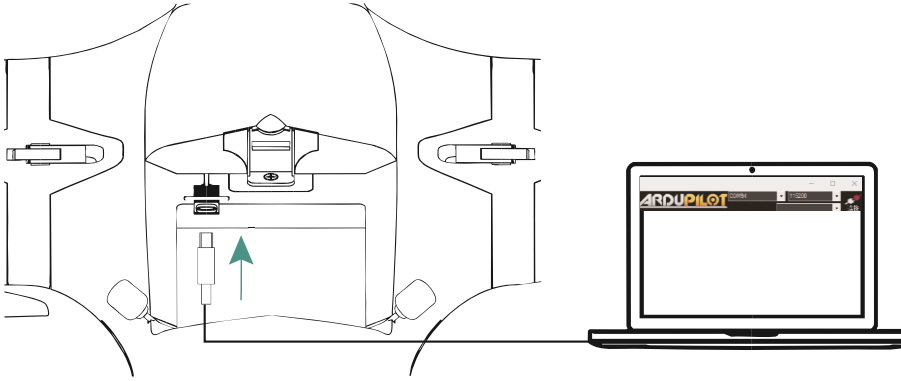
Connect remote control signals via an HD video transmitter (Benfeng T3/DJI O3/DJI O4).
Plug the HD video transmitter cable with remote control transmission function into the VTX interface, as shown in the figure below (disconnect the RC signal wire if not using the transmitter's built-in remote control function).



For standard SBUS receivers, forward signals by referencing the TX12 remote controller' s channel settings.
For ELRS-type receivers forwarded via the T3 ground station (VRX), note that the receiver output signal type in the remote controller script must be changed to DJI RS PRO for recognition by the T3 ground station. After forwarding, Channels 5-16 will shift backward by one position (e.g., Channel 6 on the remote controller will be detected as Channel 5 by the flight controller). This issue does not occur with standard SBUS receivers.

Software Setup & Calibration

Users are required to pre-download the MissionPlanner parameter configuration software for system preparation.
Power aircraft, connect via Type-C to Mission Planner (115200 baud).



RC Calibration

Transmitter calibration is mandatory after replacement

⚠propeller removal is compulsory during indoor system debugging.

Arming Inhibition Alert

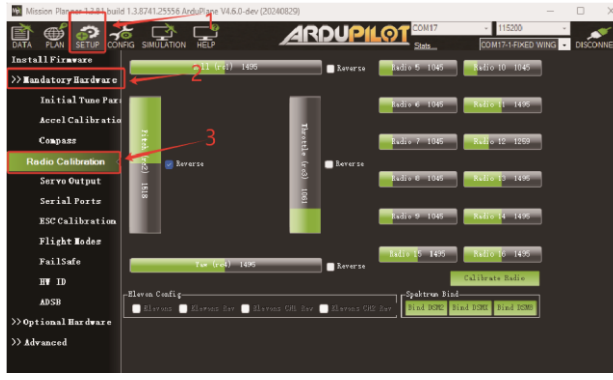
Aircraft arming will be disabled when connected to the ground control station (GCS) software with an uncalibrated transmitter. The system will generate an "：Arm：RC3 _ MIN is xxx Related tips.

RC Calibration:

1.Navigate:Initial Setup

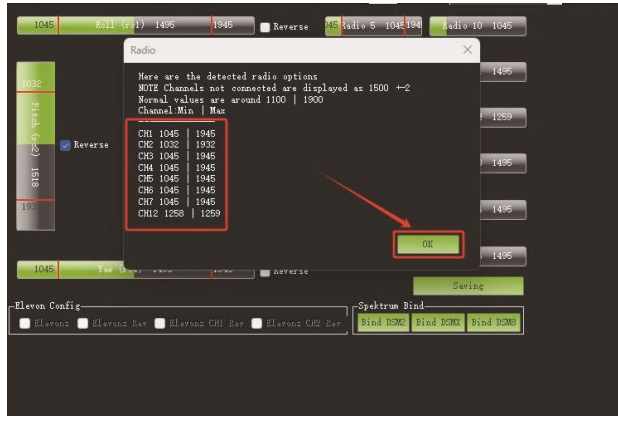
2.Mandatory Hardware

3.RCCalibration.



Click on 'Calibrate Remote Control' and slowly rotate the left and right joysticks for three consecutive circles to allow the flight control to collect the maximum and minimum values of the joysticks;

After completing the action, click "Calibration Complete" and wait for 5 seconds for the remote control calibration value to appear. Click "Confirm" to confirm.



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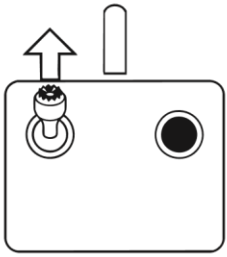
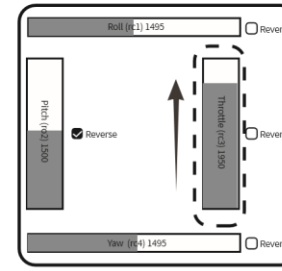
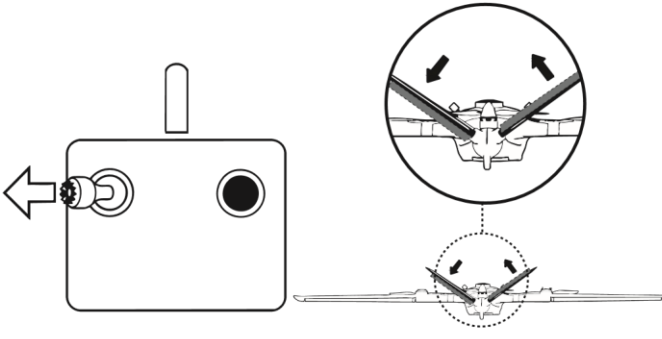
Transmitter Stick Direction Verification & Control Surface Check (Mode 2 Configuration Example):

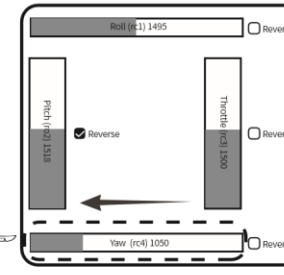
1.Left Stick Forward (Throttle Channel):



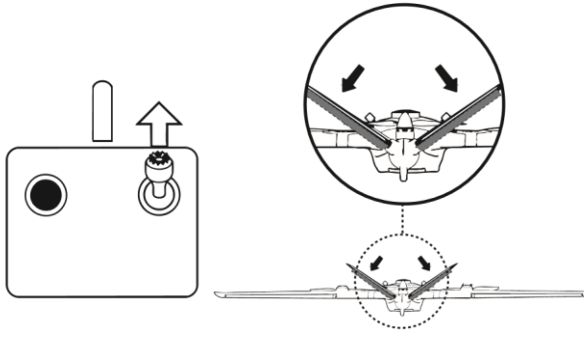


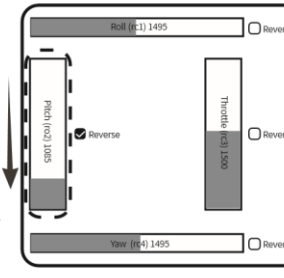
2.Left Stick Left Deflection (Yaw Channel):





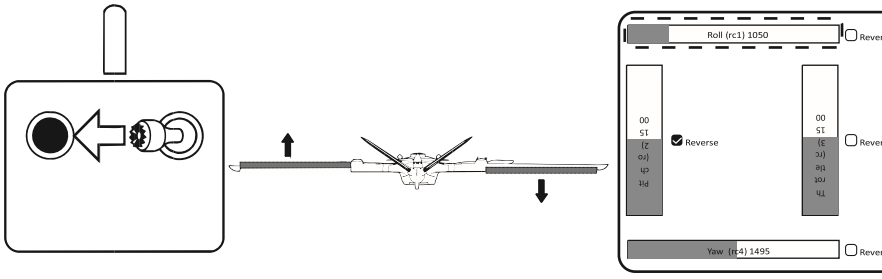
3.Right Stick Forward (Pitch Channel):





⚠ Notice: The control surface deflection direction will be inverted relative to transmitter stick input, which is the intended behavior. Ensure the actual surface movement matches the diagram reference (Default setting: Reverse channel enabled).

4.Turn the right lever to the left (aileron)：



Safety Precautions:

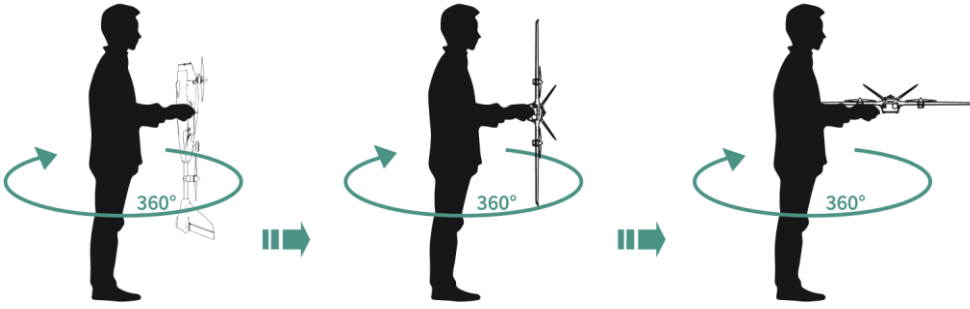
If there is any inconsistency with the above actions, the channel corresponding to the remote control should be set to reverse without changing the front and back of this interface.

During the confirmation process, be careful not to pull the throttle to the lowest position. The direction of the lowest throttle will unlock the aircraft to the left or right!

Compass Calibration

Method 1: RC Trigger

Safety Notice: The aircraft has undergone factory calibration prior to delivery. Perform compass calibration if operating in high electromagnetic interference environments or experiencing arming failure.

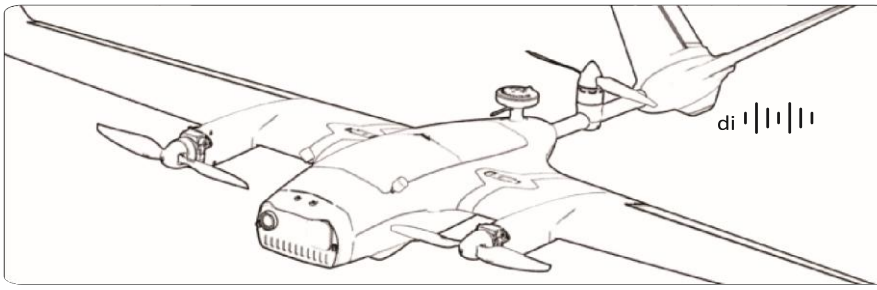


Lift the airplane, make the airplaneRotate head up 360 °

Lift the airplane, make the airplane Rotate 360 ° sideways upwards

Lift the airplane, make the airplane Rotate head up 360 degrees.°

Then you can rotate the plane at any angle until you hear a long beep "beep..." indicating that the calibration is complete. At this point, you need to turn on the calibration Switch back to the original position and restart the aircraft



(Compass calibration mode cannot be triggered after unlocking the aircraft)

Method 2： Use ground station software to enter compass calibration

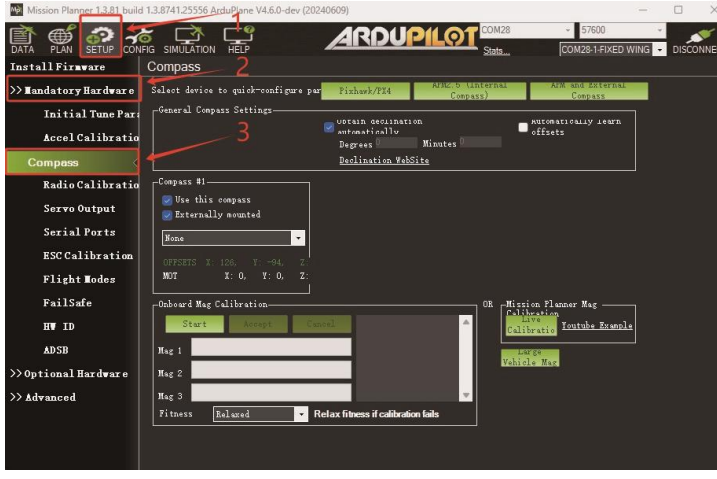
Remove the wing for subsequent calibration steps

Connect parameter tuning software

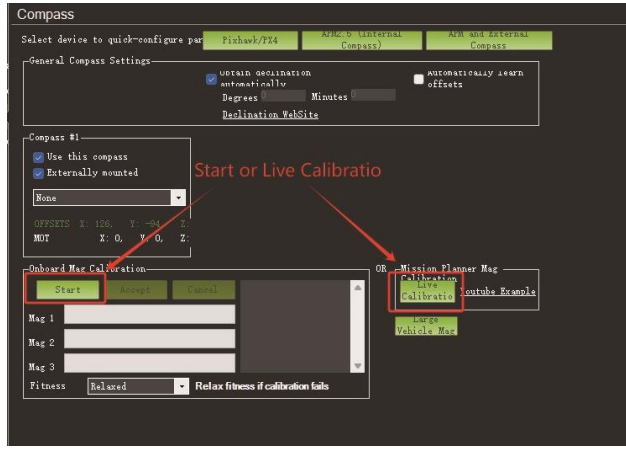
1.Access Initial Configuration Interface

2.Select Essential Hardware

3.Initiate Compass Calibration



4.Perform Calibration Rotation



Upon entering calibration mode, the flight controller will emit intermittent beeps (0.5Hz pulse)

Rotate the aircraft freely along all axes until either: a)
Progress bar reaches 100%
b) Auditory confirmation changes to continuous tone (2kHz, 3sec duration)

Note: Rotation direction is arbitrary; focus on completion progress

5.Validation & Completion

Successful calibration triggers "CALIBRATION SUCCESSFUL" pop-up Confirm by clicking "OK"

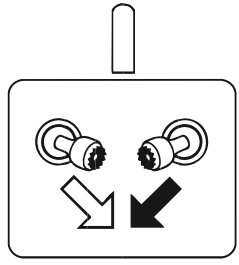
Pre-Flight Checklist

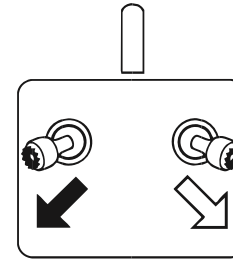
1.Wing-Fuselage Locking Mechanism
2.Power System Verification
3.Propeller Integrity Inspection
4.Center of Gravity (CoG) Validation
5.Motor Run-Up Test
6.Pitot Tube Function Check

Motor Arming/Disarming Procedure

Arming Sequence

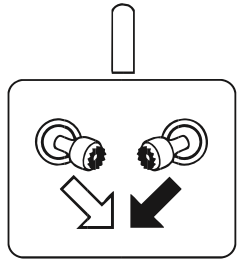
Arming operations are only permitted in multirotor mode. Switch the aircraft to QStabilize (Multirotor Stabilized Mode) or QLoiter (Multirotor GPS Mode), then perform any of the following stick command combinations to activate the motors. Immediately release the control sticks after motor activation. Upon successful arming, the motors will enter an idle rotation state.

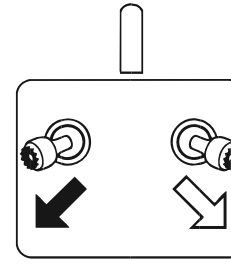




Motor Disarming

Motor disarming is only permitted in multirotor mode. While motors are in idle state, perform and hold either of the following stick commands until motor shutdown.





Hover Flight

Switch the aircraft to QLoiter (Multirotor GPS Mode), arm the aircraft via the transmitter, and allow motors to enter idle state. Gradually increase throttle until takeoff. At 5-10m altitude, test control response by executing pitch/roll/yaw inputs. Verify Z-axis motion orientation (ZMO) aligns with stick commands and confirm stable lateral movement. Land immediately if actual motion contradicts control inputs.

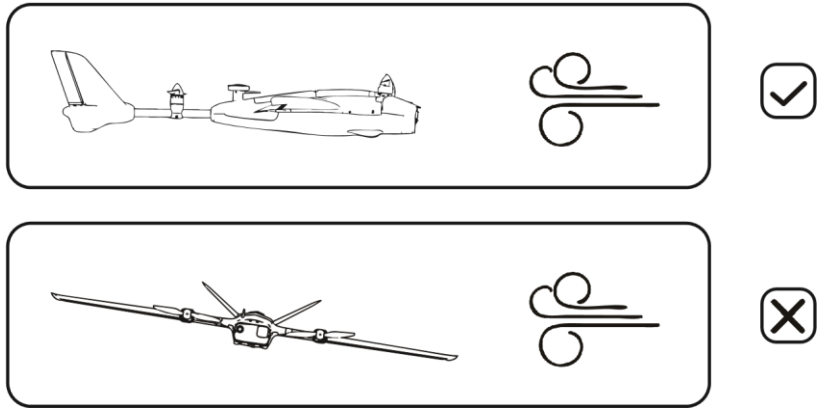
⚠**WARNING!Do NOT orient the aircraft laterally (crosswind) or tail-first into wind during multirotor hover in high wind conditions!**

Fixed-Wing Departure & Return

Departure

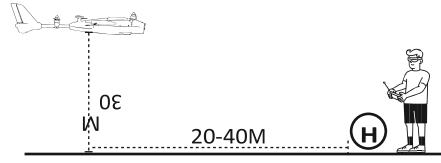
Hover the aircraft in multirotor mode to 25-30m altitude with throttle at 50%, then switch to Fixed-Wing FBWA Mode. The aircraft will transition to fixed-wing flight. After transition completion, gently pull the elevator stick to climb.

⚠ **Note: In high wind conditions, ensure the aircraft faces headwind during transition. Never perform crosswind transition in strong winds!**



Manual Return

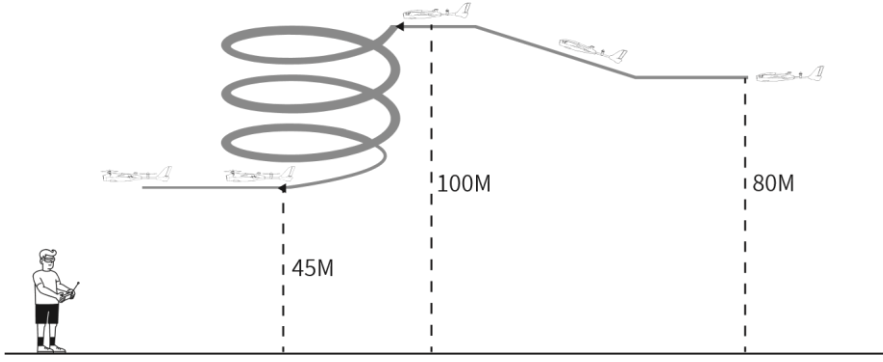
In fixed-wing mode:Maintain throttle above 50% and orient the nose into open headwind (reduce airspeed in advance).At 20-40m from takeoff point and ~30m altitude, switch the transmitter mode to Multirotor GPS Mode.The aircraft will transition to multirotor mode and hover. Adjust position and gradually reduce throttle to descend until landing.Disarm motors after touchdown.



Automatic Return-to-Launch (RTL)

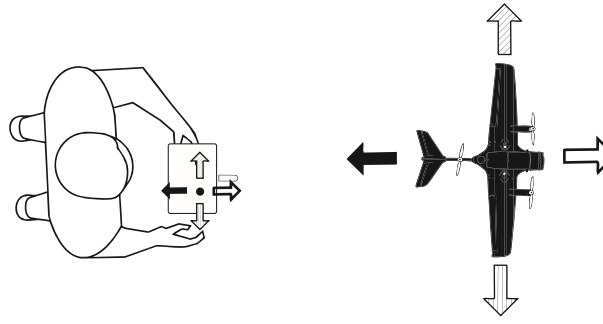
To use this function, ensure the takeoff point has ≥12 satellite signals and no tall obstacles within 50-120 meters forward of the aircraft's arming direction. For automatic return and landing, keep the throttle stick at approximately 50% position, toggle the mode switch to Return-to-Launch (RTL), and the aircraft will autonomously return to the takeoff point and land. Return altitude logic: If the

altitude is below 100 meters before return, the aircraft will automatically climb to 100 meters for return; if the altitude exceeds 100 meters, the aircraft will maintain the current altitude for return and landing.



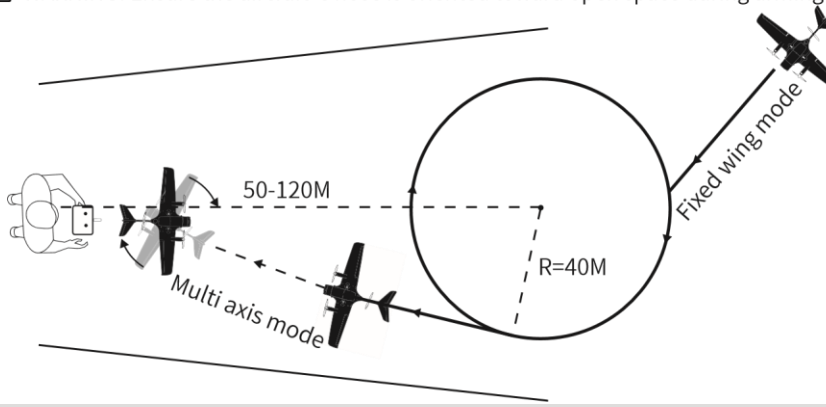
（During return flight, toggling the channel switch will cancel the return operation at any time, switching the aircraft mode to the corresponding channel-selected mode.）

During multirotor hover mode descent, the landing position can be adjusted using the aileron or pitch stick without switching modes.



Return direction logic: Upon entering return mode, the aircraft will fly in fixed-wing mode to a point 50-120 meters ahead of its arming heading direction (distance automatically determined based on wind conditions), descend in a holding pattern, and automatically switch to multirotor mode at 45 meters altitude to vertically land at the takeoff point.

⚠ WARNING! Ensure the aircraft's nose is oriented toward open space during arming!



Emergency Handling

Transmitter Signal Loss

Default setting: When control priority is with the transmitter, signal loss triggers return mode (RTL in fixed-wing mode / QRTL in multirotor mode). Do not toggle transmitter mode switches during this process. In AUTO mission mode, signal loss does not trigger return; the aircraft continues autonomous tasks.

Low Battery Voltage

Default setting: Triggers RTL when voltage drops below 19.8V. Within 3km of the takeoff point, the aircraft has sufficient power to return. Beyond this range, gradually reduce altitude during return to conserve power or execute emergency landing.

Mode Descriptions

Multirotor Stabilized (QSTABILIZE): Provides stabilization assistance only. Altitude /position are manually controlled. Not recommended for beginners. (Users with throttle-centering transmitters should switch to QHOVER altitude hold mode.)

Multirotor GPS (QLOITER): Maintains position and altitude with centered throttle. Requires strong GPS signals. Recommended for takeoff by beginners. Throttle must exceed 50% for liftoff.

Fixed-Wing Stabilized (FBWA): Provides attitude stabilization. Airspeed varies with throttle. Agile control with pitch/roll limits. Does not maintain altitude/airspeed. Low throttle may trigger stall.

Fixed-Wing Cruise (CRUISE): Maintains altitude/heading with centered throttle. Stick inputs adjust heading/altitude at reduced rates. Ideal for beginners and long-range FPV.

Fixed-Wing Loiter (LOITER): In Fixed-Wing Loiter mode, the aircraft will orbit the target point at a preset radius instead of hovering (multirotor characteristic). The orbit radius is set via parameter WP_LOITER_RAD (default approximately 60 meters).

Return-to-Launch (RTL): Return to the takeoff point and land automatically.

Autonomous (AUTO): Autonomous mission mode. The aircraft will follow pre-set waypoints and automatically return to land after completion. (This mode requires manual activation.)

Multirotor Landing (QLAND): The aircraft will land at its current position. Landing position can be manually adjusted during descent, or control can be regained by switching modes. This mode activates during emergency low-voltage alerts or the final stage of AUTO missions.

Flight Controller Common Parameters

Altitude Protection Parameter (Q_ASSIST_ALT, 0): If hover altitude is below this value, fixed-wing transition is blocked. In fixed-wing mode, flight below this altitude triggers multirotor mode transition for protection. Set to 0 to disable (default: 0, unit: meters).

Speed Protection Parameter (Q_ASSIST_SPEED, 7): Transition assist speed. Set to 0 to disable airspeed dependency (speed protection off). Default: 7, recommended range:
6-9, unit: m/s.

Attitude Error Threshold (Q_ASSIST_ANGLE, 30): In Fixed-Wing FBWA mode, exceeding 30° attitude error triggers transition to Fixed-Wing Cruise for protection. Set to 0 to disable.
Default: 30, unit: degrees.

Cruise Speed (AIRSPEED_CRUISE, 20): Effective in AUTO mode. Airspeed for autonomous missions.
Default: 20, unit: m/s.

Return Point Orbit Altitude (Q_RTL-ALT, 45): In RTL mode, the aircraft descends in fixed -wing mode and converts to multirotor mode upon reaching this altitude. Default: 45, unit: meters.

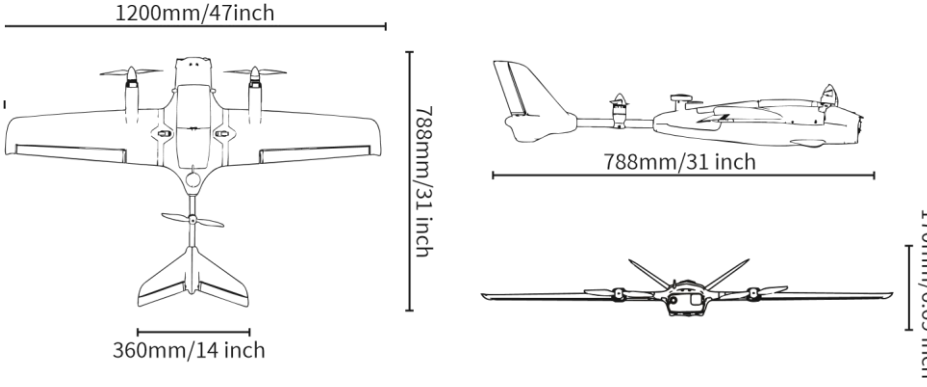
Voltage Protection

1.Return-to-Launch Voltage Threshold (BATT_LOW_VOLT, 19.8): Triggers automatic return and landing if voltage remains below 19.8V for 10 seconds. Set to 0 to disable.
Default: 19.8, unit: volts (recommended 14.8V for 4S power systems).

2.Emergency Landing Voltage Threshold (BATT_CRT_VOLT, 17): Triggers automatic multirotor mode landing if voltage remains below 17V for 10 seconds. Set to 0 to disable.
Default: 17, unit: volts (recommended 13.6V for 4S power systems).

Aircraft Voltage Protection Logic:Return-to-Launch triggered at ≤19.8V (sudden throttle increase may cause voltage drop to 21.6–20.0V, potentially triggering RTL).
Emergency landing (QLAND mode) triggered at ≤17.0V, forcing immediate landing at current position.

Aircraft Dimension Parameters



Aircraft Basic Parameters

Material	EPP Airframe
Wingspan	120cm
Length	78.8cm
Empty Weight	1010g
Takeoff Weight	Standard Takeoff Weight: 1435g (with battery) Maximum Takeoff Weight: 1835g (with battery, 400g payload)
Takeoff/ Landing Method	VTOL (Vertical Takeoff and Landing)
Landing Accuracy	＜2m
Propulsion System	Dual electric propulsion / Tractor configuration
Cruise Speed	16m/（s 57km/h）
Max Speed	42m/（s 150km/h）
Stall Speed	10m/s
Wind Resistance	Level 4 wind resistance (fixed-wing mode)
Flight Altitude	3200m
Operating Temperature	-10℃-40℃
Battery	4400mah 6S（ 22.2V） Battery compartment max dimensions: 90×75×52mm
Assembly/ Disassembly Method	Tool-free assembly/disassembly

Foam Case Volume	840X405X210mm

Battery

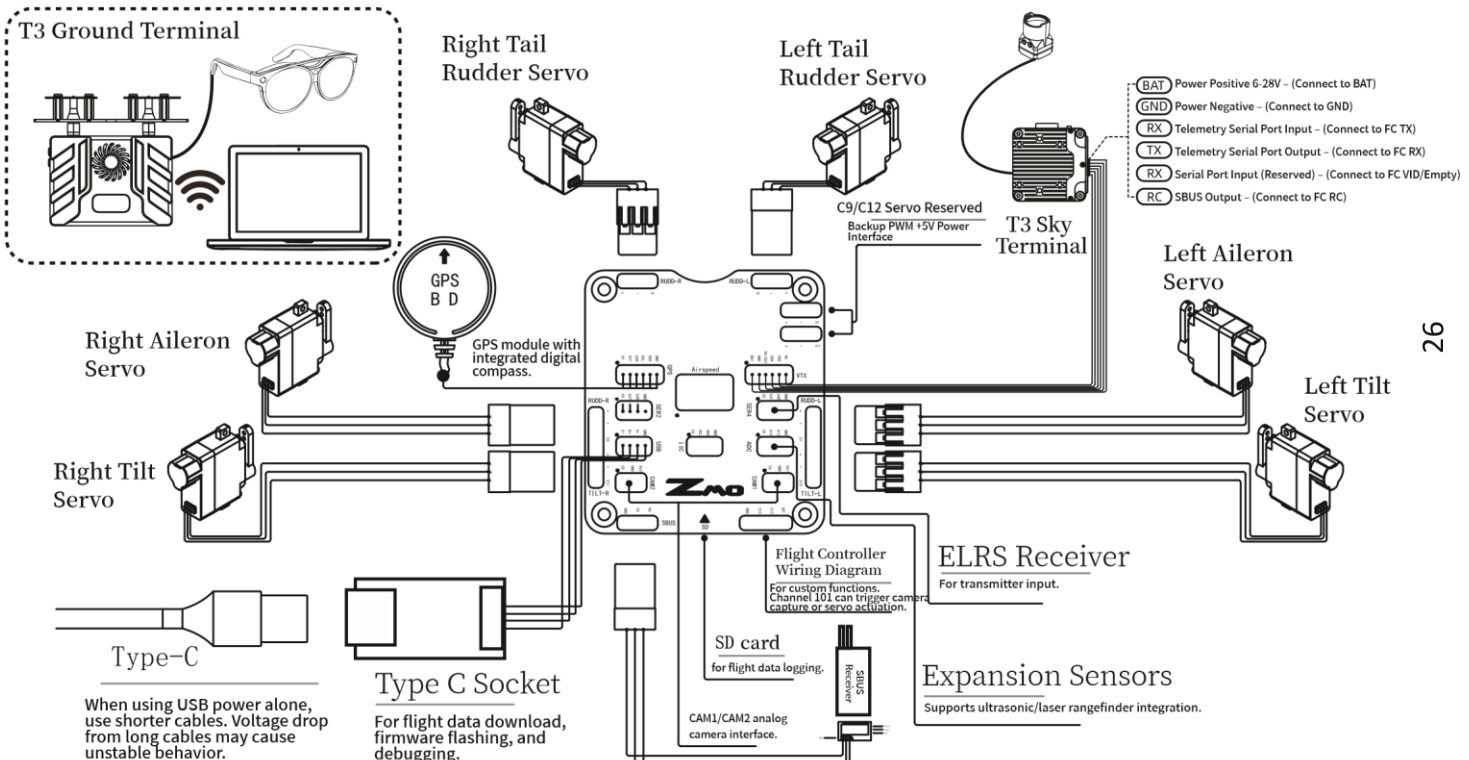
Battery Type: Lion 21700 cells
Nominal Voltage:22.2V (25.2V fully charged)
Capacity:4400mAh
Discharge Rate:10C (continuous)
Charge Rate:1-1.5C (recommended charge current: 4-6A)
Dimensions: 72×64×44mm
Weight:425g
Connector Type:XT60

Lithium Battery Usage Warnings

Fully charge the battery before the first flight!

1.Keep the battery away from flammable materials.
2.Do not exceed 1.5C charge rate (i.e., maximum charge current 6.6A). Recommended optimal charge current: 4A. Prolonged high-current charging reduces battery lifespan.
3.Never disassemble, modify wiring, or puncture the battery.
4.Do not exceed maximum discharge rate or load.
5.Risk of explosion if damaged in fire or improperly disposed.
6.For long-term storage: Maintain cell voltage at 3.85V (total voltage 23.1V). Inspect every 2 months during storage.
7.Avoid unnecessary charge cycles.
8.Monitor the battery during charging.
9.Critical: Prevent over-discharge. Voltage below 17V causes irreversible damage.

Flight Controller Wiring Diagram



Flight Controller Serial Port Connection Settings for Common VTX/Receivers

VTX (Serial 1) for Bianfeng T3 VTX:

SERIAL1_PROTOCOL	2

(Factory default settings for Bianfeng T3 VTX parameters)

VTX (Serial 1) for Snail VTX or DJI O3/O4:

(Disconnect SBUS signal line from VTX interface if not using DJI VTX control link; otherwise, remote control signals from other interfaces will not be recognized)

SERIAL1_BAUD	115
SERIAL1_OPTIONS	0
SERIAL1_PROTOCOL	42
OSD_TYPE	5
MSP_OPTIONS	4
OSD1_FLTIME_EN	1
OSD1_FLTIME_X	15
OSD1_FLTIME_Y	15
OSD1_ASPD1_EN	1
OSD1_ASPD1_X	1
OSD1_ASPD1_Y	7
OSD1_HORIZON_EN	1
SERIAL4_PROTOCOL	23
SERIAL4_OPTIONS	0
RSSI_TYPE	3

SER4 (Serial 4) for ELRS Receiver (CRSF)

VTX (Serial 1) for DJI O2 VTX:

SERIAL1_PROTOCOL	33
SERIAL1_BAUD	115
SERIAL1_OPTIONS	0
OSD_TYPE	1
SERIAL1_PROTOCOL	37
SERIAL1_BAUD	4
SERIAL1_OPTIONS	68

VTX (Serial 1) for SmartAudio:

SERIAL1_PROTOCOL	44
SERIAL1_BAUD	4
SERIAL1_OPTIONS	5

VTX (Serial 1) for IRC Tramp:

SERIAL2 for Telemetry (MAVLINK):

SERIAL2_PROTOCOL	2
SERIAL2_BAUD	57
SERIAL2_OPTIONS	0
SERIAL1_OPTIONS	0
OSD_TYPE	1

Frequently Asked Questions

Question: The aircraft cannot arm?

Answer: Check if the transmitter channel direction configuration is correct and calibrated. Connect to Ground Control Station (GCS) to view error messages. Common causes include uncalibrated transmitter or compass.

Question: When switching from Multirotor GPS (QLoiter) to Fixed-Wing FBWA mode, the aircraft remains hovering. How to resolve?

Answer: Set throttle to 50%, toggle the mode switch back to QLoiter, then re-engage FBWA mode. Increase transition altitude to 30 meters or disable the altitude protection parameter (Q_ASSIST_ALT).

03 **Question: Why does fixed-wing transition fail?**

Answer: For safety, transition is blocked if aircraft pitch/roll exceeds 15°. Excessive pitch angles are typically caused by high wind speeds (>6m/s) or improper wind direction. Perform transitions into headwind.

04 **Question: The aircraft reverts to multirotor mode during flight. What to do?**

Answer: Reversion to QLoiter may occur due to airspeed below protection threshold or excessive attitude angles. Toggle back to QLoiter with throttle at 50%, then re-engage FBWA mode to resume fixed-wing flight.

05 **Question: FPV goggles display video but no OSD overlay. How to fix?**

Answer: Verify OSD settings, ensure TX-RX wiring between VTX and flight controller is correct, and confirm OSD parameters match manufacturer specifications.

06 **Question: Does it support DJI O2/O3/O4 VTX, analog VTX, or Snail VTX?**

Answer: Yes. Ensure correct wiring and use updated mounting brackets for cameras.

Question: Does it support ELRS receivers?

Answer: Yes. Connect the receiver to SER4 port. If no input is detected, verify wiring and serial port parameters.

08 **Question: Does it support mission planning?**

Answer: Yes. Refer to ArduPilot documentation: ArduPilot - Versatile, Trusted, Open/Flight Missions · quadplane (cuav.net).