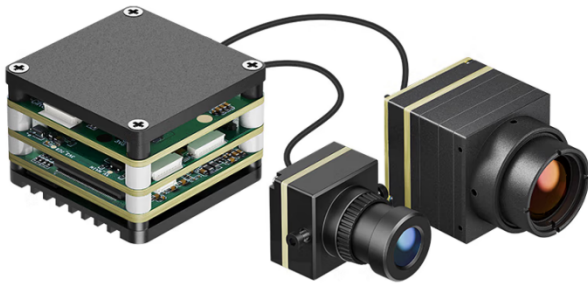


1. PRODUCT DESCRIPTION

Our AI visual tracking system is purpose-built for drones, providing advanced autonomous capabilities through precise target recognition and tracking. By seamlessly integrating high-performance target recognition, dynamic tracking, and anti-jamming control, the system enhances its operational effectiveness. The fusion of deep learning algorithms with powerful processing chips enables automatic target acquisition. This combination ensures stable and precise tracking, even in complex electromagnetic environments. As a result, there is a significantly lower operational threshold for pilots and a dramatic improvement in mission efficiency.



Single-light AI visual tracking system



Dual-light AI visual tracking system

1.1 Core Features and Advantages

1.1.1 km Ultra-Long-Range Recognition

Achieve unprecedented situational awareness with a recognition range of up to 1.1 km. It delivers significantly higher recognition accuracy than conventional AI systems, enabling reliable beyond-visual-range operations even in the most complex and cluttered environments.

1.1.2. High-Density Multi-Target Tracking

Powered by an optimized YOLOv7 architecture, the system can simultaneously track over 50 dynamic targets within its field of view under optimal conditions. This robust capability is enhanced by support for self-training algorithms, allowing for the deployment of customized classification models designed for particular mission requirements.

1.1.3. Picture-in-Picture (PiP) Architecture for Situational Awareness

Enhance operational effectiveness with innovative dual-stream PiP technology. This architecture seamlessly combines a wide-angle view for global situational awareness with an 8x digital zoom sub-window for precision tracking of individual targets. This allows operators to conduct real-time environmental analysis while exercising judicious decision-making for precision strikes or interventions, all within a single, consolidated interface.

1.1.4 Adaptive Lock-On Tracking

Once a target is identified, the system employs an intelligent "crosshair adsorption" algorithm to automatically guide the drone's heading, swiftly centering the target on screen. This reduces lock-on time to under 0.5 seconds, drastically minimizing pilot workload and achieving a 92% success rate in tests for locking onto fast-moving targets.

1.1.5 Dynamic Memory Locking

Overcome temporary obstructions with advanced predictive tracking. By integrating temporal prediction models and Kalman filter algorithms, the system can reacquire a target within 3 seconds after a visual loss. This enhances tracking continuity by 40% in challenging environments like dense woodlands.

1.1.6 Multi-Sensor Fusion & 24/7 Operation

To ensure all-weather, day-and-night mission capability, we utilize switchable visible-light and uncooled thermal imaging sensors, ensuring reliable target identification in temperatures from -20°C to 60°C and effectively countering camouflage and thermal masking attempts.

1.1.7 Lightweight, Rapid Integration

under 50 grams, the kit supports easy integration with open-source platforms like Betaflight. Achieve AI capability in under 5 minutes via plug-and-play installation, making it compatible with a wide range of platforms, from industrial-grade drones to FPV racers.

1.1.8 Target Re-locking Support:

After locking a target, if you wish to change the target, you can toggle the corresponding channel's remote-control lever. An additional aiming crosshair will appear in the VTX image. Use the R/O direction stick to move the aiming crosshair to the new target, and then lock it again.

1.1.9 new target, and then lock it again.

Expand Search Range: When the crosshair is not yet aligned with typical targets (e.g., people or vehicles) but you want to lock onto them quickly, simply toggle the corresponding channel on the remote control to expand the search range. Once activated, the crosshair will swiftly and precisely snap to the detected targets, and the drone's flight path will automatically adjust to these targets.

2. WORKING PRINCIPLE

2.1 System Core Components

AI Image Processing Board: As the central control unit of the system, it acts like the "brain" of the system. It processes the image data captured by the high-definition camera in real-time, utilizing advanced AI algorithms for target detection and recognition. The system also features an automatic adhesive tracking function, where it can automatically attach and track a target precisely locking onto the target's features. Additionally, it has memory tracking functionality, recording the

target's movement characteristics and historical trajectory to provide more accurate data support for subsequent tracking.

High-Definition Camera: Provides high-quality image input and supports ultra-low-latency latency analog output(<60ms), ensuring both real-time video transmission and high-definition clarity. It also supports Picture-in-Picture (PiP) digital zoom, allowing the pilot to better identify target details, making the target features clearer for the AI image processing board to perform accurate recognition.

Flight Control: Receives target info & instructions from the AI Image Processing Board, and adjusts the drone's attitude based on real-time info, It facilitates a smooth transition from manual control by the pilot to autonomous target tracking mode. Based on the memory tracking info from the AI Board, it adjusts the flight more stably & accurately by the target's trajectory, ensuring consistent tracking.

2.2 Working Flow

Step 1: Target Pre-Setting & Monitoring

During flight, the pilot monitors the surveillance area using FPV (First-Person View) video. When a target (such as a human or vehicle) appears within the frame, the system automatically detects and identifies the target through its built-in model and adhesive recognition function. It quickly determines key features of the target and locks onto it stably. Additionally, the system uses the PiP mode to display a zoomed-in view, helping the pilot confirm target details and prepare for subsequent tracking. And AI Image Processing Board begins to store memory of the target, recording its initial position, appearance, and movement parameters.

Step 2: Signal Interference Monitoring & Mode Switching

When the target is within the maximum range of 1.2 kilometers, if there is interference in the target area (for example, the target emits interference signals, resulting in unstable remote control signals or even a risk of losing control), the pilot can manually switch to the AI tracking mode before the remote control signal is lost, activate the tracking system, and let the AI visual system with strong analysis and tracking capabilities take over the flight control commands, and continue to stably track by using the memorized target information.

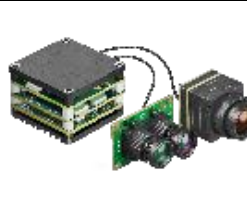
Step 3: Autonomous Visual Tracking & Flight Control Takeover

Once AI mode is activated, the AI Image Processing Board relies on real-time image analysis, advanced target recognition algorithms, and the automatic adhesive recognition and memory tracking features to continuously monitor the target's status. As the target moves, the system constantly matches the target's features in memory, ensuring accurate tracking even if part of the target's appearance changes. The flight control system continuously adjusts the drone's attitude based on the latest status of the target. The system ensures low-latency feedback (below 60ms) through simulated output, allowing the drone to stably track the target during flight. Even if the target moves quickly or is briefly obstructed, the memory tracking function helps maintain the lock.

Step 4: Flight Mission Execution

After AI Image Processing Board takes over, the drone calculates the optimal trajectory and flies towards the target area based on the memorized target path and real-time monitoring of the target's dynamics. Thru this process, the FC system continuously adjusts the drone's flight posture in real-time, based on the target data returned by the AI module, combined with memory information, This ensures that the cross hair in the center of the FPV video remains aligned with the target, ultimately achieving precise target tracking.

3. TECHNICAL SPECIFICATIONS

Photo				
Module	AS450	AS1200	ST450	ST1200
Target Recognition Type	Default:Human,Vehicle			
Target Detection Range	Vehicle:450m, Human:170m	Vehicle:1200m, Human:500m	Vehicle:450m, Human:170m	Vehicle:1200m, Human:500m
Min Target Tracking Pixel	16x16 pixels			
Max Tracking Speed of Dynamic Target	60 km/h			
Intelligent Adhesive Tracking	Supports cross hair fuzzy locking for close-range adhesive tracking			
Trajectory Prediction & Memory Tracking	Supports trajectory Prediction and feature Memory tracking			
Max Target Recognition No.	50			
Picture-in-Picture (PiP)	Supported			
Input Voltage	DC9~16V			
Power Consumption	10W			
Operating Temperature	-20℃ ~ 60℃			
AI Image Processing Board				
Computing Powerof Main Controller	TOPS*1	TOPS*6	TOPS*1	TOPS*6
Communication Protocol	CRSF			
Communication Method	UART			
Video Output Format	CVBS			
Supported Firmware	Beta Flight			
Input Voltage	9 ~ 16V			
Mounting Holes	25.5*25.5mm			
Dimensions	38*38*29mm			
Weight	43.8g			
Visible Light Camera Module				

Low Light Performance of Short-focal Camera	7341mV/lux·s	9650mV/lux·s	7341mV/lux·s	9650mV/lux·s
Short-focal CMOS	1/2.8 Inch	1/2.6 Inch	1/2.8 Inch	1/2.6 Inch
Short-focal FOV	69°(H)*42°(V)	72°(H)*45°(V)	69°(H)*42°(V)	72°(H)*45°(V)
Short-focal Length	4mm	3.9mm	4mm	3.9mm
Low Light Performance of Long-focal Camera	N/A	9650mV/lux·s	N/A	9650mV/lux·s
Long-focal CMOS	N/A	1/2.6 Inch	N/A	1/2.6 Inch
Long-focal FOV	N/A	26°(H)*15°(V)	N/A	26°(H)*15°(V)
Long-focal Length	N/A	12mm	N/A	12mm
Video Input Format	1920*1080@30hz			
Dimensions	19*19*30mm	40.8*25*26mm	19*19*30mm	40.8*25*26mm
Weight	13.6g	17.0g	13.6g	17.0g
Thermal camera				
Pixel Pitch	N/A	12 μm		
Response Band	N/A	8~14μm(LWIR)		
FOV	N/A	20.3°(H)×15.2°(V)		
Focal Length	N/A	9.1mm		
Video Input Format	N/A	384*288@25Hz		
Dimensions	N/A	26*26*32.85mm		
Weight	N/A	32.4g		

4. USER INTERFACE DEFINITION AND WIRING

4.1 AI Visual Tracking System Interface Diagram

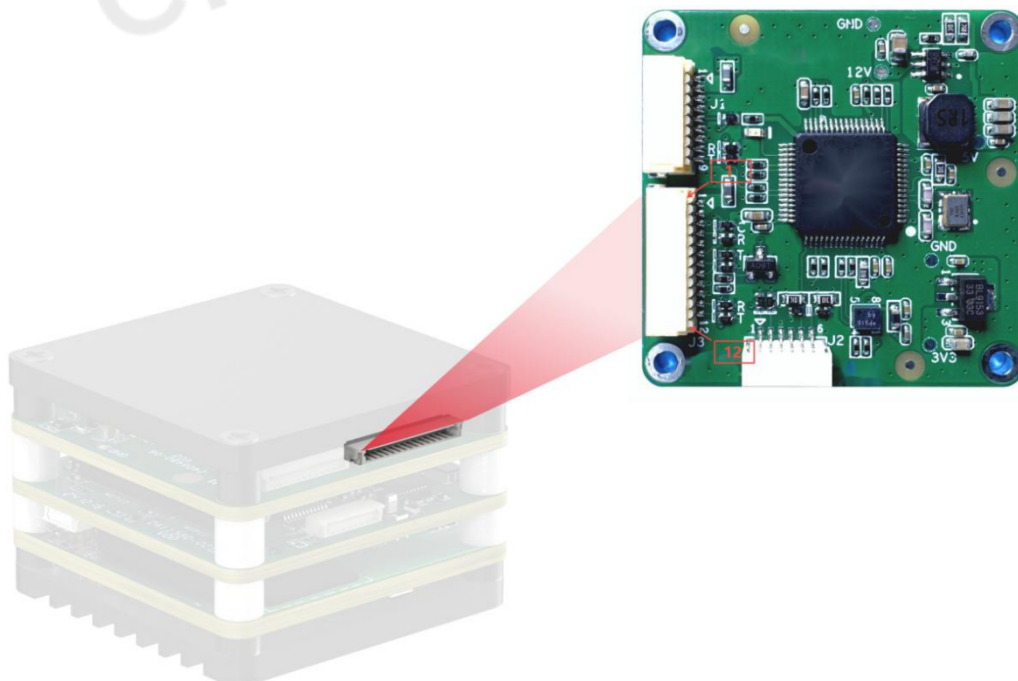


Fig4.1 AI Visual Tracking System Interface Diagram

4.2 AI Visual Tracking System User Interface Definition Table

Pin No.	Definition	IN/OUT	Function
1	VCC	IN	9~16V Power Input
2	VCC	IN	9~16V Power Input
3	GND	GND	Power Input GND
4	VIDEO_OUT	OUT	Analog Video Signal Output
5	GND	GND	Analog Video Signal Output GND
6	UART3_RX	IN	Connect to FC UART TX
7	UART3_TX	OUT	Connect to FC UART RX
8	SBUS	IN	Reserved / No function
9	5V	OUT	5V power output
10	GND	GND	Power output GND
11	UART6_RX	IN	Connect to Receiver TX
12	UART6_TX	OUT	Connect to Receiver RX

Table 4.2 User Interface Definition Table of the AI Visual Tracking System

4.3 AI Visual Tracking System Wiring Diagram

This wiring example uses flight controller below as an example, the wiring interface between the AI Visual Tracking System and the flight controller is introduced. As defined in Table 4.2 and the physical interface position is shown in Figure 4.3, the port settings of the flight controller side connecting to the ELRS receiver are all set as UART1.

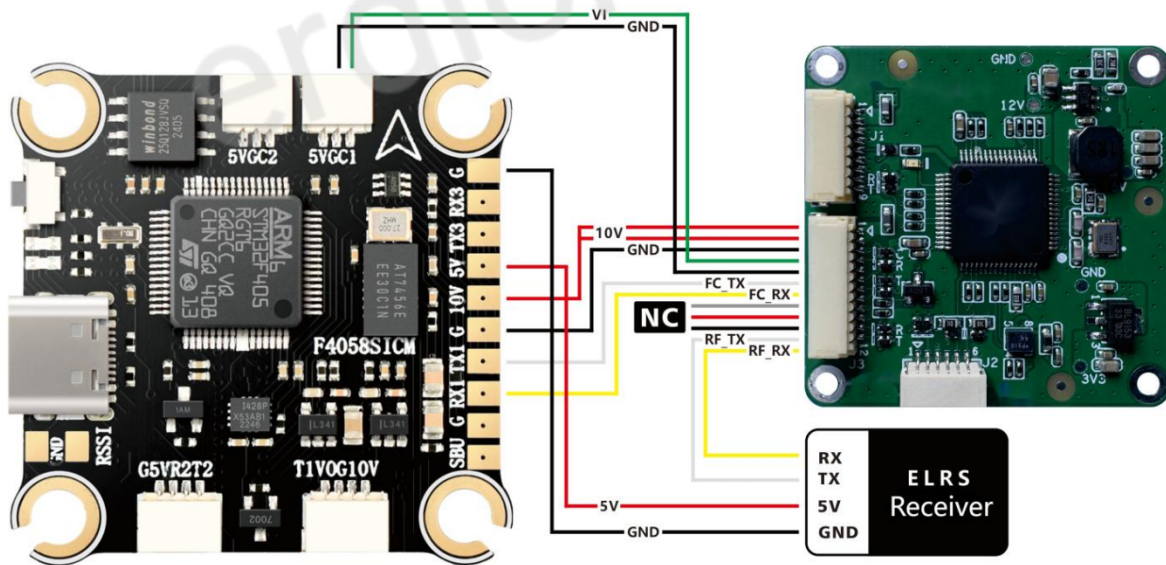


Fig 4.3 AI Visual Tracking System & FC Diagram

4.4 Camera Installation Angle

Note: During installation, maintain the camera's pitch angle at approximately 30° relative to the ground (or the drone's horizontal plane).

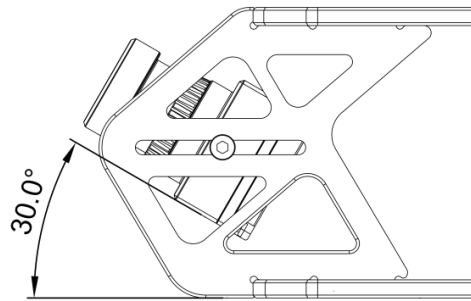


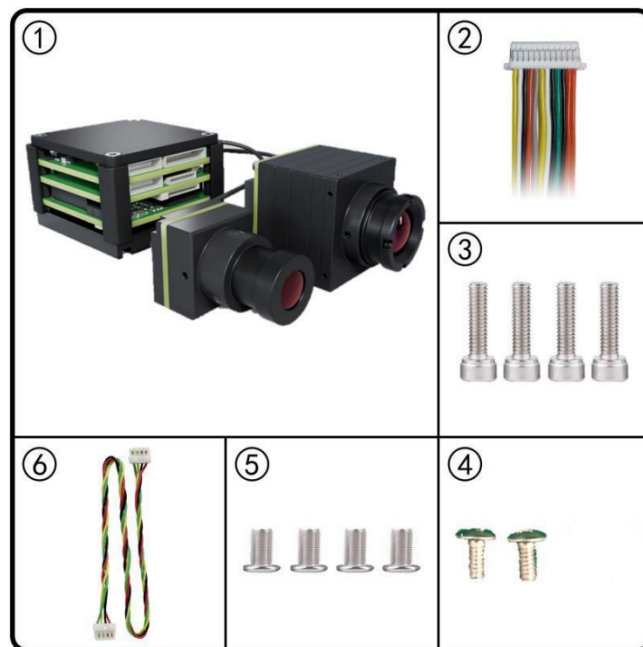
Fig 4.4 Camera Installation Angle

5. AI VISUAL TRACKING SYSTEM LIST

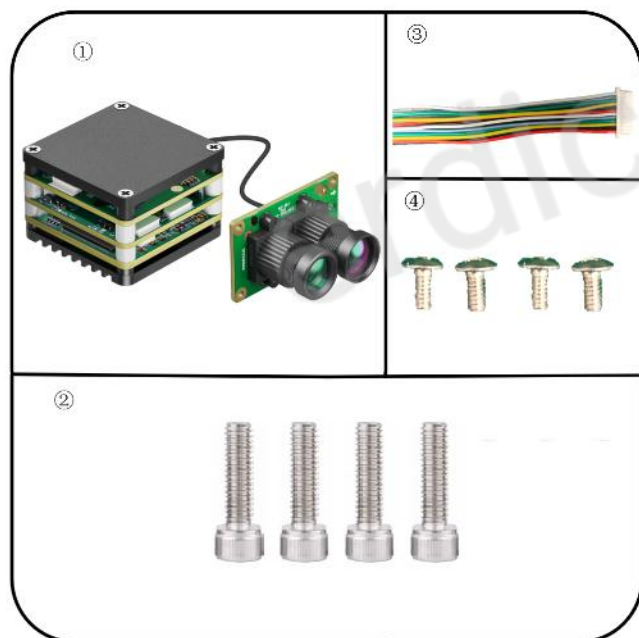
5.1 AI Visual Tracking System AS450/ST450 List

The image shows four components labeled 1 through 4. ① is a black AI Visual Tracking System AS450 module with a camera lens. ② shows four hexagon socket screws. ③ shows a multi-colored ribbon cable. ④ shows two cross-slot pan head screws.	①: AI Visual Tracking System AS450 × 1; ②: Hexagon Socket Crew M2*6 × 4; ③: SH1.0-12PIN 15cm Ribbon Cable × 1 (used to connect the flight controller and the AI Visual Tracking System); ④: Cross Slot Pan Head Screw M2*4 × 2.
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- ①: AI Visual Tracking System ST450 × 1;
- ②: SH1.0-12PIN 15cm Ribbon Cable × 1 (used to connect the flight controller & the AI Visual Tracking System);
- ③: Hexagon Socket Screw M2*6 × 4;
- ④: Cross Slot Pan Head Screw M2*4 × 2;
- ⑤: Cross Recessed Pan Head Screw M1.6*4 × 4;
- ⑥: 4Pin Thermal Imaging Camera Connection Cable × 1.

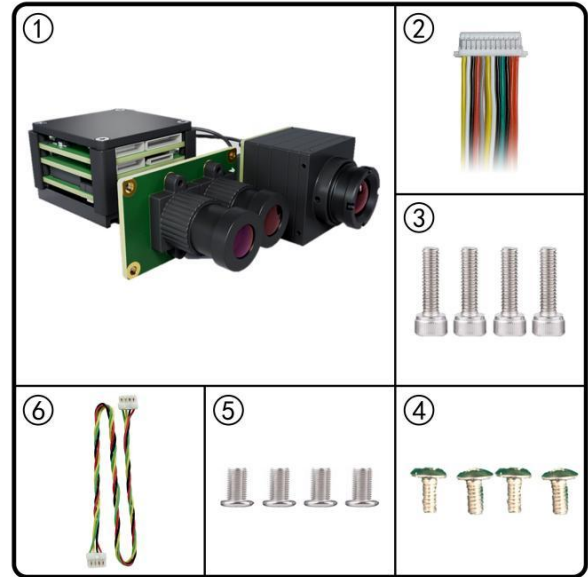


5.2 AI Visual Tracking System AS1200/ST1200 List



- ①: AI Visual Tracking System AS1200 × 1
- ②: Hexagon Socket Screw M26 × 4
- ③: SH1.0-12PIN 15cm Ribbon Cable × 1 (for connecting the flight control and AI Visual Tracking System)
- ④: Cross Slot Pan Head Screw M24 × 4
- ⑤: Screw X × 1 (for thermal imaging module installation)

- ①: AI Visual Tracking System ST1200 × 1;
- ②: SH1.0-12PIN 15cm Ribbon Cable × 1 (used to connect the flight controller & the AI Visual Tracking System;
- ③: Hexagon Socket Screw M2*6 × 4;
- ④: Cross Slot Pan Head Screw M2*4 × 4;
- ⑤: Cross Recessed Pan Head Screw M1.6*4 × 4;
- ⑥: 4Pin Thermal Imaging Camera Connection Cable × 1.



6. PRODUCT DIMENSION AND INSTALLATION

6.1 AI Image Processing Board Size

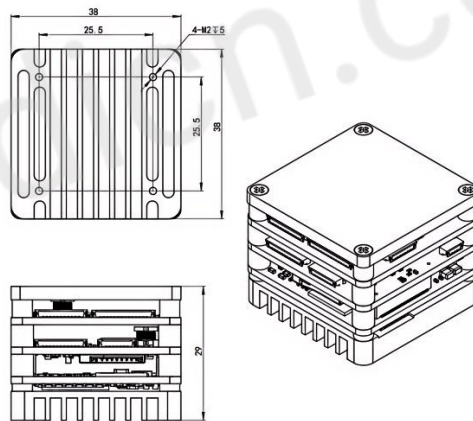


Fig 6.1 Size of the AI Image Processing Board

6.2 HD Visible Light Camera Module Size (AI Visual Tracking System AS450/ST450)

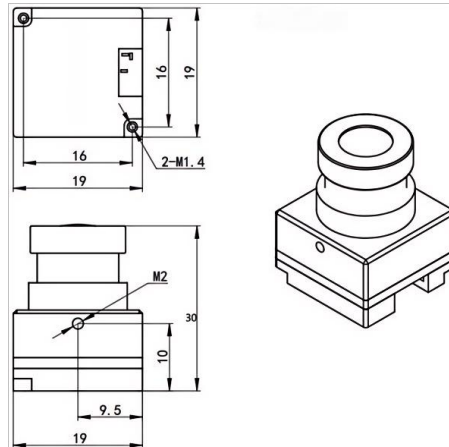


Fig 6.2 HD Camera (AI Visual Tracking System AS450/ST450) Size (mm)

6.3 High-Definition Dual Visible Light Camera Module Size (AI Visual Tracking System AS1200/ST1200)

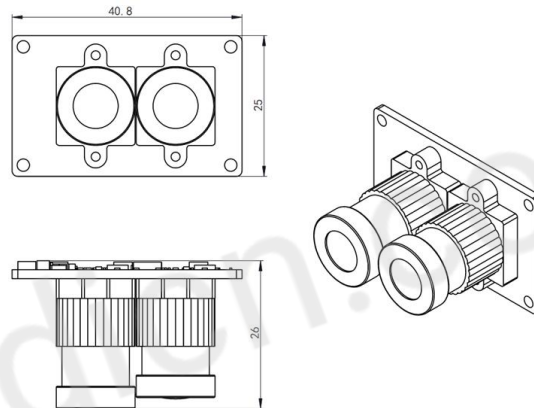


Fig 6.3 Size of High-Definition Camera (AI Visual Tracking System AS1200/ST1200)

6.4 Thermal Imaging Camera Module Size

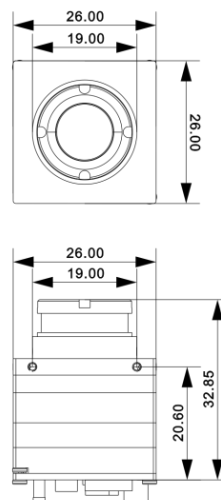


Fig 6.4 Size of Thermal Imaging Camera

7. AI VISUAL TRACKING SYSTEM SETTING AND OPERATION

7.1 Flight Controller Setting

This example takes the FC405/ICM42688 flight controller of HSAirforce as an example, and the firmware version of the flight controller is 4.4.2.

Step 1: Open Beta Flight, select the corresponding COM port, and then click "Connect", as shown in Figure 7.1.1.

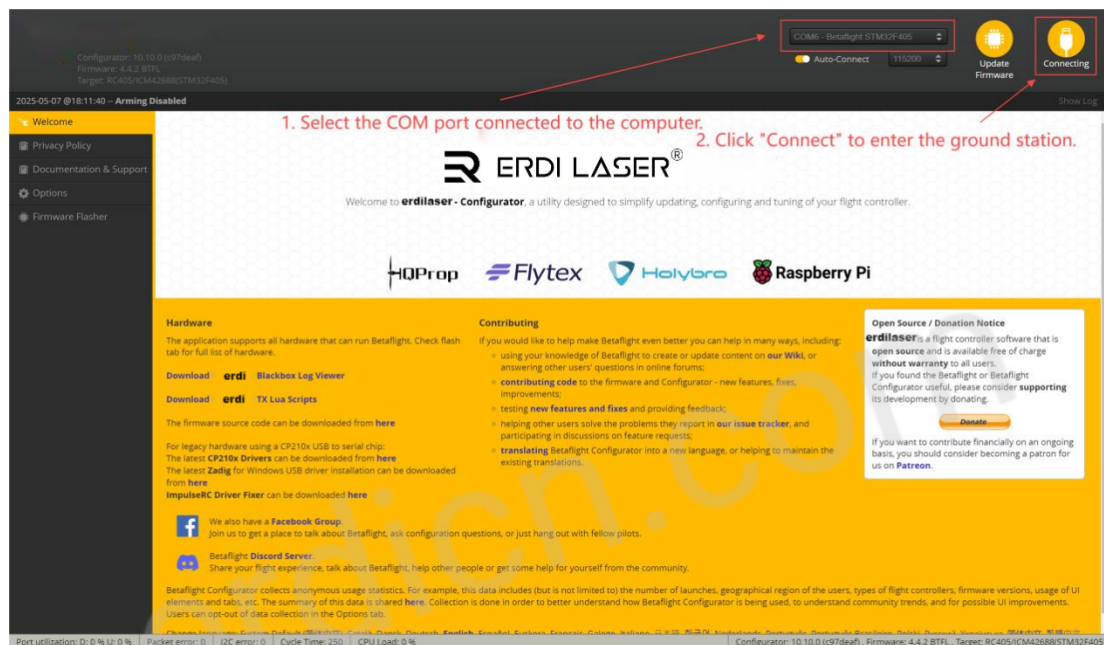


Fig 7.1.1 Connecting to Beta Flight

Step 2: Click the **Ports** on the left side of the ground station software. For example, if the flight controller's UART1 is connected to the AI module, enable the corresponding Serial Digital Receiver switch for UART1 in the software. After configuration, click "Save" or "Save and Reboot" (the switch will appear yellow when enabled and gray when disabled). Refer to Figure 7.1.2 for visualization.

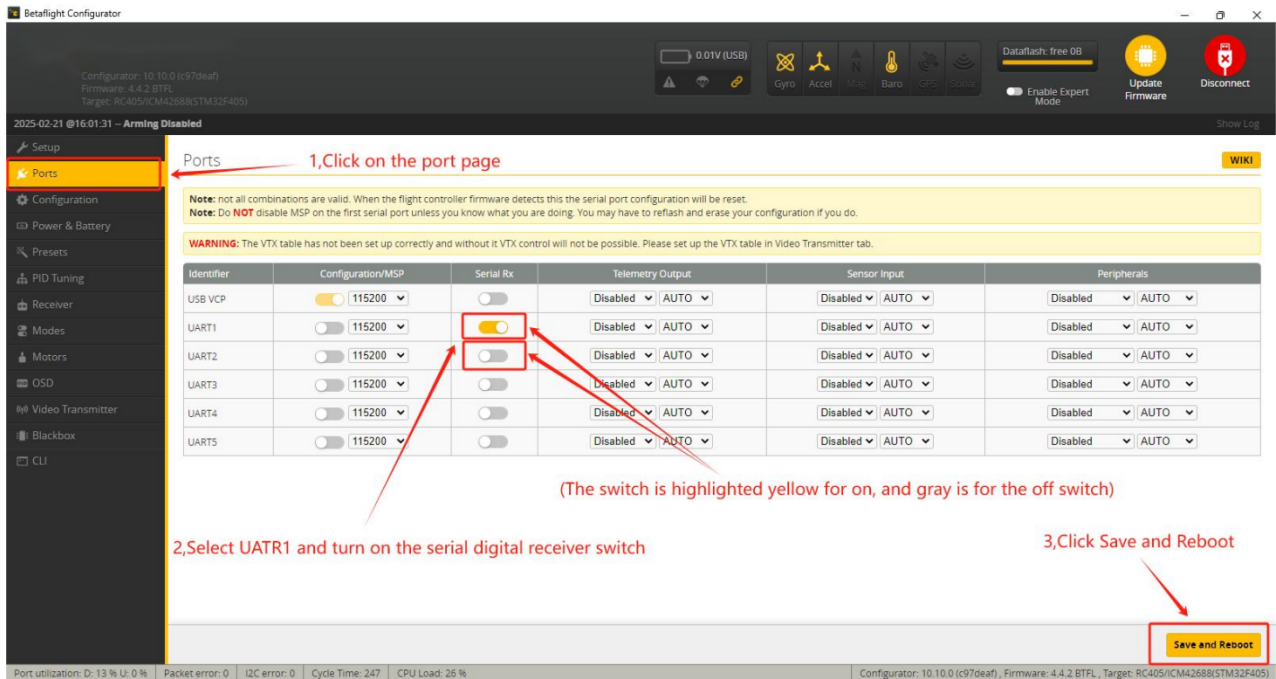


Fig 7.1.2 Flight Control Port Settings Serial Port

Step 3: Click on the PID Tuning option on the left side of the ground station. Scroll down the page to the Self-stabilization/Semi-self-stabilization option. Set the angle limit in this option to 75, and then click "Save", as shown in Figure 7.1.3 and Figure 7.1.4.

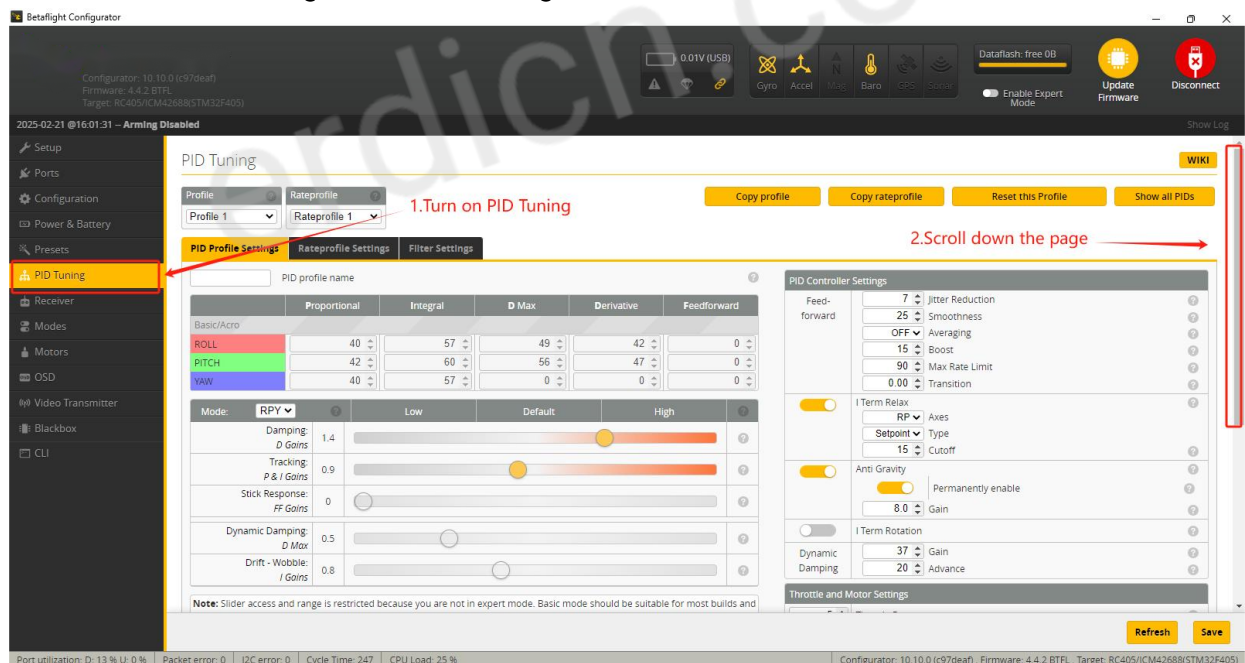


Fig 7.1.3 PID Control Interface Settings

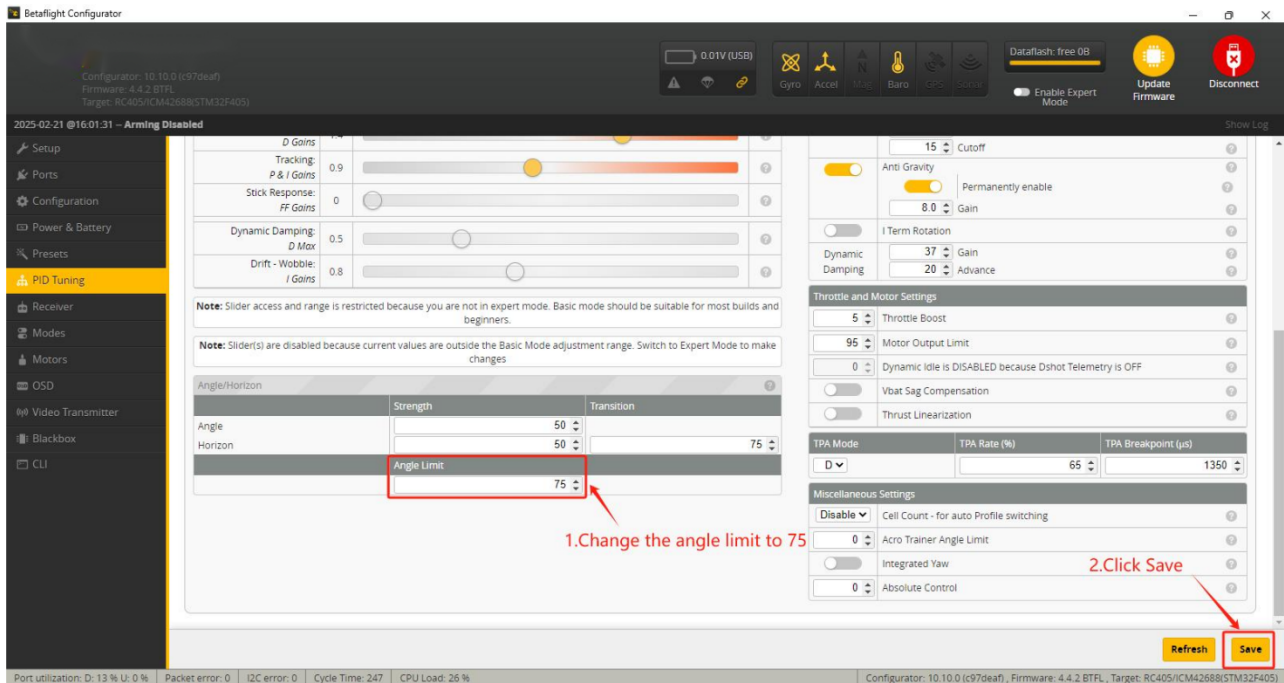


Fig 7.1.4 PID Control Interface Settings

Step 4: Click on the Modes option on the left side of the ground station. Set ARM as AUX1 (it must be AUX1 and cannot be changed), and set ANGLE as AUX6 or above the AUX6 (the functions of AUX2-AUX5 have already been occupied by the AI module), as shown in Figure 7.1.5.

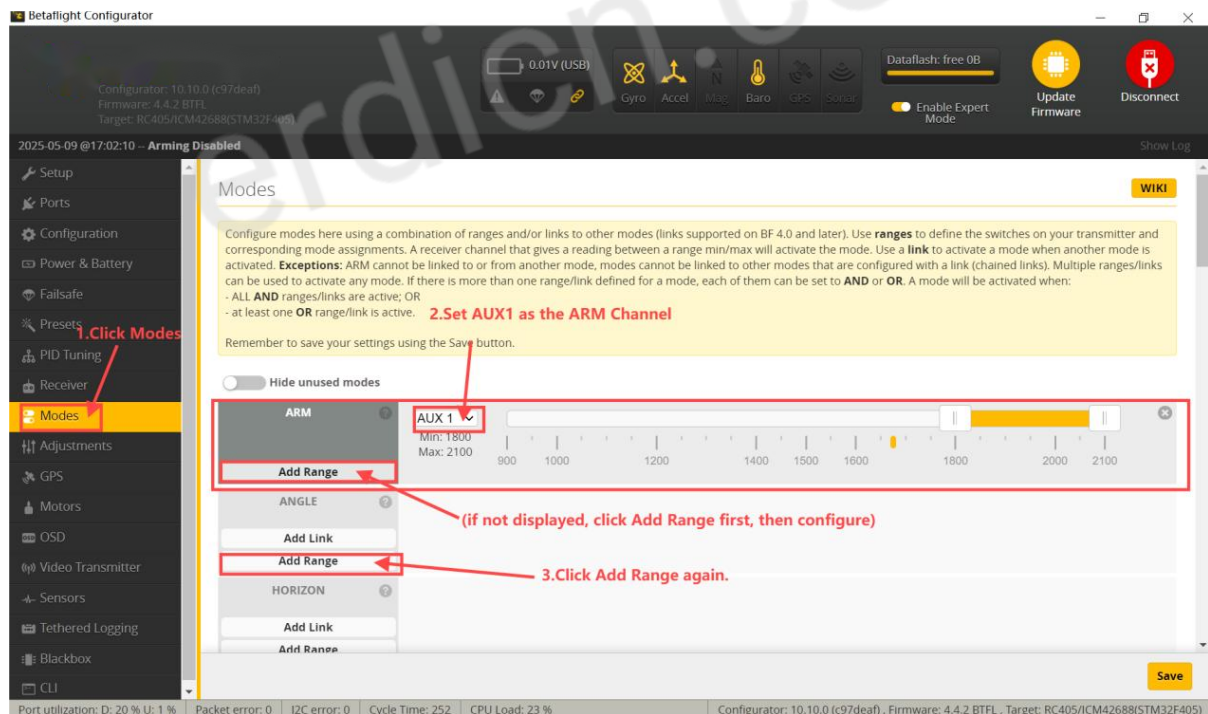


Fig 7.1.5 Flight Mode Configuration Interface

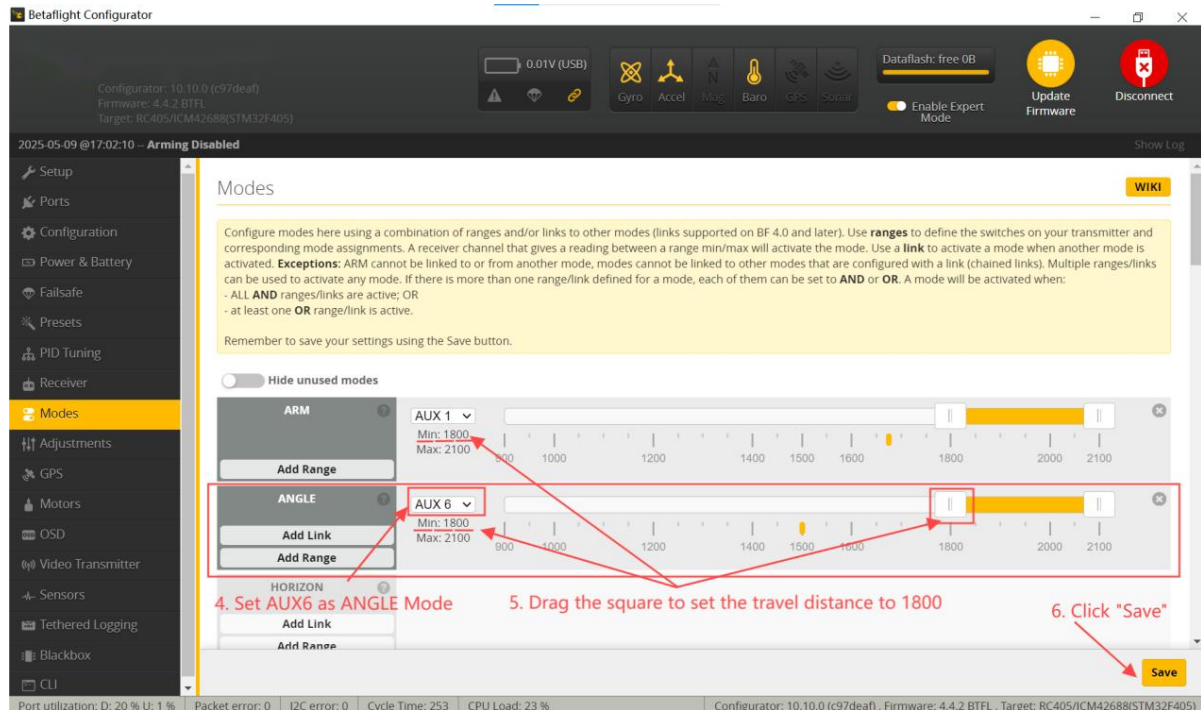


Fig 7.1.5 Flight Mode Configuration Interface

Step 5: Click on the Receiver option on the left side of the ground station:

- ① Make sure to change the serial digital receiver protocol to the CRSF protocol.
- ② Turn on the telemetry output switch and click "Save", as shown in Figure 7.1.6.

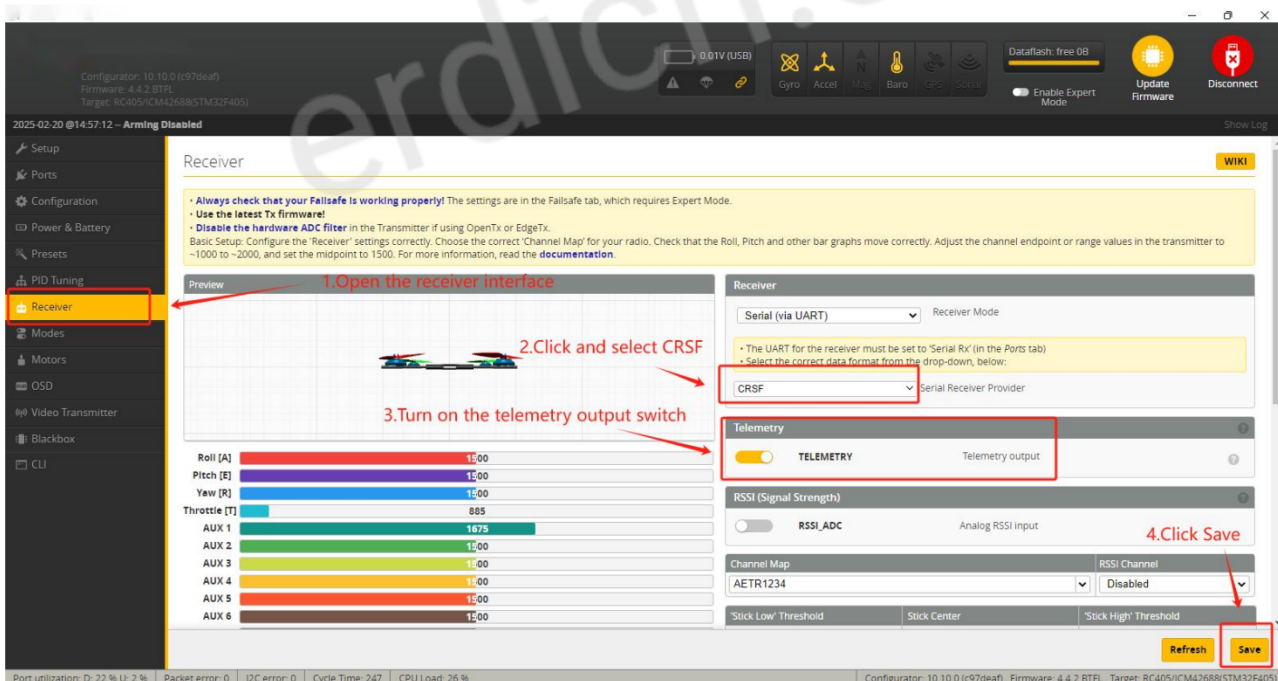


Fig 7.1.6 Flight Control Receiver Interface Settings

7.2 AI Visual Tracking Series Remote Control Channel Functions

7.2.1 Pre - Operation Notes

- ① Before operation, please first open the channel setting interface of the RC, set the corresponding channels according to the channel table in the following figure, and based on the individual operation habits of the pilot, set different channels to correspond with the corresponding channel switches of the RC.
- ② After completing the setup, power on the aircraft (ensure propellers are not installed) and perform a ground static test. If the channel configuration is successful, the word "TRACKING" will appear on the screen after target locking.

7.2.2 AI Visual Tracking Series Remote Control Channel Function Table

RC Channels	AS450	
	Down Position	Up Position
CH5	Motors locked	Motors unlocked
CH6	/	Lock target
CH7	/	Expand target search range
CH8	/	Fine-tune locked target (using remote control joystick)
CH9	No function	
CH10	Drone enters manual mode	Drone enters stabilized mode

RC Channels	AS1200	
	Down Position	Up Position
CH5	Motors locked	Motors unlocked
CH6	/	Lock target
CH7	/	Expand target search range
CH8	/	Enables precise micro-adjustments to locked targets thru directional input from the remote control stick
CH9	Switch to wide-angle camera at down position	Switch to telephoto camera at up position
CH10	Drone enters manual mode	Drone enters stabilized mode

RC Channels	ST450	
	Down Position	Up Position
CH5	Motors locked	Motors unlocked
CH6	/	Lock target
CH7	/	Expand target search range
CH8	/	Fine-tune locked target (using remote control stick)
CH9	Switch to wide-angle camera at down position	Switch to telephoto camera at up position
CH10	Drone enters manual mode	Drone enters stabilized mode

RC Channels	ST1200	
	Down Position	Up Position
CH5	Motors locked	Motors unlocked
CH6	/	Lock target
CH7	/	Expand target search range
CH8	/	Fine-tune locked target (using remote control joystick)
CH9	Down position: Telephoto camera; Mid position: Wide-angle camera; Up position: Thermal imaging	
CH10	Drone enters manual mode	Drone enters stabilized mode

7.2 Precautions Before Use

- Strictly follow the electrical interface definitions to confirm the power supply voltage. Do not input a voltage outside the supported range, as it may damage the equipment.
- Before powering the module, confirm that the wiring is correct and ensure it is not reversed.
- When powering with a battery, check to ensure the battery is supplying power correctly.
- Check if the AI processing board and camera are installed securely.
- After powering on, ensure the display is normal.
- When the aircraft is not in the unlocked condition, after switching to tracking mode, observe if the lock frame appears in the center of the screen and locks onto the target, and ensure it can be unlocked normally.
- Check whether the stick of CH6 on the RC is in the down position. If not, you need to set it to the down position before unlocking.

7.4 Intelligent Tracking Operation Guide



7.4.1 Target Locking & Initiating Tracking

- **Real-time Picture Collaboration:** The pilot observes the target through the real-time high-definition picture (including the PiP function) transmitted back by the drone, adjusts the flight attitude, and aligns the crosshair at the center of the picture with the target to be tracked.
- **One-Button Adhesive Locking:** Gently toggle the locking joystick of the remote controller. The AI algorithm automatically adsorbs the target and generates a tracking frame. The system immediately takes over the flight control and initiates the tracking program.
- **Dynamic Attitude Compensation:** During the tracking process, the drone calculates the target's movement trajectory in real time. Through dynamic attitude adjustment (pitch/yaw/roll), it ensures that the cross hair is always locked within the tracking frame, guaranteeing the tracking accuracy.

- **Expand Search Range:** Set the stick corresponding to channel 7 of the remote controller to the high position, and the adsorption range of the target will be larger after the target is locked (turn it on before locking the target).
- **Seamless Target Switching after Locking:** Set the stick corresponding to channel 8 of the remote controller to the high position, and cooperate with the pitch and roll joysticks to switch the target. After the selection frame is aligned with the target, set channel 8 to the low position, and the locking of the new target will take effect (turn it on after locking the target).
- **Free Selection of Visual Perspectives:** Set the stick of channel 9 of the remote controller to the low position/middle position/high position for seamless switching of the corresponding camera (it can be turned on before or after locking the target).
- **Multi-Flight Mode Options:** You can use Manual Mode and Self-stabilization Mode for flight control (mode switching is not allowed after locking the target).

7.4.2 Tracking Termination and Status Reset

- **Instant Cancel Mechanism:** Reset the remote controller lock lever, and the system will immediately cancel the tracking command, switching back to manual control mode.
- **Attitude Takeover & Reset:** The pilot manually adjusts the aircraft to a stable state. After confirming that the video feed is normal, the target search and lock process can be restarted.

8. Disclaimer

8.1 The products of our company can only be used for civil purposes. It is strictly prohibited to directly or indirectly use them for the following content or in relation to the following:

- Military combat-related purposes;
- Weapon of mass destruction proliferation;
- Terrorist activities.

8.2 The purchaser must ensure that their customers or end-users comply with the above requirements.

If the purchaser violates applicable export control or economic sanctions laws and regulations, we reserve the right to immediately suspend product delivery to the purchaser and terminate any related cooperation.