

AI + BetaFlight

2-in-1 Flight Controller

User Quick Start Guide

2-in-1 design, no need to purchase a separate flight controller

Plug & Play · Replacement for Standard BF FC

It's out-of-the-box ready with a zero-hassle installation
easy to use, no additional training

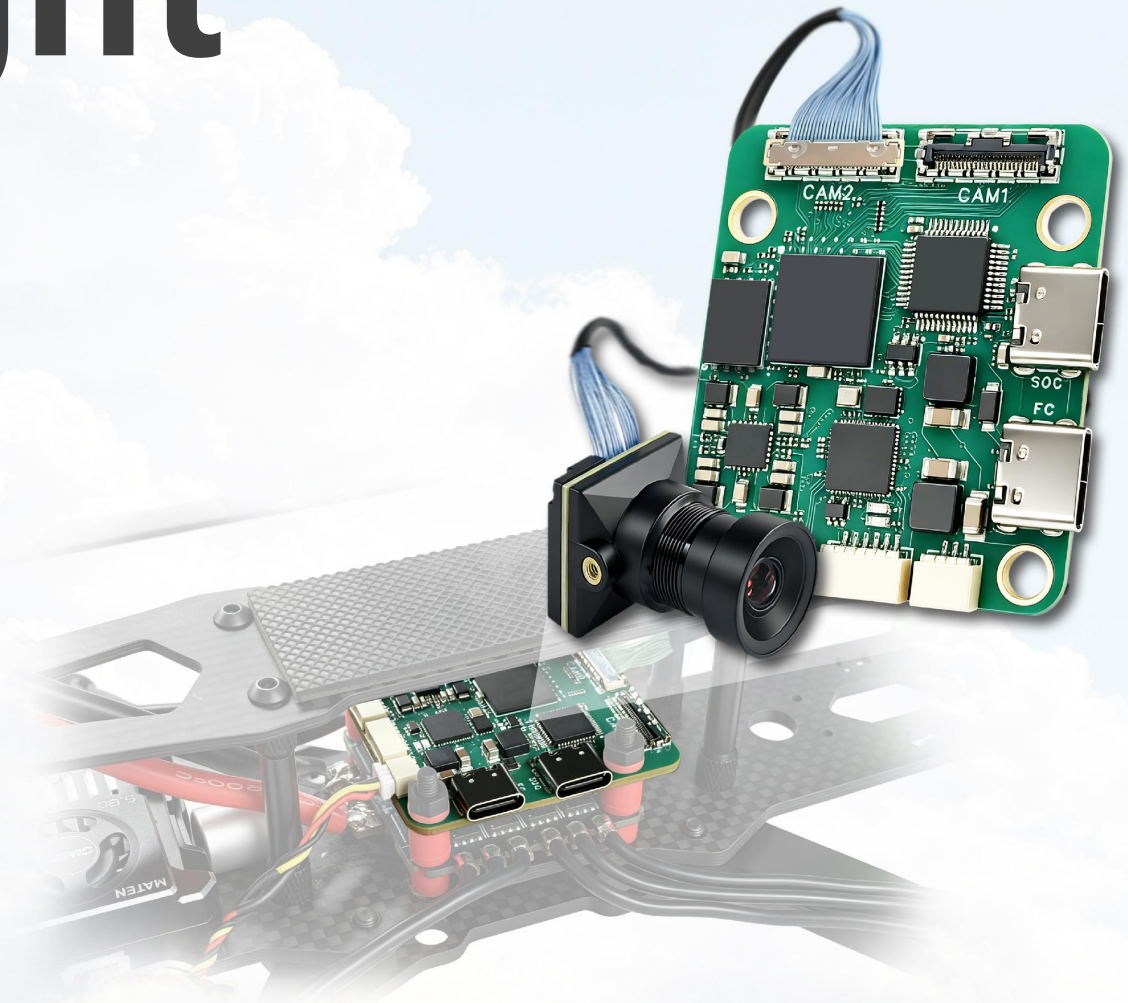
Integrated AI Vision Tracking Engine
locking and tracking

Full compatibility with all common (CVBS) analog VTX

Highly Integrated & Lightweight Design

Features a single-board design that is ultra-lightweight and has low power consumption

Exceptional Cost-Effectiveness



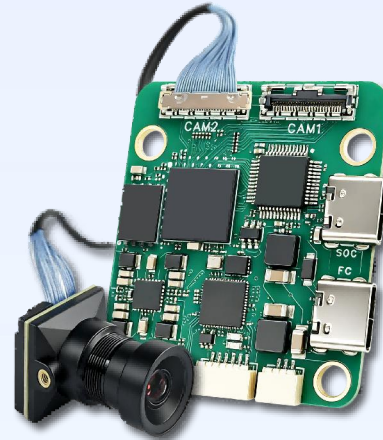
Intelligent AI takeover, fearless in signal blind spots.

Advanced flight control integrated with AI enables seamless human-AI collaboration. When anticipating entry into a signal blind spot, the pilot can smoothly switch to AI takeover mode. Even with a complete loss of remote control and video transmission, the powerful onboard AI can still precisely approach the target, ensuring the mission is accomplished.



PART 1

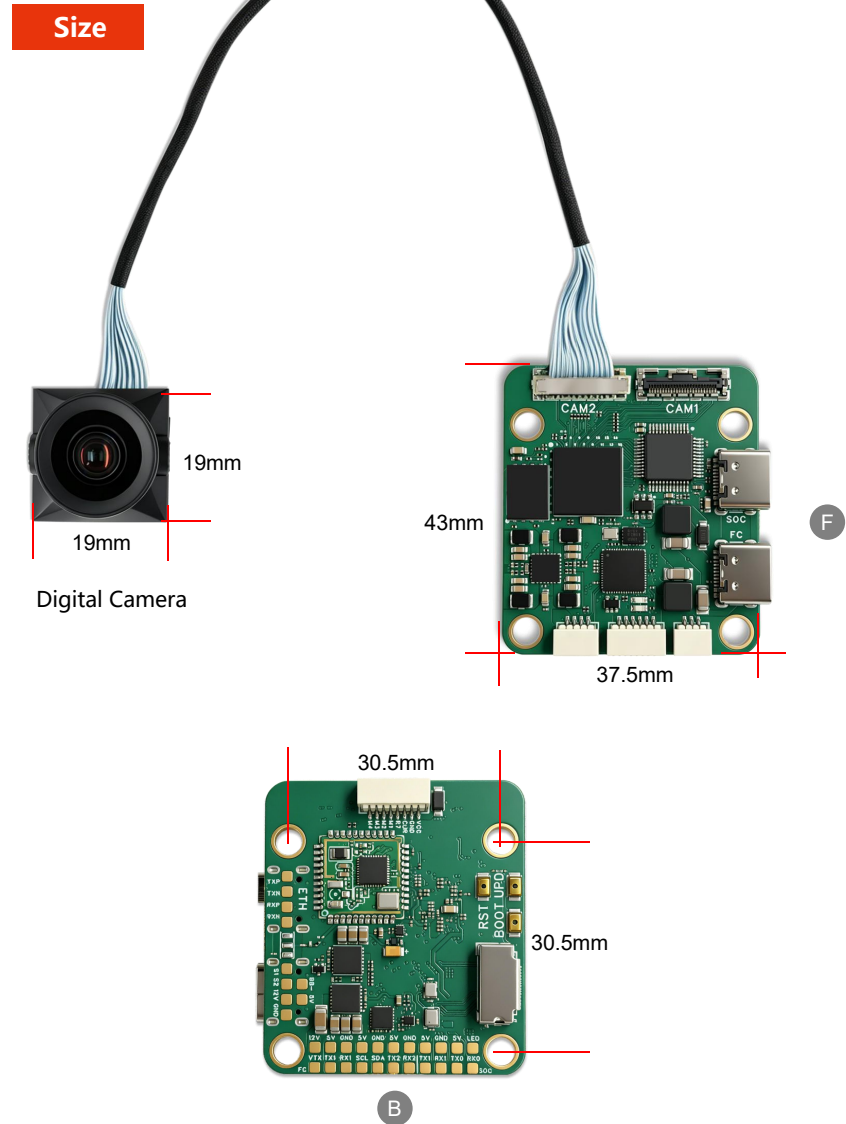
Main Parameters





1-Main Parameters

Category	Parameter	Value
Core Specs	Supported Frames	5-18 inch quadcopters
	Firmware	Beta Flight (No extra purchase.)
	Input Voltage	4S - 8S LiPo
	Power Consumption	2W
	Weight	10 g
Camera & Vision	Camera Compatibility	1080P Digital Camera
	Lens Focal Length	4mm
	Frame rate	60FPS
	Camera Angle	0-60° (20-30° Recommended)
	Field of View (FOV)	96°
	Video Output Format	CVBS
	Starlight Night Vision	Available
	AI Performance	AI Lock Range
	Minimum Target Size	20x20 pixels
	Max Target Speed	> 80km/h
	AI Lock Modes	Hard Lock : Crosshair mandatory lock, Capable of locking onto any kind of targets, moving & stationary.
Peripherals& Connectivity	Receiver Protocol	ELRS(CRSF)
	ESC Protocol	DSHOT 300/600
	Servo	Two-channel PWM servo signal
Environmental	Operating Temperature	-25°C to 55°C



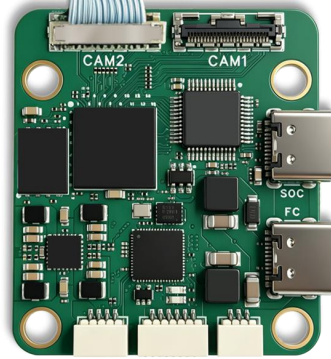
PART 2

Circuit connection Diagram



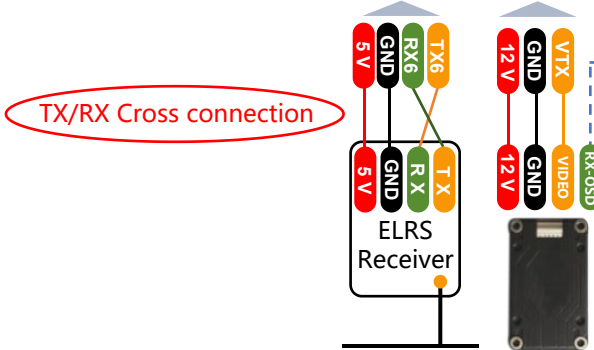
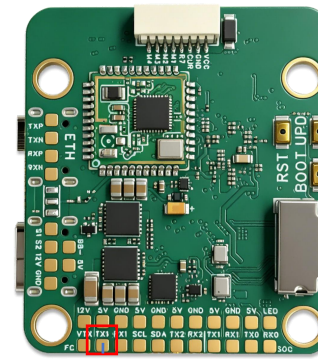
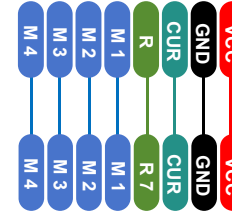
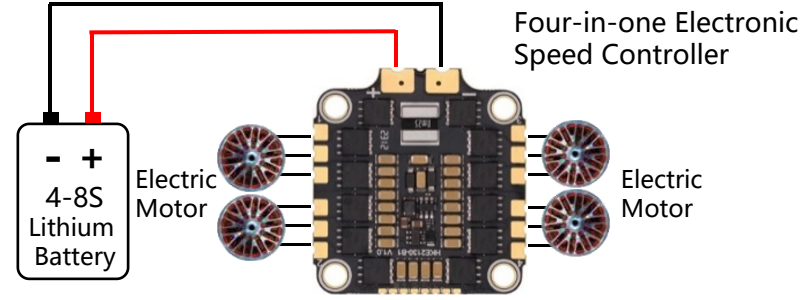


2-Circuit connection Diagram



SOC: firmware upgrade

FC: Betaflight GCS



If you need to adjust VTX parameters via remote control, please connect to TX1.

PART 3

Initial Setup & Calibration

(using Betaflight GCS)



BETAFLIGHT

Welcome to the **Betaflight App**, a utility designed to simplify updating, configuring and tuning of your flight controller.



3-Initial Setup & Calibration (using Betaflight GCS)

Step 1: Connecting to the Configurator

- BF 4.6 firmware can only be configured via the official web-based ground station (<https://betaflight.am32.ca/>). It is recommended to use Chrome or Edge browsers. The traditional desktop Configurator is no longer supported.

⚠ Troubleshooting: If the flight controller (FC) fails to connect, please verify the following: You are using a USB data cable (not a charge-only cable). The FC is powered on. The correct USB drivers are installed.

2. Select the correct COM port from the dropdown menu.

1. Use a USB data cable to connect the flight controller's FC port to the computer's USB port, Navigate to <https://betaflight.am32.ca/> in your browser. If prompted, select "Can't find my USB device".

3. Click Connect and wait for the interface to establish communication with the FC.

⚠ Please connect to the FC port of the flight controller.



3-Initial Setup & Calibration (using Betaflight GCS)

Step 2: Setup

The Setup tab is the default landing page after connecting the flight controller (FC). It displays essential FC information, sensor statuses, and vehicle attitude.

Calibrate Accelerometer
Place board or frame on **leveled** surface, proceed with calibration, ensure platform is not moving during calibration period

Calibrate Magnetometer
Rotate multicopter at least **360** degrees on all axis of rotation, you have 30 seconds to perform this task

Erase Settings
Erase the flight controller to an **unconfigured state**.

Activate Boot Loader / DFU
Reboot into **boot loader / DFU** mode.

Yaw: 192 deg
Pitch: 0.4 deg
Roll: 0.1 deg

Reset Z axis, offset: 0 deg

Instruments

GPS

3D Fix: **False**
Number of Satellites: 0
Latitude: 0.0000 deg
Longitude: 0.0000 deg

System info

Arming Disable Flags:	RX_FAILSAFE MSP
Battery voltage:	25.37 V
Capacity drawn:	23 mAh
Current draw:	0.20 A
RSSI:	0 dBm
MCU:	CH32H415
CPU Temperature:	93 °C

Sensor info

Gyro:	ICM42688P
Accel:	Not detected or disabled
Mag:	Not detected or disabled
Baro:	Not detected or disabled
Sonar:	Not detected or disabled
Optical Flow:	Not detected or disabled

Firmware info

MSP API:	1.47.0
Build date:	May 5 2026 19:51:41
Build type:	Local Build
Build info:	No build information available
Firmware:	

Network info

Status:	Online
Type:	3g
Power:	2.34 W

Port utilization: D:17%-U:2% Connection: 00:02 Packet error:0 I2C error:1 Cycle Time:124 CPU Load:21%

App Version: 2025.12.2 (a2d0f50), Firmware: 4.6.0 BTF, Target: WCH/WCH_H4(CH32H415)

Attitude Indicator Verification

After calibration, observe the attitude indicator in the center of the screen:

- When the FC is placed level, the indicator should display a level state.
- Pitch and Roll values should read approximately 0°.
- Slowly tilting the FC should cause the indicator to respond accordingly.
- If the orientation is incorrect, adjust the board alignment angles in the Configuration tab under Board Alignment.



3-Initial Setup & Calibration (using Betaflight GCS)

Step 3: Ports

The Ports tab is used to configure the peripheral assignments for each UART on the flight controller. Proper port configuration is essential for your peripherals to function correctly.

1. Select the appropriate protocol for your VTX.

Identifier	Configuration/MSP	Serial Rx	Telemetry Output	Sensor Input	Peripherals
USB VCP	115200	<input type="checkbox"/>	Disabled AUTO	Disabled 57600	Disabled 115200
UART1	115200	<input type="checkbox"/>	Disabled AUTO	Disabled 57600	VTX (IRC Tramp) 115200
UART2	115200	<input type="checkbox"/>	Disabled AUTO	Disabled 57600	Disabled 115200
UART3	115200	<input type="checkbox"/>	Disabled AUTO	Disabled 57600	Benewake LIDAR 115200
UART4	115200	<input type="checkbox"/>	Disabled AUTO	Disabled 57600	Blackbox logging 115200
UART5	115200	<input type="checkbox"/>	Disabled AUTO	Disabled 57600	Camera (RunCam Protocol) 115200
UART6	115200	<input checked="" type="checkbox"/>	Disabled AUTO	Disabled 57600	OSD (FrSky Protocol) 115200
UART7	115200	<input type="checkbox"/>	Disabled AUTO	Disabled 57600	VTX (IRC Tramp) 115200
UART8	500000	<input type="checkbox"/>	Disabled AUTO	ESC 57600	VTX (MSP + Displayport) 115200

2. After changing port settings, you must save and reboot the flight controller for the changes to take effect.

Save and Reboot



3-Initial Setup & Calibration (using Betaflight GCS)

Step 4: Configuration

The Configuration tab contains the flight controller's core system settings, including PID loop frequency, feature switches, and customization options.

The screenshot shows the Betaflight Configuration page. A red box highlights the 'Configuration' tab in the left sidebar. A red box highlights the 'Board Alignment' section, with a red arrow pointing to it from a text box that reads: "If the flight controller board's mounting orientation is changed, you must re-adjust the angles in the Board Alignment section to match the actual mounting orientation exactly." Another red box highlights the 'Save and Reboot' button at the bottom right, with a red arrow pointing to it from a text box that reads: "Save and Reboot".

Configuration

System configuration

Note: Not all combinations of features are valid. When the flight controller firmware detects invalid feature combinations conflicting features will be disabled.
Note: Configure serial ports before enabling the features that will use the ports.

Note: Make sure your FC is able to operate at these speeds! Check CPU and cyclotime stability. Changing this may require PID re-tuning. TIP: Disable Accelerometer and other sensors to gain more performance.

8.00 kHz Gyro update frequency
8.00 kHz PID loop frequency

Accelerometer
 Barometer (if supported)
 Magnetometer (if supported)

Personalization

Aircraft name
Pilot name

Camera

0 FPV Camera Angle [degrees]

Arming

180 Maximum ARM Angle [degrees]
 Calibrate Gyro on first arm

Other Features

Feature	Description
<input type="checkbox"/> AIRMODE	Permanently enable Airmode
<input type="checkbox"/> CHANNEL_FORWARDING	Forward aux channels to servo outputs
<input type="checkbox"/> INFLIGHT_ACC_CAL	In-flight level calibration
<input checked="" type="checkbox"/> LED_STRIP	Multi-color RGB LED strip support
<input checked="" type="checkbox"/> OSD	On Screen Display
<input type="checkbox"/> SERVO_TILT	Servo gimbal

Board Alignment

0 Roll Degrees
0 Pitch Degrees
270 Yaw Degrees

Active IMU

Sensor Configuration

NONE Rangefinder
NONE Optical Flow

Accelerometer trims

0 Accelerometer Roll Trim
0 Accelerometer Pitch Trim

Dshot Beacon Configuration

1 Beacon Tone

Enabled	Feature	Description
<input type="checkbox"/>	RX_LOST	Beeps when TX is turned off or signal lost (repeat until TX is okay)
<input checked="" type="checkbox"/>	RX_SET	Beeps when aux channel is set for beep

Beeper Configuration

Enabled	Feature	Description
<input checked="" type="checkbox"/>	GYRO_CALIBRATED	Beeps when gyro has been calibrated
<input checked="" type="checkbox"/>	RX_LOST	Beeps when TX is turned off or signal lost (repeat until TX is okay)
<input checked="" type="checkbox"/>	RX_LOST_LANDING	Beeps SOS when armed and TX is turned off or signal lost (autoland/autodisarm)
<input checked="" type="checkbox"/>	DISARMING	Beep when disarming the flightcontroller
<input checked="" type="checkbox"/>	ARMING	Beep when arming the flightcontroller
<input checked="" type="checkbox"/>	ARMING_GPS_FIX	Beep a special tone when arming the board and GPS has fix
<input checked="" type="checkbox"/>	BAT_CRIT_LOW	Longer warning beeps when battery is critically low (repeats)

Save and Reboot

Save and Reboot



3-Initial Setup & Calibration (using Betaflight GCS)

Step 5: Power & Battery

The Battery Calibration page is used to configure battery parameters, calibrate the voltage sensor, and set up the current sensor to ensure accurate and reliable battery readings.

BETAFLIGHT
App Version: 2025.12.2 (a2d0f50)
Firmware: 4.6.0 BFL
Target: WCH/WCH_H4(CH32H415)
2026-05-08 @16:49:54 -- Arming Disabled

25.37V (6S)
Gyro Accel Mag Baro GPS Sonar
Dataflash: free 0B
Update Firmware Disconnect
Enable Expert Mode Show Log

Power & Battery

Battery
Onboard ADC Voltage Meter Source
Onboard ADC Current Meter Source
3.3 Minimum Cell Voltage
4.3 Maximum Cell Voltage
3.5 Warning Voltage
0 Capacity

Power State
Connected: Yes (Cells: 3)
Voltage: 25.35 V
mAh used: 26 mAh
Amperage: 0.05 A

Amperage Meter

Calibration Manager

To calibrate, use a multimeter to measure the actual voltage / current draw on your aircraft (with a battery plugged in), and enter the values below. Then, with the same battery still plugged in, click [Calibrate].

Note: Before calibrating the scale make sure that divider and multiplier for voltage and offset for amperage is set properly. Leaving the values at 0 will not apply calibration.
Remember to remove propellers before plugging in a battery!

0 Measured Voltage
0 Measured Amperage

Calibrate

1. Click "Calibrate" .

2. In the pop-up window, enter the correct voltage measured by a multimeter, then click "Calibrate" . The flight controller will automatically adjust the scaling ratio so that the ground station readings match the multimeter readings.

3. Save the settings after calibration is complete.

Calibration Save

Port utilization: 0:17%-U:1% Connection: 01:09 Packet error: 0 I2C error: 1 Cycle Time: 123 CPU Load: 21%

App Version: 2025.12.2 (a2d0f50), Firmware: 4.6.0 BFL, Target: WCH/WCH_H4(CH32H415)



3-Initial Setup & Calibration (using Betaflight GCS)

Step 6: Receiver

The Receiver tab is used to configure the receiver's protocol, channel mapping, and signal processing parameters.

1. Use the Channel Monitor to verify the receiver is working properly: Ensure the receiver and transmitter are paired.

- Move the transmitter's sticks and observe the corresponding channel bar graph changes.
- Confirm the Roll/Pitch/Yaw directions are correct.
- Confirm the throttle displays the lowest value when at the lowest position.
- Toggle each switch and confirm the AUX channels switch correctly.

2. Save.



3-Initial Setup & Calibration (using Betaflight GCS)

Step 7: Modes

The Modes tab is used to configure the channel assignments for flight mode switches. Properly configuring these switches allows for safer and more convenient flight.

Beginners are recommended to practice with ANGLE mode first, then switch to ACRO mode after becoming familiar with the controls. ANGLE mode limits the maximum bank angle (default 65 degrees), and the aircraft will automatically return to level when the sticks are released.

Mode Switch Assignment Example

Mode	Example Channel	Description	Switch Position
ARM (Unlock)	AUX1	Unlock motors	Switch high position
ACRO (Manual)	AUX2	Full manual control, no self-leveling	Switch low position (900~1300)
ANGLE (Self-Level)	AUX2	Limit maximum bank angle, auto-center	Switch mid position (1300~1700)
HORIZON (Semi-Level)	AUX2	Small angle self-level, large angle stunt	Switch high position (1700~2100)
BEEPER (Buzzer)	AUX3	Trigger buzzer via transmitter switch after crash for easy recovery	As needed



3-Initial Setup & Calibration (using Betaflight GCS)

Step 8: Motors

⚠ Before testing the motor order, be sure to remove all propellers! High - speed rotating propellers can cause serious injury!

The Motors tab is used to configure motor mixing types, ESC protocols, test motor directions, etc. This is a critical step to ensure the aircraft flies properly.

1. Motor Order Calibration:
Operation steps: Click **“Reorder Motors”** to ensure the motor order matches the diagram. The BF default order is: 1-Bottom Right, 2-Top Right, 3-Bottom Left, 4-Top Left (X-frame).

2. Motor Direction Calibration:
Operation steps: Click **“Motor Direction”**, observe the rotation direction of each motor. Diagonal motors should rotate in the same direction. If a motor’s direction is incorrect, click the **“Reverse”** option for that motor to correct it.

3. Save and Reboot

Motor Test Mode / Arming Notice:
WARNING: Serious risk of injury! Remove all propellers!
• Motors will spin up when armed or when sliders are raised
• Motor test mode will remain active after moving to another Tab
• Hitting any key will stop the motors, but only in the Motors Tab
• Disconnecting the USB cable may not stop the motors!
I understand the risks, the propellers are removed - enable motor control and arming, and disable Runaway Takeoff Prevention.



3-Initial Setup & Calibration (using Betaflight GCS)

Step 9: OSD

The OSD (On - Screen Display) page is used to configure the flight information displayed on the FPV screen. A reasonable OSD configuration can provide key information during flight.

1. The on-screen overlay display information can be set according to your needs and preferences.

2. Save.

The screenshot displays the Betaflight GCS interface for the OSD configuration. The top bar shows the Betaflight logo, app version (2025.12.2), and target (WCH/WCH_H4(CH32H415)). The left sidebar contains navigation options, with 'OSD' highlighted. The main area is titled 'OSD' and includes a note about font preview. A list of elements is shown on the left, with 'Altitude' selected. The central preview window shows a simulated FPV view with various OSD elements overlaid, including battery voltage, altitude, and a 'LOW VOLTAGE' warning. The right sidebar contains configuration options for the active OSD profile, video format, units, timers, alarms, and warnings. A 'Save' button is located at the bottom right of the configuration area.



3-Initial Setup & Calibration (using Betaflight GCS)

Step 10: Video Transmission

The Video Transmission page is used to configure the FPV transmitter's band, channel, frequency, and power level. Proper VTX configuration ensures a clear and stable video feed.

“Device Ready” being True indicates normal communication between the flight controller and the transmitter.

VTX Configuration Method:

1. Find your transmitter control wire (usually a separate signal wire labeled “RX/DATA/IRC”) and connect it to the TX pin of UART 1 on the flight controller. (Refer to the wiring diagram for the transmitter and flight controller)
2. In the Peripheral column, select the transmitter protocol (refer to the transmitter manufacturer’s manual).
3. Import the transmitter table (download from the transmitter manufacturer).
4. Save.

Save Load from clipboard Load from file Save to file Save Lua Script

PART 4

AI Mandatory Lock

*** Need to set remote control switch for AI mandatory Lock Function (CH10)**



4-Set remote control switch for AI Mandatory lock function (CH10)

* Take Jumper T15Pro RC as example, other brands support self-defined setup.



1. Enter menu



2. Select Model Setup



3. Click Mixer



4. Click "+" to add RC channel



5. Select Channel "CH10"



6. Toggle the switch to be mapped (take SA as input source)



7. Click Confirm to save and return

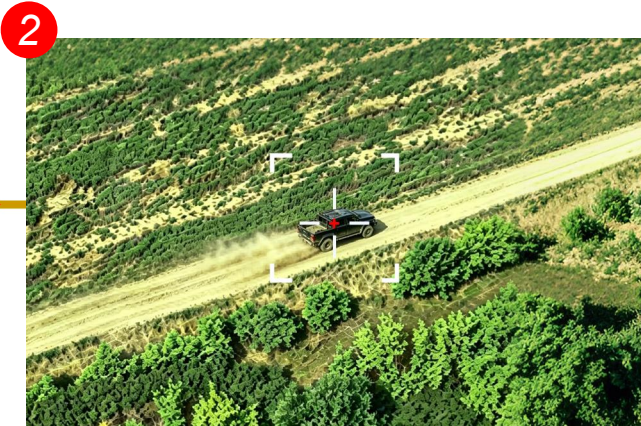


8. The lock switch (SA) is displayed in the list, channel setup completed successfully.

 **4-AI Mandatory Lock Operation Diagram (any kind of targets, moving & Stationary.)**



1 Aim the crosshair at the target



2 Align with the target



3 Push the CH10 switch down to enter hard lock mode



4 A green hard lock box appears



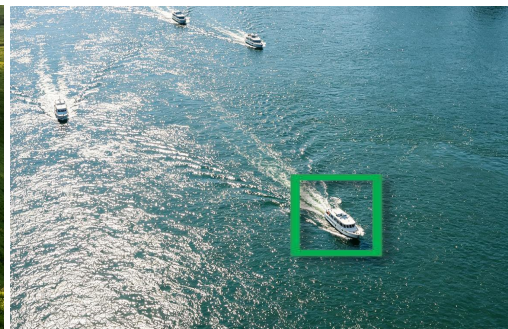
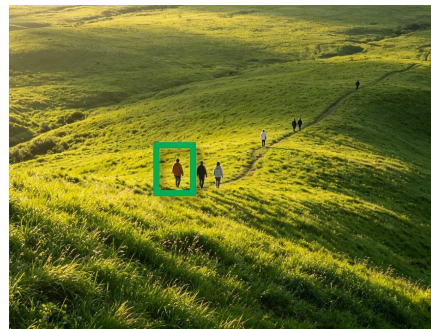
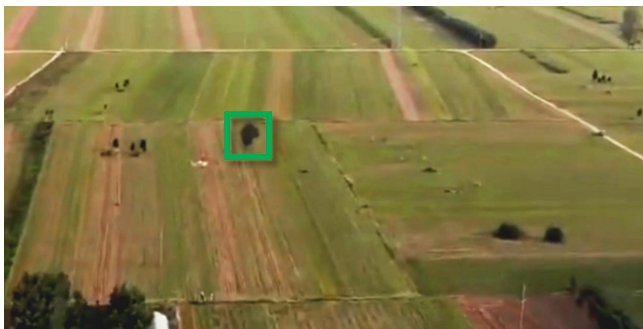
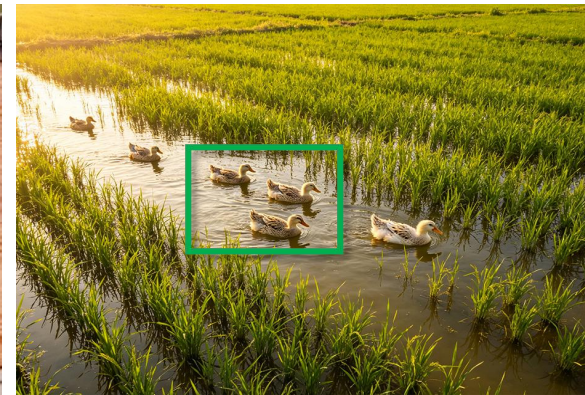
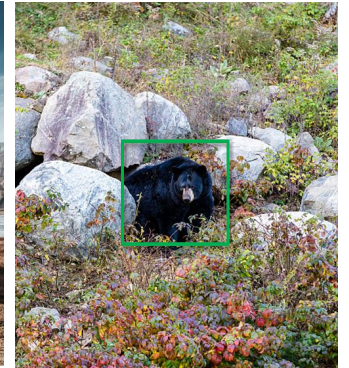
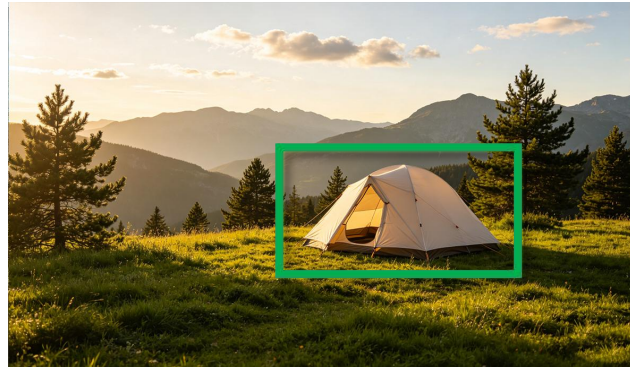
5 Release both hands



6 Hit the target



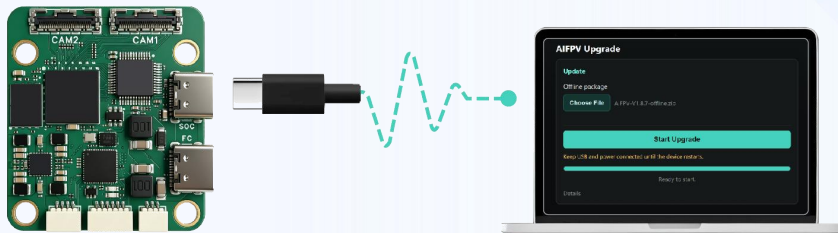
4-AI Mandatory Lock (any kind of targets, moving & Stationary.)



PART 5

Firmware Upgrade

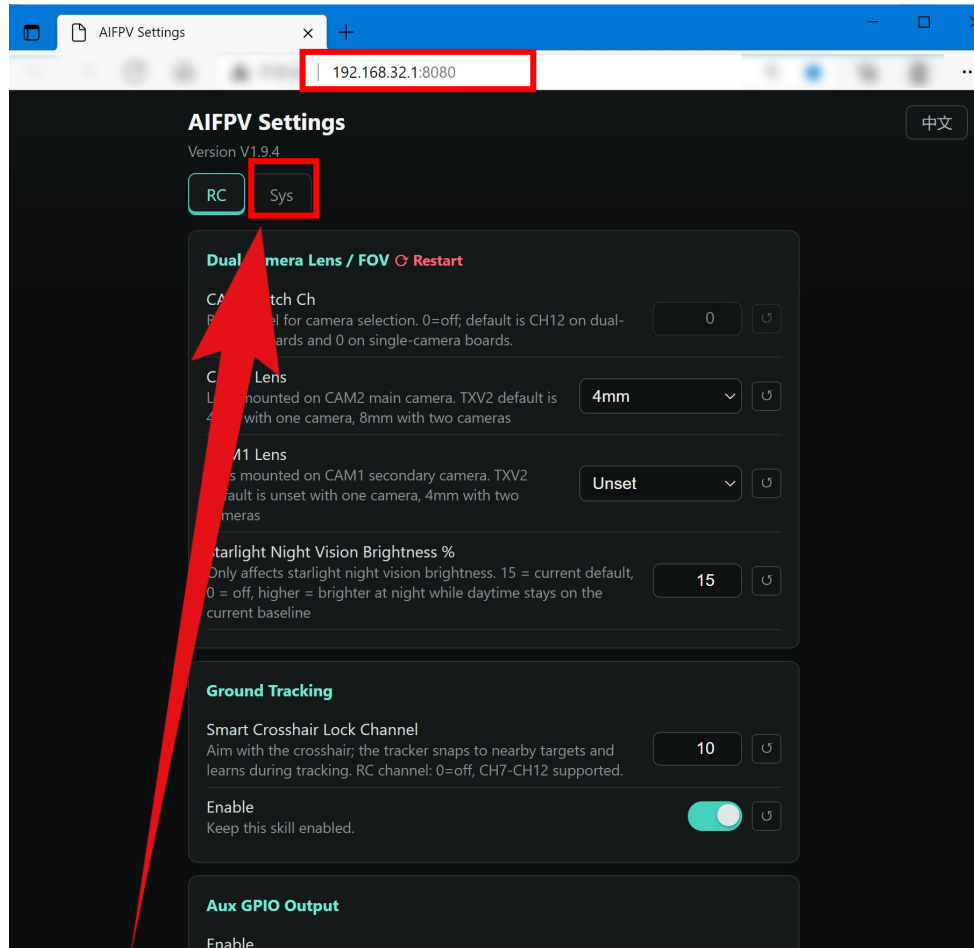
URL: 192.168.32.1:8080/





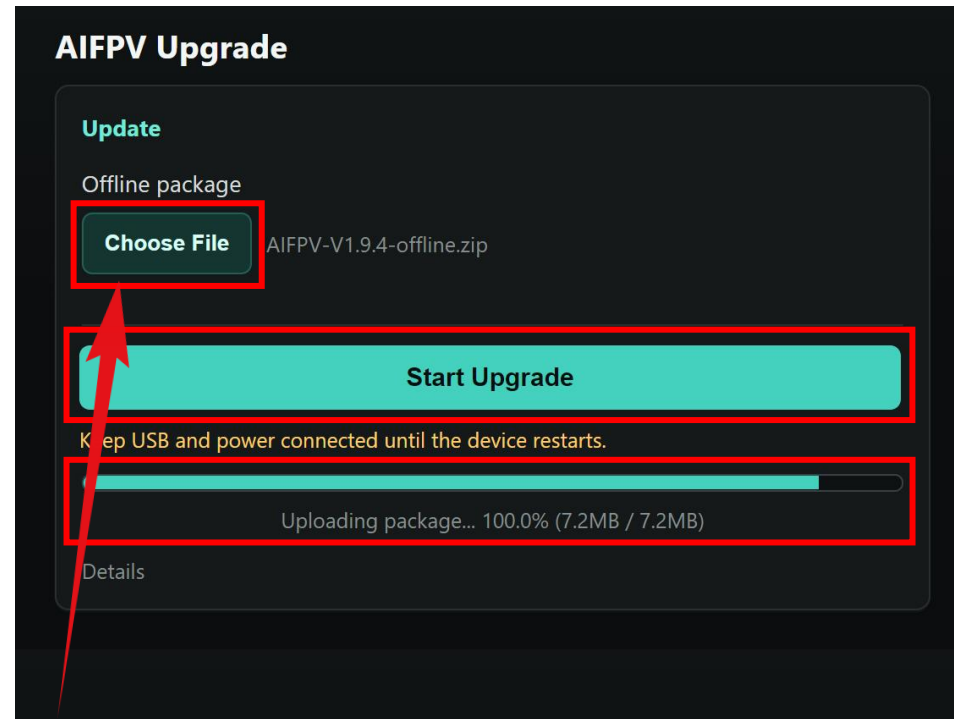
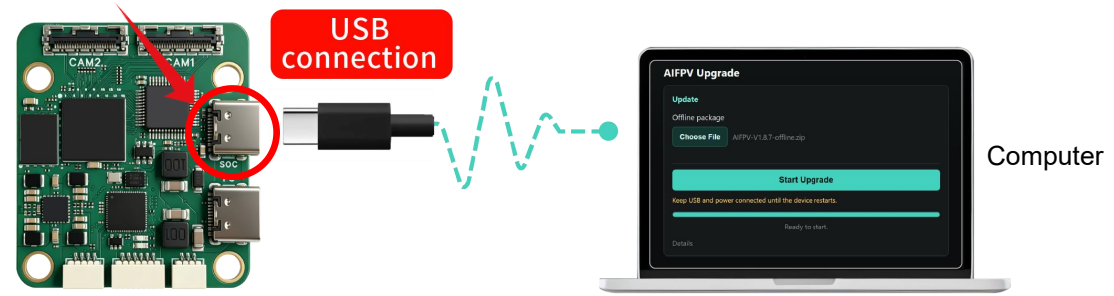
5-1 Firmware Upgrade Diagram

192.168.32.1:8080/



1. Connect the flight controller's **SOC** port to the computer with a USB data cable.
2. Open the URL_ <http://192.168.32.1:8080/> on your computer and select **"Sys"**

⚠ Please connect to the SOC port of the flight controller.

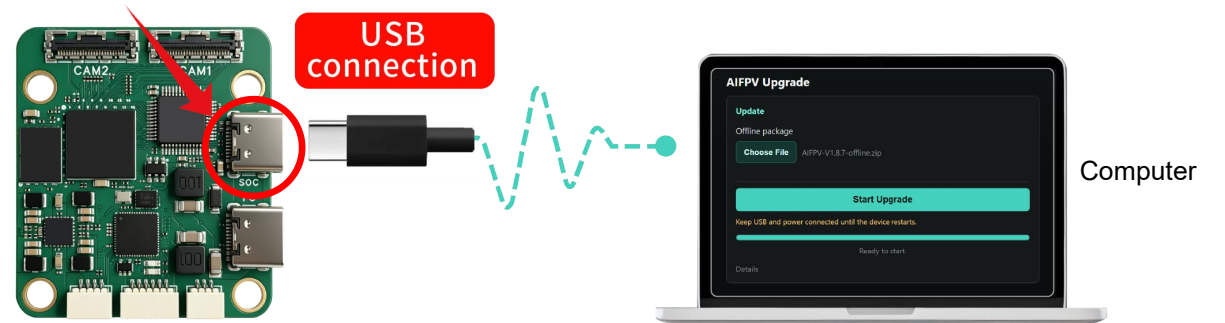


3. Click **"Choose File"** to upload the latest firmware package.
4. Click **"Start Upgrade"**.
5. Wait for the progress bar to finish, then the upgrade is completed.



5-2 Additional functions

⚠ Please connect to the SOC port of the flight controller.



192.168.32.1:8080/

AIFPV Settings

Starlight Night Vision Brightness

Starlight Night Vision Brightness %
Only affects starlight night vision brightness. 15 = current default, 0 = off, higher = brighter at night while daytime stays on the current baseline

15 ↻

Upgrade

Open Upgrade Page

Adjustable night vision brightness for night flight

PART 6

Troubleshooting





6-Troubleshooting

Below are some common problems and their solutions.

Problem Phenomenon	Possible Reasons	Solutions
Cannot connect to ground station	USB cable is not a data cable or not compatible	Replace USB data cable
Cannot connect to ground station	Port is occupied	Close other serial port software
Receiver has no signal	Protocol selection is incorrect	Select the correct protocol on the receiver page
Receiver has no signal	UART port configuration is incorrect	Check port configuration
Channel direction is reversed	Channel mapping is incorrect	Adjust channel mapping on the receiver page
Motor does not rotate	ESC protocol is mismatched	Set to DSHOT 300/600
Motor direction is reversed	Wiring error	Check "reverse" in the motor direction page
OSD does not display	Video format is mismatched	Set to automatic or match the VTX format
OSD does not display	OSD is not enabled	Enable OSD in the configuration page
VTX cannot be controlled	Tuning wire is not soldered or connected incorrectly	Solder the tuning wire to the corresponding serial port TX pin
VTX cannot be controlled	UART port is not configured with the corresponding protocol	Configure VTX Tramp on the port page
Battery voltage is inaccurate	Voltage meter is not calibrated	Calibrate the voltage meter with a multimeter
Unlock fails	Safety conditions are not met	Check if the throttle is at the lowest position