
V7-PRO Flight Control and Data Manage System User Manual(V1.0)

Version	Modify	Instruction
V1.0	2024/08/08	

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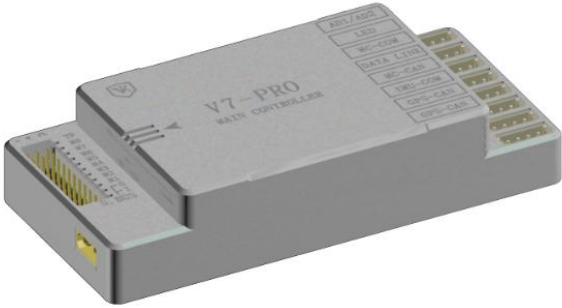

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1. Installation

1.1 Component List

Table- 1 System Module List

Component	Picture	Instruction
Main Controller (standard)	 <p>A rectangular grey printed circuit board (PCB) module. The top surface is labeled 'V7-PRO MAIN CONTROLLER'. It features a gold-plated edge connector on the left side and a multi-pin connector on the right side. Various components like an LED and resistors are visible on the top surface.</p>	<p>Size: 114*53*26 mm Weight: 165 g Power: 10--58 v Shell material: Aluminum</p>
GNSS-A (standard)	 <p>A circular white module with a black cable. The top surface has an orange circular logo with 'GNSS' in the center and 'SSN9 COMPASS' around the perimeter.</p>	<p>Size: 64*64*14mm Weight: 60 g Module: GPS+GLONASS+BD</p>
GNSS-B (standard)	 <p>A circular white module with a black cable. The top surface has a pink circular logo with 'GNSS' in the center and 'SSN9 COMPASS' around the perimeter.</p>	<p>Size: 64*64*14mm Weight: 60 g Module: GPS+GLONASS+BD</p>
LED (standard)	 <p>A small, square-shaped grey module with a black cable. It has a small square window on the top surface, likely for an LED indicator.</p>	<p>LED Indication refer to appendix 1</p>

<p>Obstacle Radar (optional) RADAR-OB</p>		<p>Size: 66*74*19.3 mm Weight: 110 g Range: 1.5---20 m Horizontal Width: ±17° Vertical Width: ±3°</p>
<p>RTK Base Station (optional) RTK-G-MP</p>		<p>1) Support fixed base station mode to provide high-precision positioning for airborne RTK 2) Support mobile base station mode can realize dynamic take-off and landing, following flight function 3) LED Indication refer to appendix 2</p>
<p>RTK module (optional) RTK-A-MPH</p>		<p>Size: 85*49*21 mm Weight: 100 g Power: 10---58 v Module: GPS+GLONASS+BD Support dual antenna measuring LED indication refer to appendix 4</p>

1.2 Component Connect

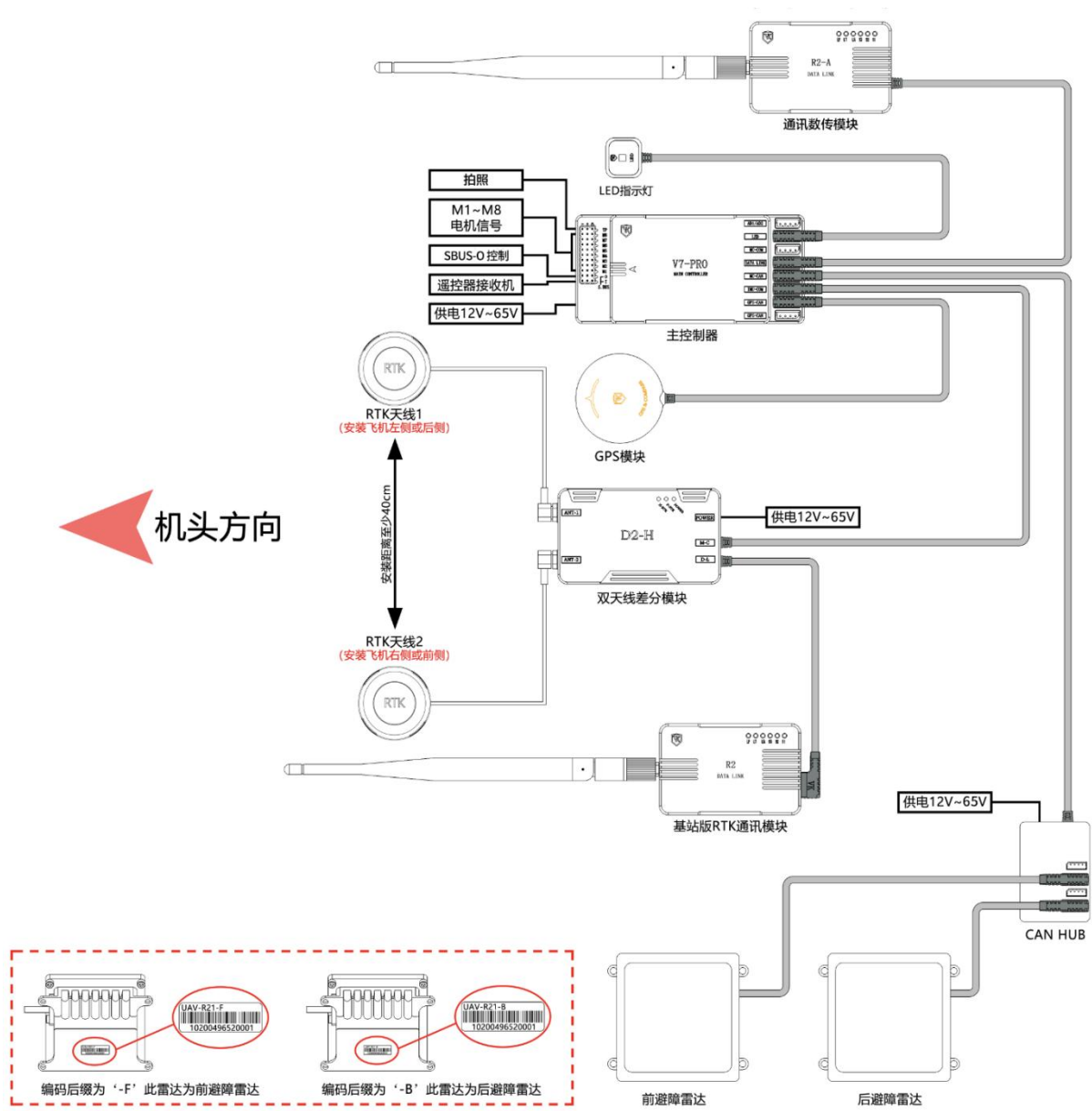


Chart- 1Fixed Base Station RTK Version Airborne System Connection Chart

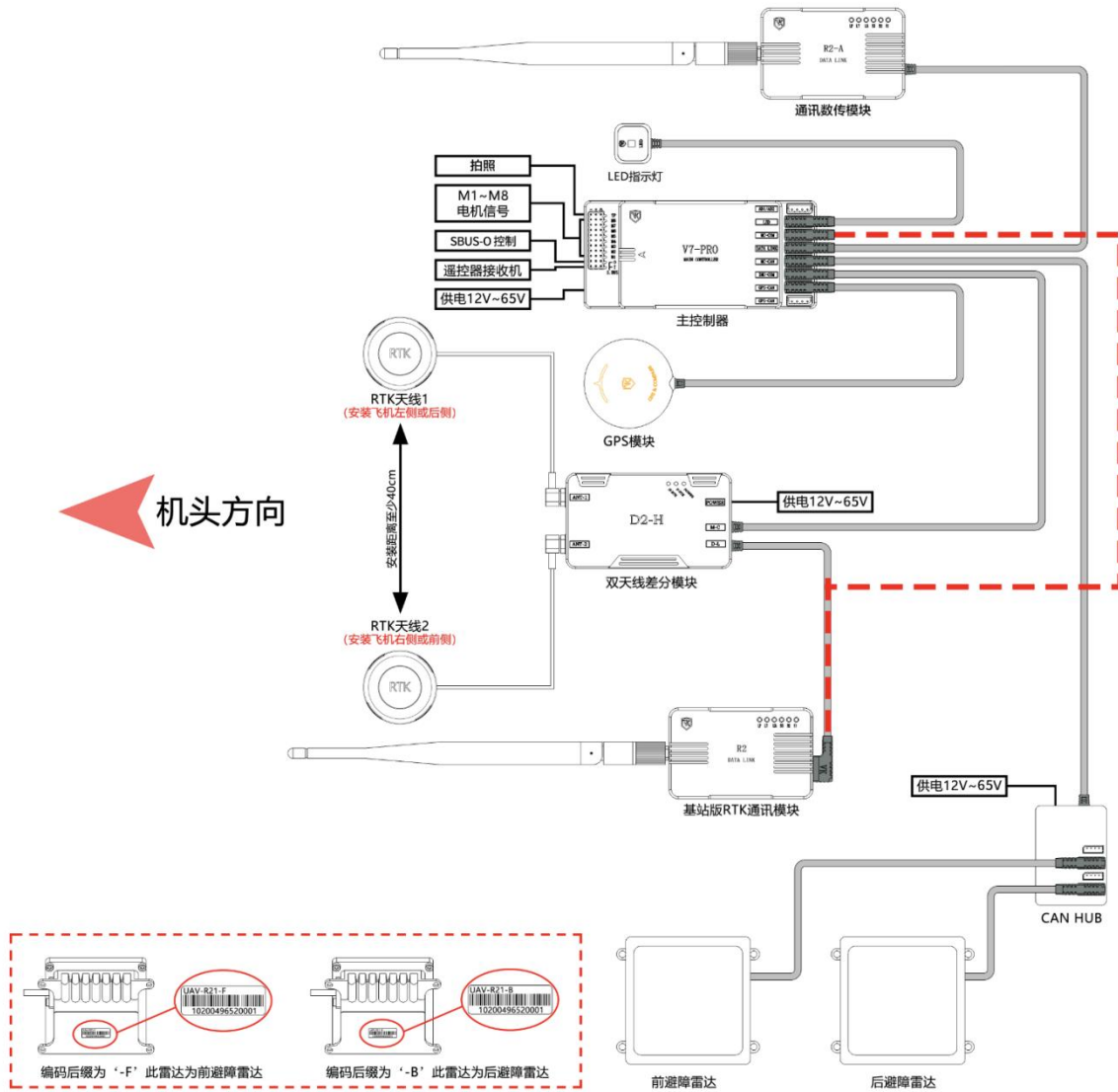


Chart- 2 Mobile Base Station RTK Version Airborne System Connection Chart

1.3 System Install

1.3.1 Main Controller Install

Caution:

➤ Installed horizontally on the panel's center as far as possible to avoid instability caused by vibration during the flight of the plane.

➤ The side with V7 logo must be upward. The installation direction can be one of the four directions: forward, backward, left and right. The default is forward installation, in this case the small arrow sign should be aligned with the head of the aircraft. If the installation is set to right, the small arrow should point to the right side of the aircraft, as shown in the figure below:

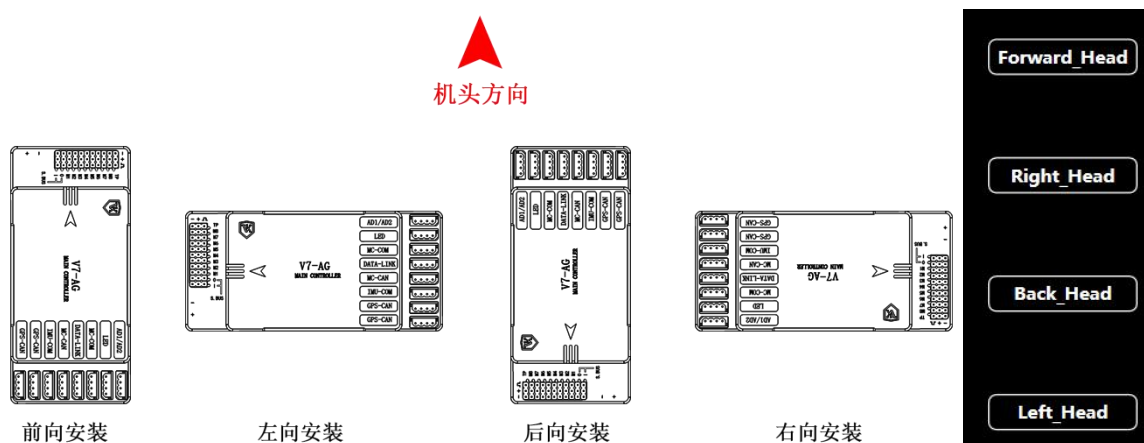


Chart- 3 Main Controller Installation Direction

Caution: The actual installation direction of the flight controller must be strictly consistent with the installation

direction set on the ground station, otherwise it will cause an accident of falling off the plane.

After the main controller is installed, GNSS module, LED module, ESC and other components shall be connected to the main controller.

Caution: ESC and main controller only need to connect the signal and the ground.

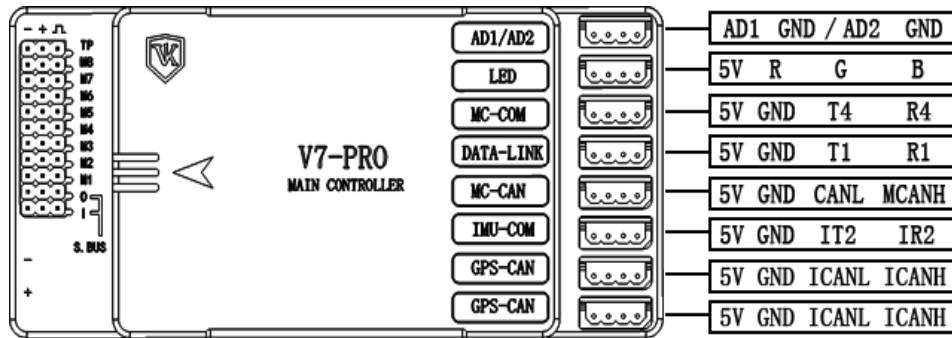


Chart- 4 Main Controller Pins Definition

The main interface function of the V7-PRO flight control system are described as below:

Table- 2 Description of Main Controller Interface Function

interface	instruction	interface	instruction
XT30	10---65 v	AD1/AD2	Supports up to 100V voltage detection
S.BUS-I	Remoter S.BUS input	LED	LED
S.BUS-O	SBUS signal output	MC-COM	passthrough/engine/pod/flow
M1	M1 motor	DATA LINK	Connect to radio
M2	M2 motor	MC-CAN	CAN-HUB

M3	M3 motor	IMU-COM	RTK input interface
M4	M4 motor	GPS-CAN	Connect to GNSS module
M5	M5 motor	GPS-CAN	Connect to GNSS module
M6	M6 motor		
M7	M7 motor		
M8	M8 motor		
TP	Photo taking interface		

1.3.2 Dual Antenna RTK Install

➤ The two antennas of the dual-antenna RTK module must be firmly fixed on the aircraft, and the distance between the two antennas must be greater than 30cm. RTK supports four installation directions, as shown in the following chart:

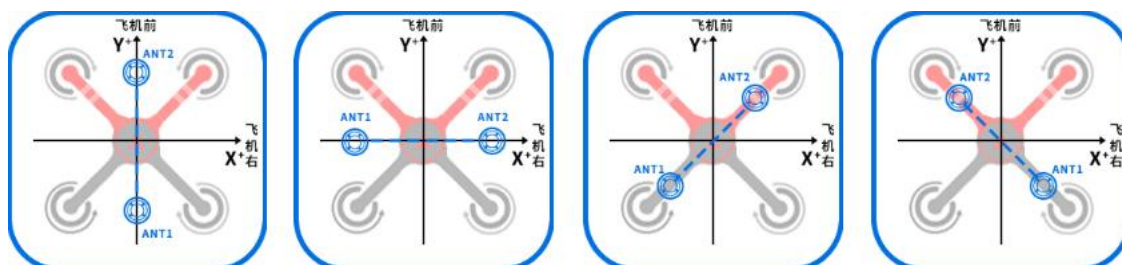


Chart- 5 RTK Installation Direction Chart

➤ The RTK installation deviation is the projection of the line from the center of the drone body to the RTK module labeled ANT1 under the body coordinate system. Left and right are the X-axes; left is negative and right is positive. The front and rear are the Y-axes, positive front and negative rear, and the Z-axis is 0 by default.

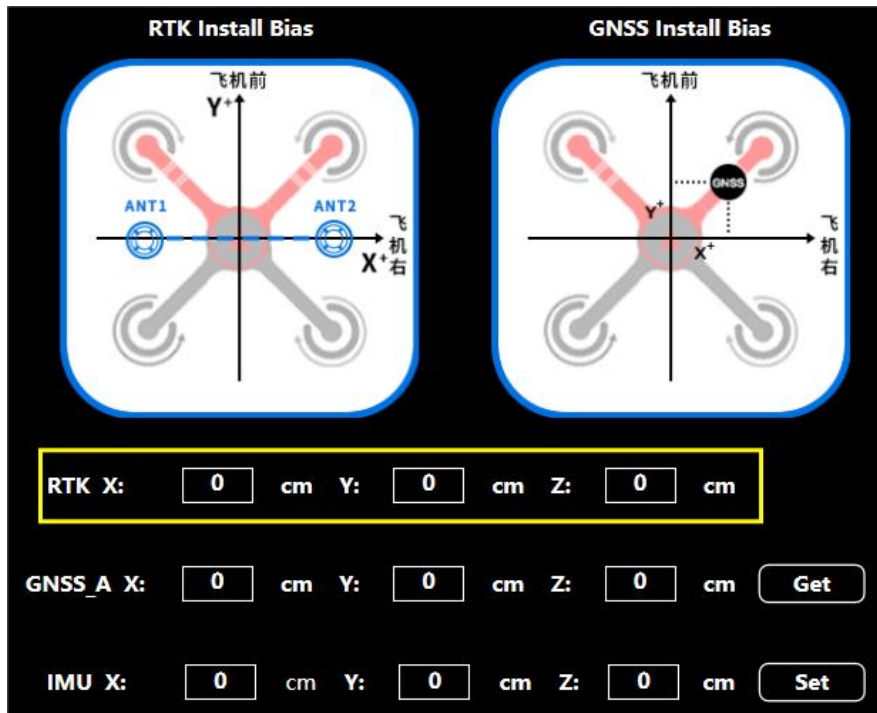


Chart- 6 RTK Installation Bias Setting

1.3.3 GNSS Install

Caution:

- The side with the logo must face upward. The small arrow should be oriented in the same direction as the nose of the aircraft.
- The GNSS module should be kept away from other electronic devices and strong magnetic substances. During installation and use, it needs to be erected more than 10cm above the plane of the body.
- The RTK version only requires the installation of RTK and the orange GNSS-A.
- The GNSS-A installation deviation is the projection of the unmanned body center and the GNSS module wiring in the unmanned body

coordinate system. Left and right are the X-axes; left is negative and right is positive. The front and rear are the Y-axes, positive in the front and negative in the rear, and the Z-axis is 0 by default.

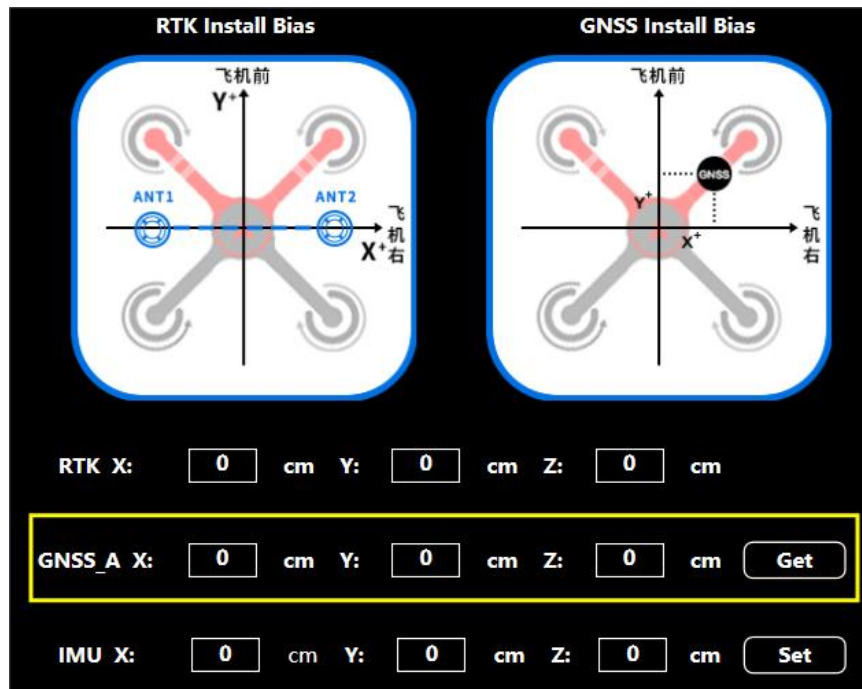


Chart- 7 GNSS Installation Bias Setting

1.3.4 IMU Installation Deviation

Setting the IMU mounting deviation can achieve better flight performance when the flight controller's mounting position is off the center of the unmanned body. The installation deviation of the IMU is the projection of the line from the center of the unmanned body to the flight controller center in the coordinate system of the airframe. Left and right are the X-axis; left is negative and right is positive. The front and rear are the Y-axes, positive in the front and negative in the rear, and the Z-axis is 0 by default.

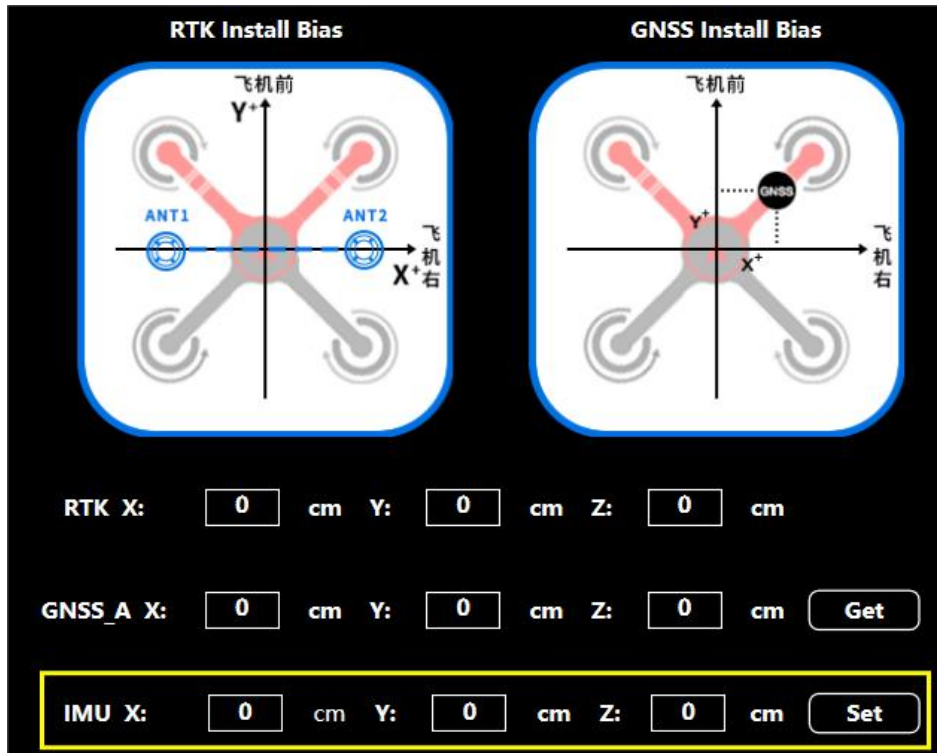


Chart- 8 IMU Installation Bias Setting

1.3.5 Radar Install

➤ The terrain radar is mounted horizontally on the bottom of the aircraft. The lower part of the radar should not be obstructed in any way.

➤ The obstacle avoidance radar is mounted at the front or rear of the aircraft. The striped heat sink on the back of the radar faces upward with a 12 degree upward elevation angle.

避障雷达安装说明

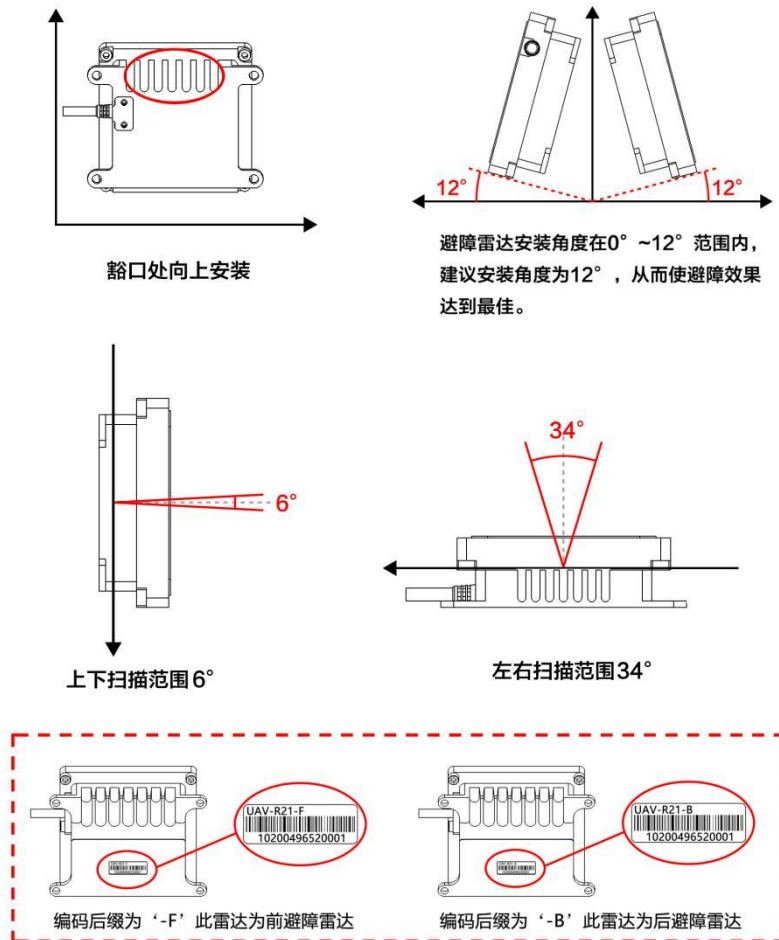


Chart- 9 Radar Install

1.3.6 Ground Station Install

The VK-GCS ground station system is a drone ground measurement and control software with a variety of operation modes, including a single station and a station with multiple machines. The software supports Windows 8 or above operating systems.

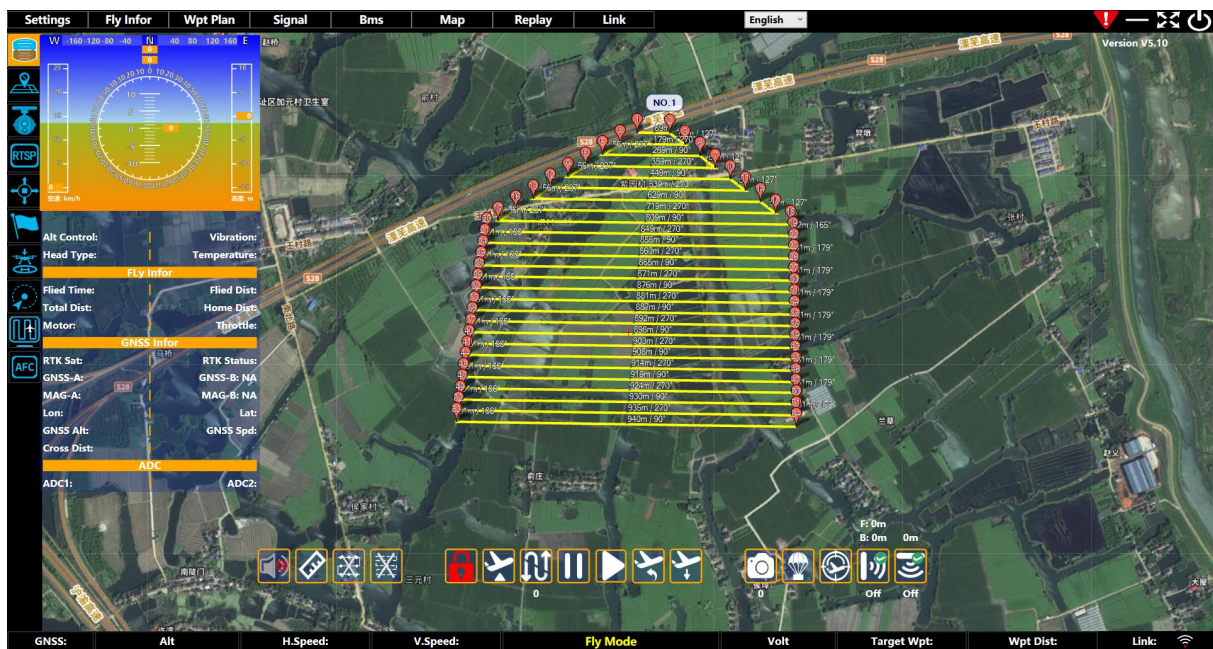


Chart- 10 VK-GCS Drone Ground Station System

Failed to open the ground station system; please check if the computer system is finished. Then install the following two plug-ins and try again.

Link: <https://eyun.baidu.com/s/3jITCHE2> Code: cgNT

Link: <https://eyun.baidu.com/s/3nwQzdgd> Code: a6i7

1.4 Function Set

A functional check of the system is necessary after completing the installation of the flight controller and ground station. Power on the plane and turn on the ground station. For the first commissioning aircraft, the standalone mode and the debug mode are selected. (The important parameters of the aircraft cannot be set in other modes except debug mode).



Chart- 11 System Startup Interface

Caution: The main rotor must be disassembled for the function check.

1.4.1 Link Check

Keep the drone and remote control powered up. (The remote control needs to switch the communication mode to compatible VK mode on the APP.) Open VK_GCS.exe, and there are three connection methods to choose from in the communication settings.

- Serial port → The baud rate : 115200 bits/s → Check the serial port number → Link;

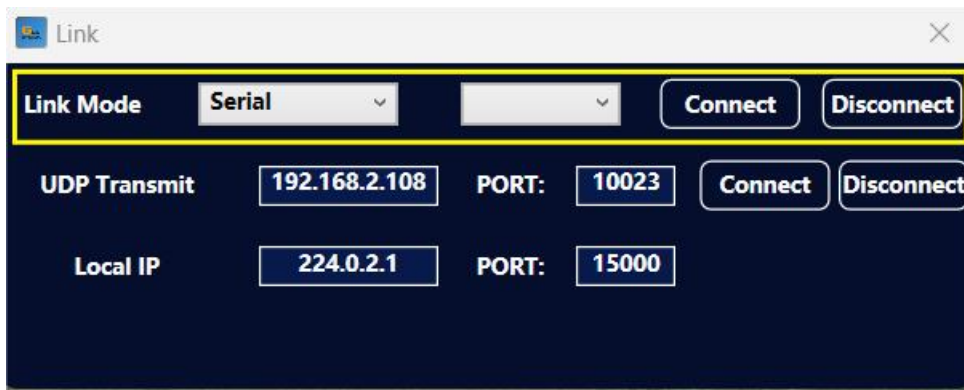


Chart- 12 Serial Communication Setting Interface

- TCP or UDP→Yellow box:Local IP and port number→Blue box:IP and port number of the aircraft communication terminal→Link.

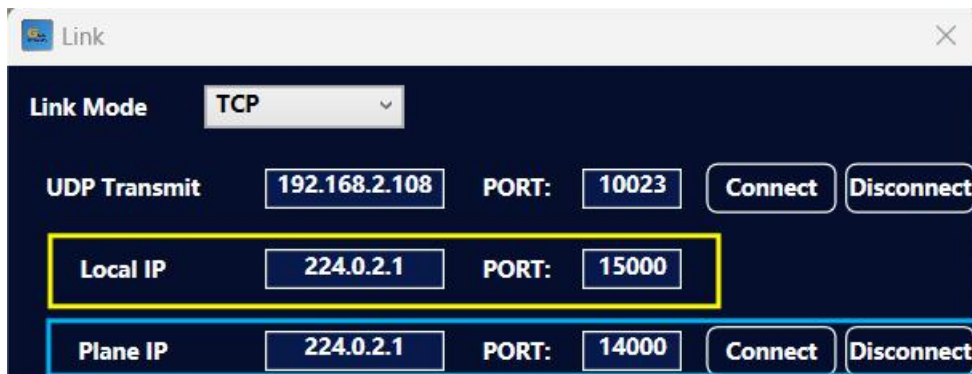


Chart- 13 TCP/UDP Communication Setting Interface

- After a successful connection, the **flight monitoring system** will display the current flight telemetry data. Enabling the voice prompt at this point will indicate that the communication is connected. Set up correctly but unable to communicate:**Flight setting**→Check the **firmware upgrade** page for the flight control ID. (The Standalone mode-0, The Multiple drone modes-1 to 20).



Chart- 14 Flight Control System ID Setting Interface

- All three communication modes support the ground station's ability to forward telemetry data to other network devices via UDP. (Appendix 6)

1.4.2 Remoter Calibration

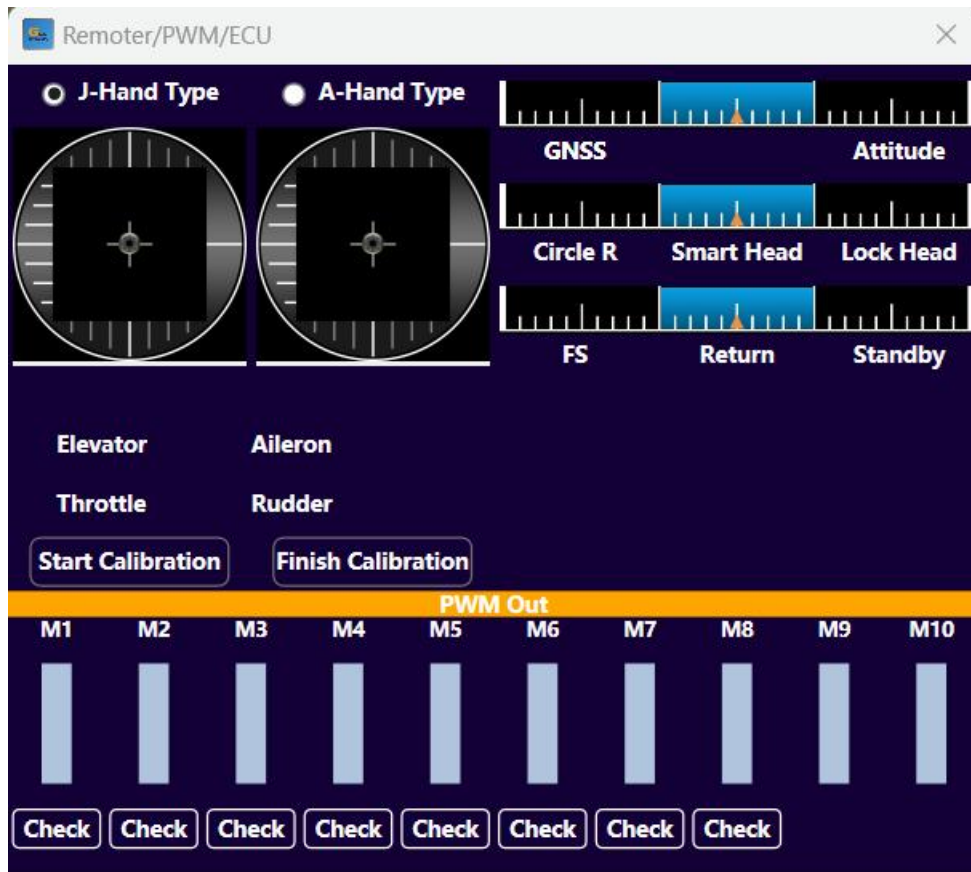



Chart- 15 Remote Control Calibration

Remote control access to SBUS-I, frequency matching success, and control signal page Compare the values of the interface. Adjust the forward, reverse, and route. Calibration Remote Control: Follow these steps::

- First, set the forward and reverse directions of each channel

correctly. Then adjust all rocker trims on the remote control to zero and all channel curves to default.

- Place the rockers all in the neutral position. There are two ways to enter the remote control calibration mode. One is to click the start calibration button, and the other is to toggle channel 7 six times in a row. When the LED flashes purple three times , it indicates that the remote control is in calibration mode. Then push the rocker of channels 1 - 4 to the maximum working range and repeat several times.
- After completing the operation, exit the remote control calibration mode by clicking End Calibration or by toggling seven channels six more times in succession. The LED flashes normally (the purple light goes off), which means the calibration is complete.

After ending the remote control calibration, the value of the 1-4 channel rocker (Chart 15: Blue Section) needs to be between 1000 and 2000. The maximum value of the number cannot exceed 2020, and the minimum value cannot be lower than 980. The blue slider for dial channels 5, 6, and 7 (Chart 15 Red Section) needs to be slid to the designated position. At the same time, the orange triangle stays in the middle of the blue slider as much as possible.

1.4.3 Motor Test

1) ESC Calibration

Remove the aircraft paddles. Push the aileron and throttle of the remote control to maximum at the same time (Chart 16). Power on flight control and ESC. Enter ESC calibration mode (flashing purple four times●●●●). ESC beeping sound. Aileron back to center, and throttle pulled to minimum. ESC sounds to indicate the completion of calibration.

Danger: Be sure to perform ESC calibration with the paddle unloaded. After the calibration is complete, the throttle of the flight control will be in straight-through mode, and the motor will be in working condition.

2) Motor Test

Install the battery and enter the `control signal` page. Click the Motor 1 - 8 check button in sequence to check the motor steering. Possible problem: The ground station shows a signal output (a vertical orange signal), but the motor does not work. Solution:Try adjusting the `motor idle speed` (in the `flight setting`, `model setting`) up one level. (During motor testing, the lower the idle speed, the safer the aircraft.)

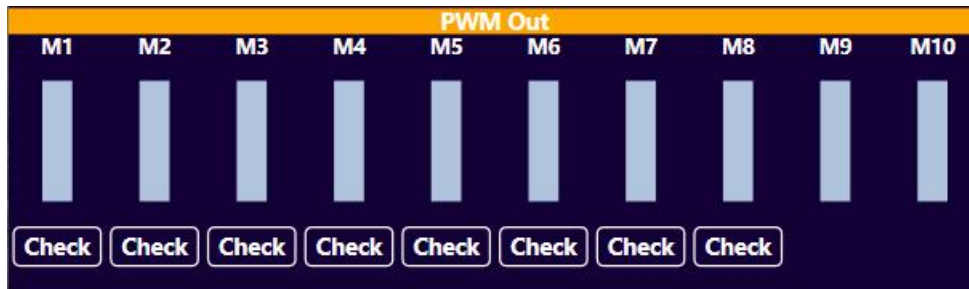


Chart- 16 Motor Test

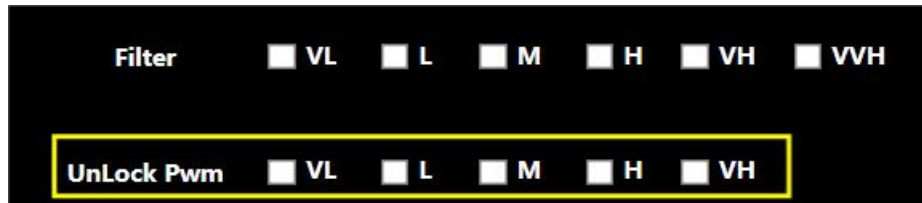


Chart- 17 Idle Speed Setting

1.4.4 Fly Calibration

1) Voltage Calibration

The voltage calibration synchronizes the battery voltage detected by the flight control system with the actual voltage. Find the **PID parameter** in the **flight setting** and fill in the difference between the two voltages. Finally, click **Set** to complete the voltage calibration.

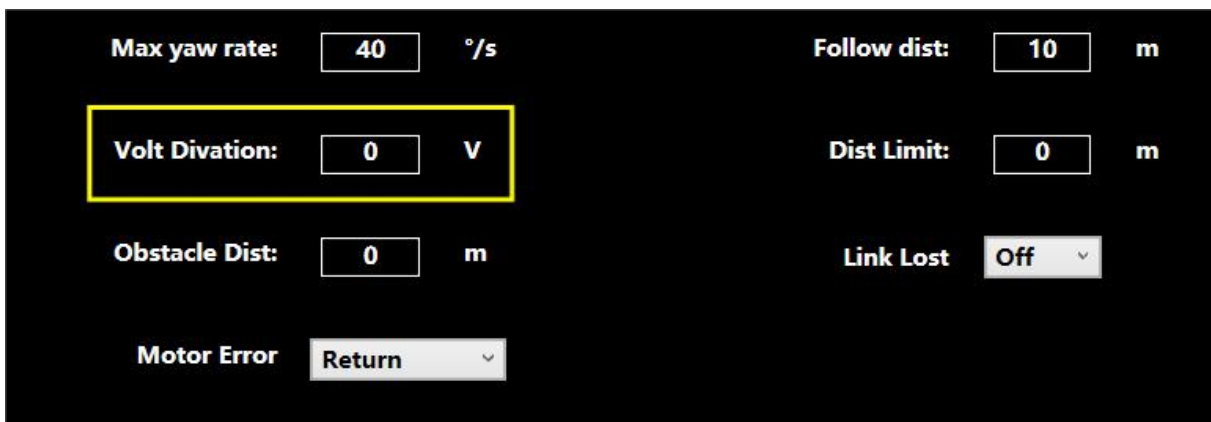


Chart- 18 Voltage Calibration

2) Horizontal Calibration

A horizontal calibration is necessary in order not to affect flight performance. First, make sure the aircraft is on a horizontal plane. At this point, if there is a difference of more than 2 degrees in the attitude angle of the aircraft, a horizontal calibration is required. In the `flight settings`, find the `model configuration` and click `Level Calibration`. At this time, the angle deviation will be cleared and the horizontal calibration will be completed.

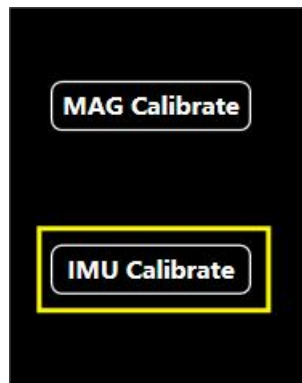


Chart- 19 IMUCalibration with IMU level

1.4.5 Default Parameter

1) Aircraft Model Setting

Caution: Setting the wrong data can directly cause the aircraft to crash.

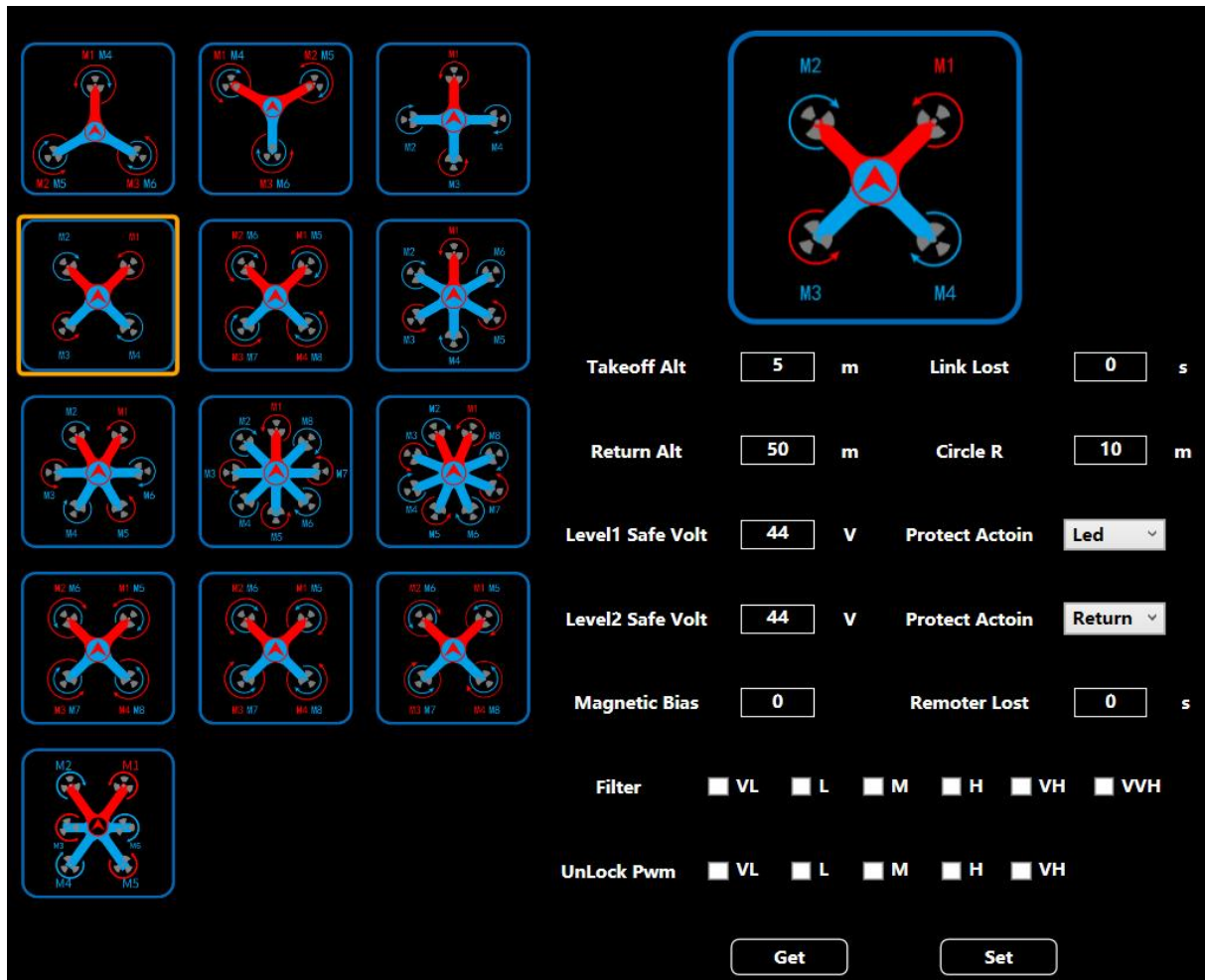


Chart- 20 Model Parameter Setting

- Take-off height: The default hovering altitude of the aircraft when unlocked.
- Communication outage: 0-turn off X-In fully automatic mode, the aircraft will return automatically after X seconds of aircraft communication interruption.
- Return height: There are two scenarios that can occur here. Firstly, the aircraft will climb to an altitude below the set return altitude before flying to the takeoff point for landing. Secondly, the current altitude of the aircraft is higher than the

set return altitude. The aircraft will maintain its current altitude and fly to the takeoff point for landing.

➤ R-point: Surround radius of the aircraft (remote control auto surround mode)

➤ Remote control interrupt: X: After the signal was lost for X seconds, the aircraft went into a return flight. The aircraft will remain hovering for X seconds. 0: The remote control signal will return immediately after the loss of connection.

➤ Noise suppression: The propeller size of the aircraft is directly proportional to the choice of noise rejection level. The KV value of the motor is inversely proportional to the noise rejection level selected. Paddles larger than 30 inches-VVH, Paddles larger than 25 inches-VH, Paddles about 20 inches-H, Paddle between 15 and 20 inches-M, smaller options L or VL.

➤ Motor idle speed: the minimum speed of the motor. Set the idle speed as low as possible while ensuring the aircraft unlocks to be able to spin.

2) Interface function Setting

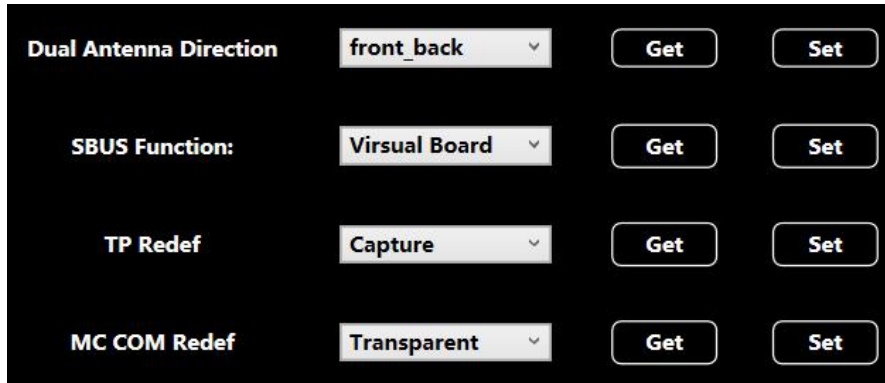


Chart- 21 Configuration Parameter

➤ SBUS multiplexing function: virtual rocker, remote control 9 to 16 channel mapping, and PWM umbrella opening function.

① Virtual rocker: With the **SBUS control** function of the ESC in **flight monitoring**, the output of 1 - 12 channels can be edited arbitrarily. The flight controller outputs the values edited by the control panel as SBUS signals from the flight controller's SBUS-0 interface. It is allowed to generate 12 PWM signals by connecting a SBUS to the PWM module.

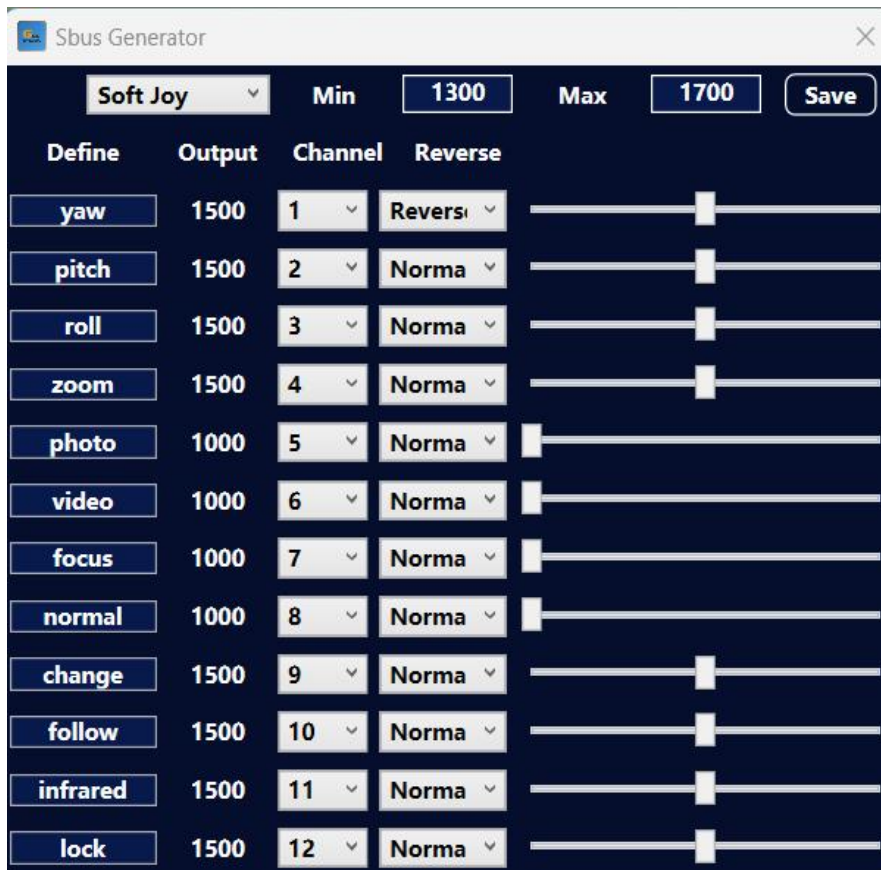


Chart- 22 SBUS Virtual rocker Function

② Remote control 9-16 channel mapping: map the PWM values of channels 9-16 to channels 1 - 8 of the SBUS-0 interface. It is allowed to generate 8 PWM signals by connecting a SBUS to the PWM module.

③ PWM Open Parachute: Requires a parachute to support PWM large value opening.

➤ TP port multiplexing function: The TP port can be multiplexed as a photo interface or a PWM open umbrella interface.

① Photograph: Set the photo signal (high level voltage, low level voltage, PWM photo signal) and their trigger time by the photo method.

② PWM Open Parachute: Requires a parachute to support PWM large value opening.

Caution:SBUS and TP ports are multiplexed for the open parachute function. If you click on the open button of the ground station or the attitude angle of the aircraft is greater than 70 degrees, the drone will immediately stop and execute the open function. Do not set these two interfaces to open the parachute function if the aircraft is not equipped with a parachute. Otherwise, the operation will cause the drone to fall.

➤ MC COM multiplexing function:

① Pass-through: The MC COM port can transmit the data sent by the peripheral to the flight control to the ground. Baud rate-115200bits/s.

② Back-up remote telemetry: At this time, the MC COM interface and the DATA LINK interface have the same function. The flight controller can support two channels of remote telemetry data at the same time.

③ Pod control:compatible with VK depth-adapted pod control.

④ On-board AFC control: Third-party on-board devices can control the aircraft via the MC COM port following AFC control commands. (Appendix 7: AFC Control Protocol)

3) Flight parameter setting

Max Vel GNSS mode:	<input type="text" value="6"/>	m/s	Max Angle:	<input type="text" value="20"/>	°
Max up rate remoter mo:	<input type="text" value="4"/>	m/s	Max down rate remoter mod:	<input type="text" value="3"/>	m/s
Return Speed:	<input type="text" value="20"/>	m/s	Max up rate cruise:	<input type="text" value="3"/>	m/s
Max down rate GNSS mc:	<input type="text" value="1.5"/>	m/s	Down rate landing:	<input type="text" value="0.4"/>	m/s
Level_1 limit alt:	<input type="text" value="1000"/>	m	Level_2 limit alt:	<input type="text" value="2200"/>	m
Max yaw rate:	<input type="text" value="40"/>	°/s	Follow dist:	<input type="text" value="10"/>	m
Volt Divation:	<input type="text" value="0"/>	V	Dist Limit:	<input type="text" value="0"/>	m
Obstacle Dist:	<input type="text" value="0"/>	m	Link Lost:	<input type="text" value="Off"/>	
Motor Error:	<input type="text" value="Return"/>				

Chart- 23 Flight Data

- GPS model maximum horizontal speed: not more than 8 m/s GPS.
- Maximum flight angle: Do not exceed 25 degrees.
- Maximum climbing speed in remote control mode: remote control mode with throttle pushed to maximum climbing speed.
- Maximum descent speed in remote control mode: remote control mode with the throttle pulled to the minimum descent speed.
- Return speed: maximum horizontal speed in return mode.
- Automatic flight maximum climb speed: Maximum climb speed in ground station autoflight mode.
- Automatic flight maximum descent speed: Maximum descent speed

in automatic flight mode of the ground station.

- Return to landing descent speed: more than 0.2 m/s.
- Level 1 height limit: After reaching it, the aircraft enters return mode.
- Level 2 height limit: After reaching it, the aircraft enters forced landing mode.
- Maximum tail-lock angular speed: The maximum angular speed of the aircraft's heading in automatic mode;
- *Following distance: Temporarily useless.*
- Voltage deviation is the difference between the measured voltage and the actual voltage of the flight control system. The voltage displayed by the ground station is calibrated by setting the numerical value.
- Distance limit: The aircraft automatically enters return mode when the distance from the aircraft to the takeoff point reaches the condition of the distance limit. 0-Turn off.
- Obstacle avoidance distance: After the aircraft reaches this distance from the obstacle, it will enter the obstacle avoidance action.
- Route communication loss switch: Turn on: The aircraft will automatically turn back after communication is lost. Turn off:

After the aircraft's communication is lost, it will fly the entire route and then return.

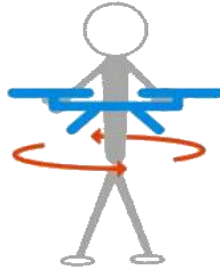
➤ Power fault diagnosis: An aircraft with six axes cannot be fully guaranteed to fly safely under one motor stopping condition. Turning on this function allows the drone to be automatically stabilized in a broken propeller condition. One motor stopped working. The power model becomes a four-axis to improve the aircraft's survivability.

2. Fly Parameters Adjustment

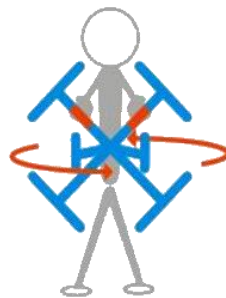
2.1 Magnetometer Calibration

After the installation is completed, the test flight can be carried out in the field. A magnetic compass calibration must be done before the test flight, and the calibration method is as follows:

➤ One method is to toggle the five channels of the remote control eight times in a row. Another way is to find the `model settings` in the `flight settings` and then click on `magnetic calibration`. The LED turns green to indicate that the vehicle is in horizontal calibration mode.



- Until the LED turns blue, the vehicle starts to enter vertical calibration mode.



- The nose of the aircraft faces up vertically, which then allows the aircraft to rotate. Calibration is successful; the LED indicates that the blue light starts flashing. Calibration failure: the LED turns red.

2.2 Sense Debugging

For the first test flight, please make sure the attitude angle of the aircraft is correct to prevent the flight control installation direction from being set incorrectly. It can be unlocked in attitude mode to test the correspondence between servo and motor. Try to debug in attitude mode for the first test flight so that the performance can be tuned to its optimum.

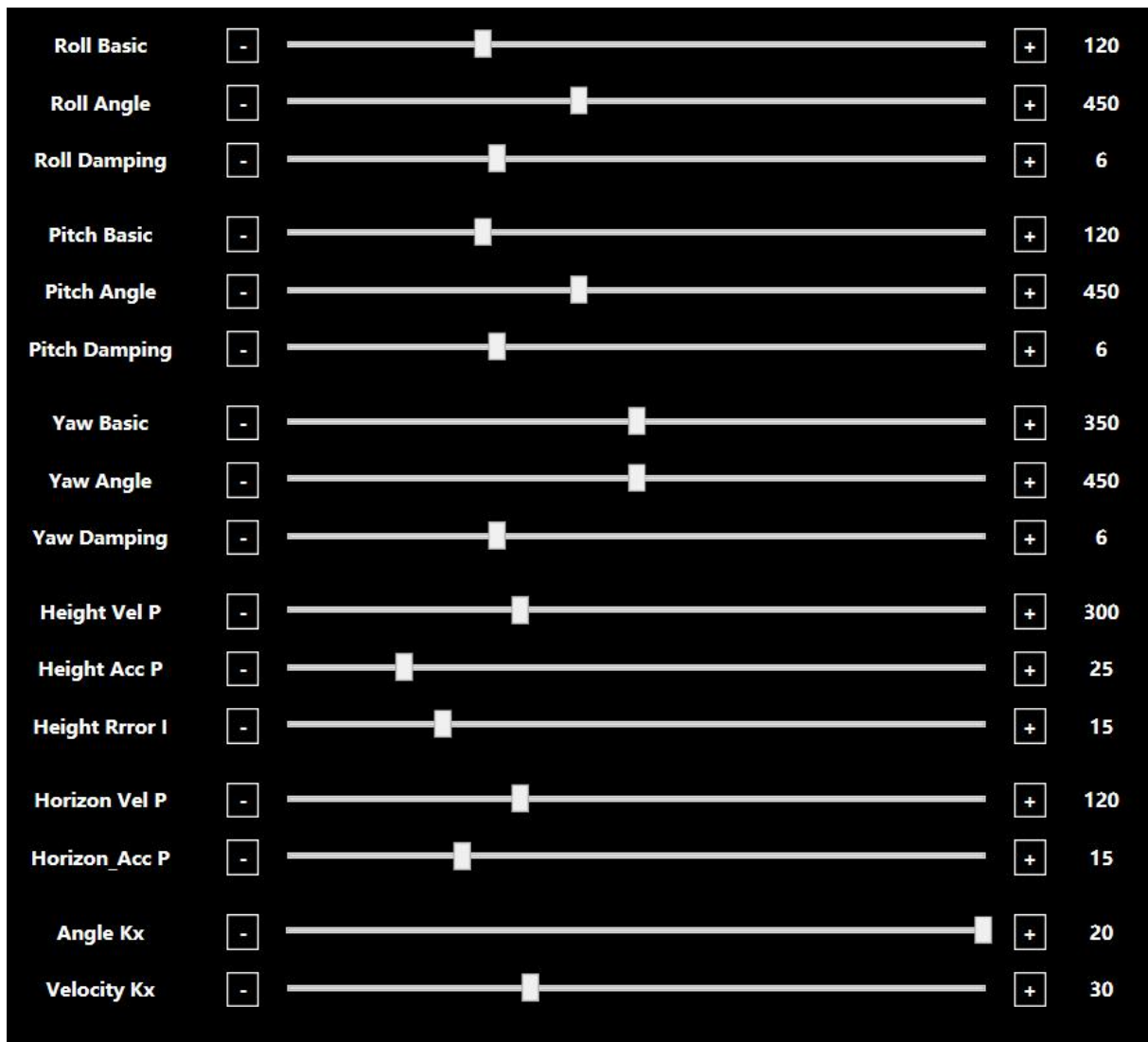


Chart- 24 Sense Setting

Description of adjustment parameters:

➤ Pitch/roll base: The default value of 120 can be used for the base sense in attitude mode (the suitable parameter for the flying machine with a 30-inch propeller or more is 100). Try not to move the stick in attitude mode in order to observe the vehicle's self-stabilization ability of the vehicle. Method: Hit the stick back to the center slightly to see if the vehicle can quickly

recover the level. Failure: Increase the value in increments of 5 each time until a slight shake occurs in the vehicle. Then adjust 20% downward to make the appropriate sense. Try not to exceed 180 in the base sense; otherwise, there will be a greater risk of Self-excited oscillation. When there is significant high-frequency jitter in the vehicle, the value is subtracted by 5 each time until the jitter is eliminated.

➤ Pitch/roll attitude: Attitude perception is the parameter that regulates how fast the vehicle follows the target angle (the maneuverability performance of the vehicle while flying). The base sense is well tuned; hit the stick quickly or hit the stick with full rudder to see if the flying machine can make an angular response. (In attitude mode, the maximum angle limit is -20 degrees.) The problem of slow vehicle response can be solved by increasing the parameters. How to determine aircraft responsiveness Download the flight data. Playback of flight data with ground station software. Compare the target angle with the current angle in the data analysis table.

➤ Pitch/roll: The purpose is to increase the stability of the vehicle and prevent Self-excited oscillation. If the jitter of the aircraft cannot be suppressed by adjusting the sensitivity, try

to set this parameter to 0. (Defaults 3 or 4 are available for flight requirements).

➤ **Yaw base/attitude:**The adjustment of the yaw sense is similar to that of the base sense of roll/pitch.This parameter can be increased by manually adjusting the yaw following speed. The default value of 350 is usually sufficient for flight. On a windy day, the yaw is turned left and right, then this parameter is increased in units of 10.

➤ **Yaw:** The stability of the yaw channel is increased by this factor. Default 2 is available for flight requirements.

➤ **Height Speed P:** Used to adjust the throttle response speed. The sensitivity is proportional to the throttle response. Most aircraft with 350 hp can meet the requirements.

➤ **Height Acc P:** Adjusts the stabilizing ability of the altitude channel and regulates the responsiveness of the throttle.

➤ **Horizontal speed factor:** An appropriate increase of this parameter has two improvements. On the one hand, it is to improve the problem of poor wind resistance when the aircraft is hovering, leading to a large position drift. On the other hand, it improves the problem of poor horizontal speed following leading to long braking distances.

-
- Horizontal Acc P: An appropriate increase in this factor can improve the situation of fine wandering when the aircraft is hovering. (15 is available for flight requirements).
 - Angular mobility: The reaction speed of the angle in attitude mode (default factor: 20). The higher this factor is, the faster the reaction speed.
 - Speed Mobility: Speed following in GPS mode. The coefficient is proportional to the speed following.

3. Route Planning

Open or close the route planning window by clicking Route Planning. The system has two kinds of route planning modes: manual planning and automatic planning. As shown below:

The screenshot shows the 'Wpt Plan' window with a table of 10 waypoints. Below the table, there are summary statistics and configuration controls.

ID	Alt	Spd	Fly Mode	Time	Mission	Heading	Circle
1	50	5	Auto Turr	30	None	0	0
2	50	5	Auto Turr	30	None	0	0
3	50	5	Auto Turr	30	None	0	0
4	50	5	Auto Turr	30	None	0	0
5	50	5	Auto Turr	30	None	0	0
6	50	5	Auto Turr	30	None	0	0
7	50	5	Auto Turr	30	None	0	0
8	50	5	Auto Turr	30	None	0	0
9	50	5	Auto Turr	30	None	0	0
10	50	5	Auto Turr	30	None	0	0

Summary statistics: Total Dist: 68.073km, Time: 226min, Area: 2km²


Configuration options:

- Skyway No: 1, Forbid No: 1
- Lon: 116.000000, Lat: 40.000000 (Set)
- Alt: 50 m, Relative (Set)
- Spd: 5 m/s (Set)
- Action: Auto Turr, Hover Time: 30
- Task: None, Circle Radius: 3 m (Set)
- WPT NO.: All, Edit All

Buttons: Save Wpts, Open Wpts (+), Upload, Download (-), Wpt Shift, KMZ/KML (O), Upload Forbid, Download Forbid, Camera Para, Delete Forbid

Chart- 25 Route Planning

3.1 Manual planning

Click  to add waypoints and select Manual Planning. As shown below:

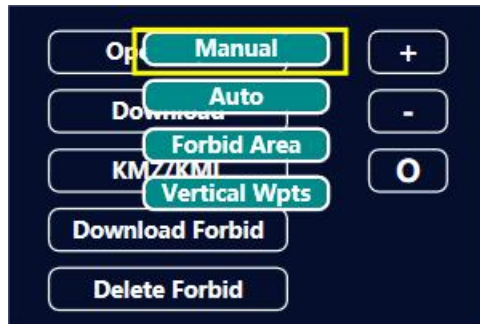



Chart- 26 Manual Route Planning

Then click on the map to add simple routes.

3.2 Automatic Planning

Automatic planning is more applicable to aerial photography operations. The route is automatically generated by planning the boundaries of the aerial survey area and setting the line spacing and direction of the route. The steps are as follows:

- 1) Click  to add waypoints and select Automatic Planning.

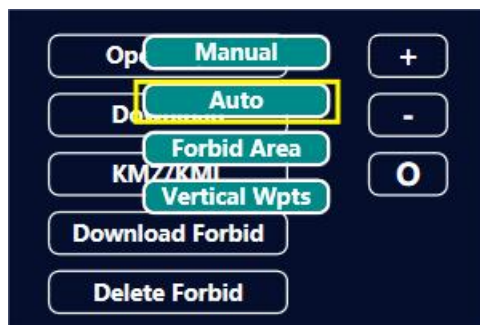


Chart- 27 Automatic Route Planning

Plan the boundaries of the survey area on the map. Set line spacing and direction angle to dynamically generate preview routes.



Chart- 28 Preview Route

Click  to end the current route planning. 点击 ,

3.3 No-fly Zone Planning

Plan the no-fly zone and then upload the data to the flight controller. That would exclude the no-fly zone from the flight range. When the aircraft touches the boundary of the no-fly zone, it will automatically return. At present, the universal firmware made by VK does not support the no-fly zone function. Please contact VK's after-sales service if you need the no-fly zone function.

3.4 Route Editing

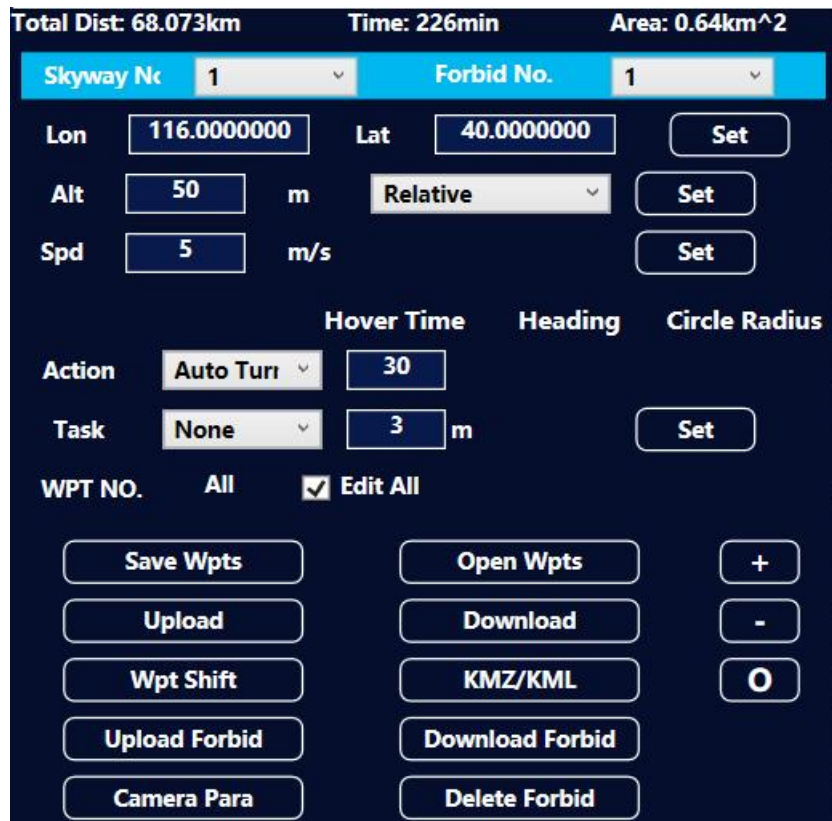


Chart- 30 Route Editing

- Skyway NO: The display of 10 routes is supported. And different routes can be selected by switching the route number.
- Altitude Type: There are 4 altitude types, including relative takeoff point altitude, altitude, relative terrain altitude, and radar altitude. The height value is set to X.
 - ① Relative takeoff point altitude: The drone will climb to an altitude of X meters from the takeoff point to execute its course.
 - ② Altitude: The drone will fly to an altitude of X meters, at which point it will rely on the altitude of GNSS for altitude control.

Relative terrain altitude: This mode must be used in 3D map mode. The drone reaches each waypoint at an altitude of X meters above

the ground.

③ Radar altitude: This mode must be equipped with VK's radar altimeter. During the course of the flight, the real-time height of the drone above the ground is X meters.

Waypoint action: Support coordinated turn, hover turn, Heading Lock, throw, landing, horizontal surround, and other route modes.

➤ Route Mission: It can support fixed-point photography and timed photography.

Caution: Editorial changes can be made to individual waypoints and entire routes. If the waypoint serial number is displayed as a separate number, the waypoint is being edited. If ALL is displayed, the entire route is being edited.

➤ Save route: The route of the current serial number can be saved to the system.

➤ Open the route: Import the downloaded route files into the ground station system.

➤ Upload waypoint: Uploads the route of the current serial number to the flight controller. (Only one route is supported for saving.)

➤ Download Waypoint: Download the routes saved inside the flight controller to the ground station.

➤ Panning route: The route can be panned by dragging and dropping.

(2D Map)

- KMZ/KML: Support importing KMZ/KML files to produce routes or scan the boundaries of routes.
- Upload the no-fly zone: Upload the locally planned no-fly zone to the flight controller.
- Download the no-fly zone: Download the no-fly zone from the flight controller to the local area and display it.
- Delete the no-fly zone: Delete the no-fly zones saved locally and in the flight controller (normal communication connection).

4. Task

1) Attitude indication: displays information such as flight attitude and position, as well as data information from the GPS, magnetic compass, and other components. The red font in the window is an alarm message. Please troubleshoot, and then fly.

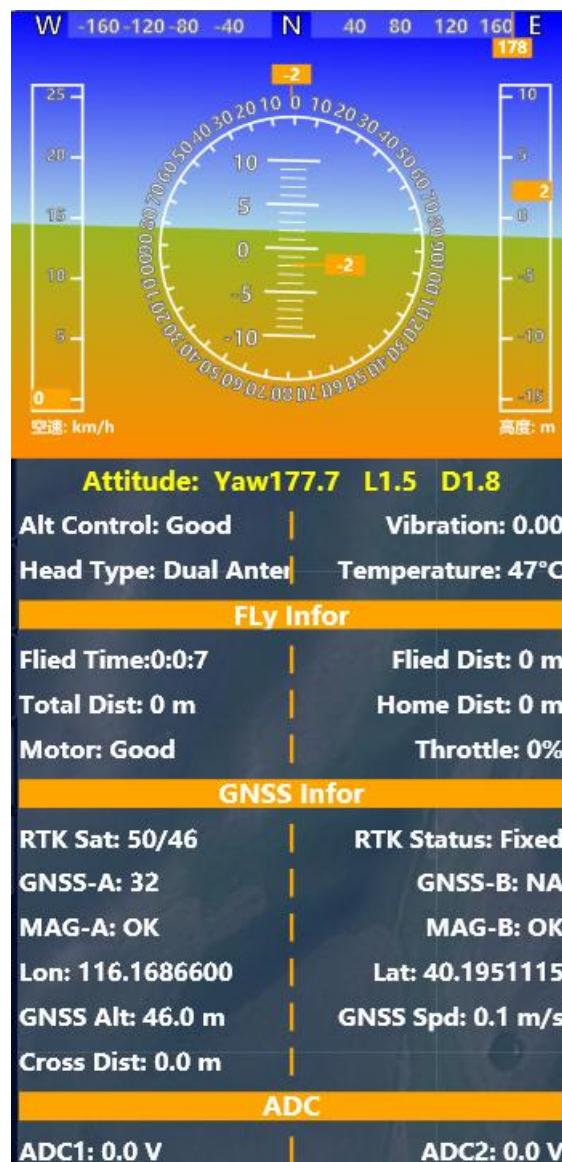


Chart- 30 Attitude Chart

2) Fly Point : Click this window to set the flight action.

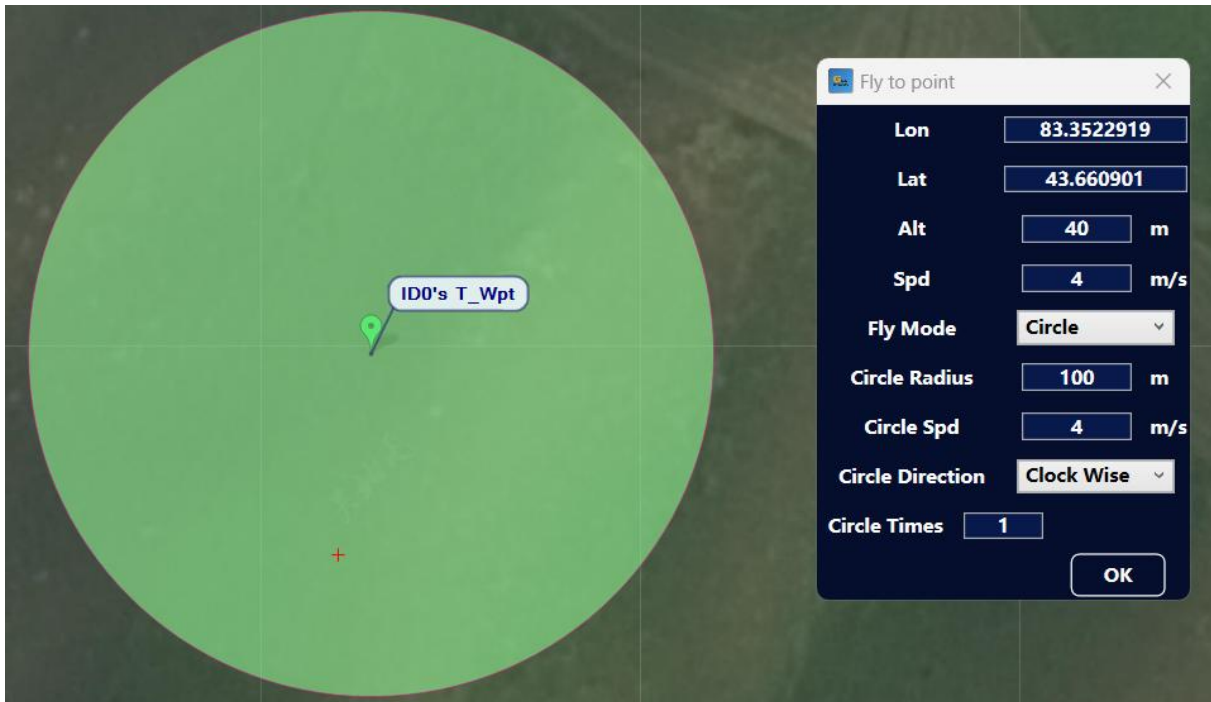


Chart- 31 Fly Point

3) Pod control: Support SBUS-0 control pods or an external SBUS-to-PWM module to control other servers . The analog SBUS input can be controlled with a VK virtual rocker or a solid rocker.

4) Video display:Support RTSP protocol of H264 format video direct display as well as video address need to be set.

5) Keyboard control: Open this window to put the aircraft into keyboard control mode. After exiting, the aircraft enters hover mode.

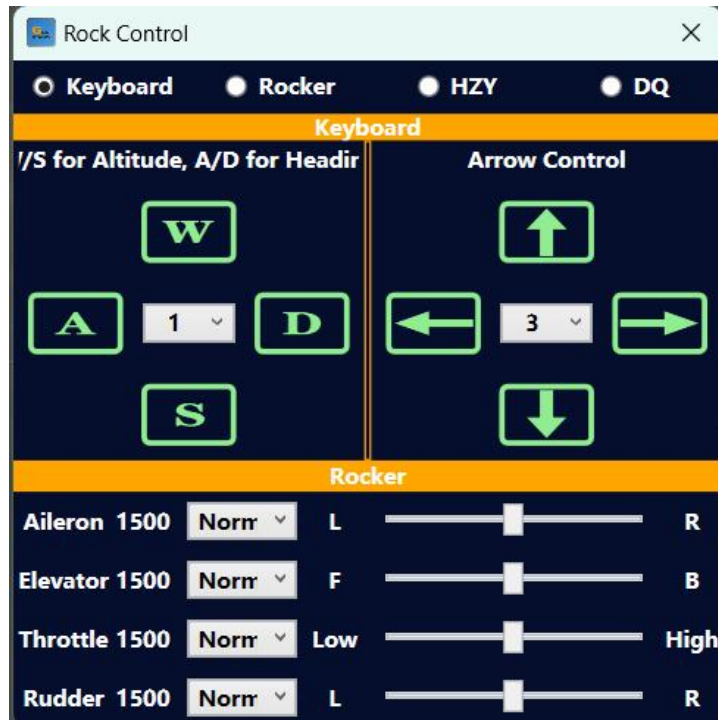


Chart- 32 Keyboard Control

6) Follow the flight. The RTK version has a maximum following speed of 20 m/s. Section 8 provides a detailed description of the specific features.

7) Set the return point: Off-site return points can be set. This function is recommended to be performed with a radar altimeter; otherwise, it is risky.

8) Set Spotlight: When this function is turned on, the aircraft's nose always points to the set focus point, regardless of the aircraft's flight mode. After canceling this function, the head restores the normal control logic.

9) Turn on voice: When this function is turned on, the ground station broadcasts the voltage, altitude, and speed of the flight

in about 20s cycles (the Win7 system does not support this function).

10) Distance measurement: Select this function and left-click on the map for straight-line distance measurement.

11) Delete POS: Delete the POS points displayed on the map. However, this operation does not delete the POS information recorded inside the flight controller.

12) Delete Tracks: The main purpose is to prevent the ground station from working too many track points for a long time (more than 1 hour), which leads to the degradation of the smoothness of the ground station operation.

14) Unlock: Under good connection conditions, click this button to unlock the aircraft to turn to landing. If no next action is taken within 3 seconds, the aircraft will automatically lock.

15) Automatic take-off: Once unlocked, the aircraft will automatically climb to the set automatic takeoff altitude by hovering over this button.

16) Cruise: When this function is turned on after the aircraft is in the air, it will enter route cruise mode. Please make sure the route has been uploaded correctly.

17) Route suspension: Clicking this function during the execution of a route on the aircraft will put the aircraft into hover mode.

18) Break-Go: After a route is interrupted, this function allows the aircraft to return to the previously interrupted location and continue to complete the remainder of the route.

19) Return of aircraft: The aircraft returns to the takeoff point, automatically lands, and locks up. The final stage of the return descent supports the remote control to fine-tune the position and descent speed.

20) Landing: Click this button, and the aircraft will remain in the same position and start descending. If a radar altimeter is installed, the descent speed of the aircraft is automatically controlled according to the actual distance from the ground. If no radar altimeter is installed, the aircraft descends at a constant speed of 0.5 m/s.

21) Photo shoot: Click once to take a photo.

22) Open the parachute: Support to turn on a PWM-driven parachute. (The SBUS-0 function needs to be set to parachute.)

23) View Central: Click to switch the view to center on the aircraft. Double-click to enter view-following mode. The center of the screen will always follow the position of the drone.

24) Obstacle avoidance radar switch: Turn on or off obstacle avoidance radar.

25) Radar altimeter switch: Turn on or off obstacle avoidance radar.

5. Multi Control

To use multi control mode, follow the steps below:

1) The ground station is set to stand-alone mode and connected to the flight controller. Set the flight controller ID to a number between 1 and 20. After setting the number, it is normal that the ground station cannot receive telemetry information from this flight controller in stand-alone mode.



Chart- 33 Set The Flight Control Number

2) After setting the desired flight control number (the flight control number cannot be repeated), multiple aircraft can be connected simultaneously through a VK one-to-many link. Open the ground station software and select the multi-aircraft mode, which can control either one aircraft or multiple aircraft at the same time.

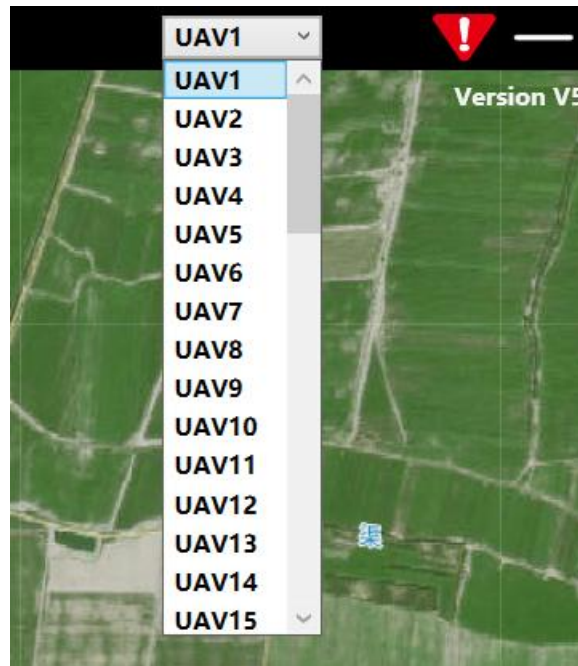


Chart- 34 Schematic Diagram of Multiple Machines at One Station

6. Firmware Upgrade

The VK_GCS ground station can provide online upgrades of the control firmware and IMU firmware of the flight system. To upgrade, please do it in stand-alone mode. It is necessary to set the system ID to 0 first; otherwise, it will cause the upgrade to fail.

The general control firmware will contain the "CONTROL" field, and the IMU firmware will contain the "IMU" field. It is important to ensure that incorrect firmware is not upgraded to the flight controller. It is not possible to upgrade the control firmware and IMU firmware at the same time.

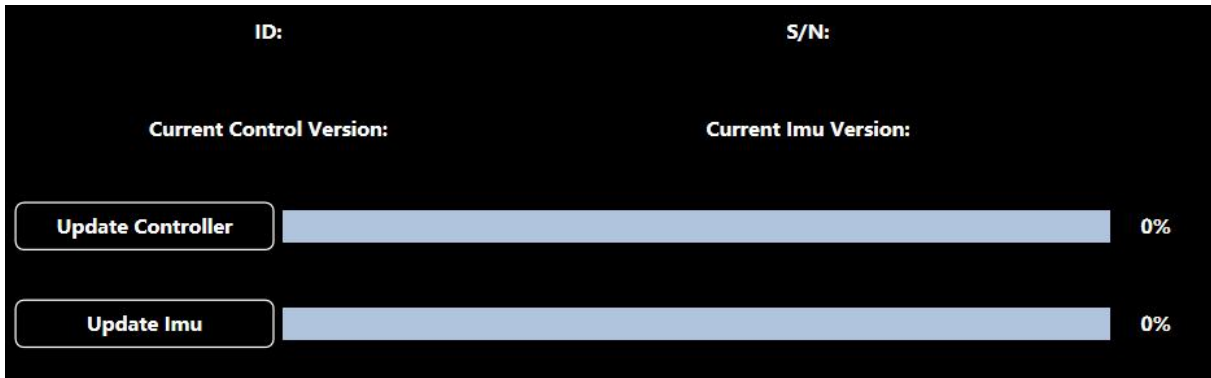


Chart- 35 Firmware Upgrade Interface

7. Data Download



Chart- 36 Flight Data Download

1) POS Data: The POS data records the position, attitude, and altitude of the aircraft when the flight controller triggers the photo signal. The POS data remains inside the flight controller after powering off until the next photo signal is triggered.

id	time	lon	lat	GPS_Alt	roll	pitch	yaw	RTK
1	19/12/15 8:30:10	115.9980665	39.7849901	200	0	-2.1	171.9	0
2	19/12/15 8:30:10	115.9980812	39.7849114	201.5	0	-6.6	171.9	0
3	19/12/15 8:30:10	115.9980949	39.7848369	202.8	0	-6.6	171.9	0
4	19/12/15 8:30:10	115.9981085	39.7847627	204	-0.1	-6.5	171.9	0
5	19/12/15 8:30:10	115.9981219	39.7846897	205.2	-0.1	-6.5	171.9	0
6	19/12/15 8:30:10	115.9981352	39.7846174	206.4	0	-6.5	171.9	0
7	19/12/15 8:30:10	115.998149	39.7845429	207.6	-0.1	-6.4	171.9	0
8	19/12/15 8:30:10	115.9981623	39.7844706	208.8	-0.2	-6.3	171.9	0
9	19/12/15 8:30:10	115.998176	39.7843962	210	0	-6.3	171.9	0
10	19/12/15 8:30:10	115.9981895	39.7843226	211.2	-0.1	-6.2	171.9	0
11	19/12/15 8:30:10	115.998203	39.7842496	212.3	-0.2	-6.2	171.9	0
12	19/12/15 8:30:10	115.9982164	39.7841767	213.5	0	-6.2	171.9	0
13	19/12/15 8:30:10	115.9982286	39.7841108	214.6	-0.1	-6.1	171.9	0
14	19/12/15 8:30:10	115.9982429	39.784033	215.8	0	-6.3	171.9	0
15	19/12/15 8:30:10	115.9982566	39.7839589	217	0	-6.2	171.9	0
16	19/12/15 8:30:10	115.9982699	39.7838864	218.2	-0.3	-6.2	171.9	0
17	19/12/15 8:30:10	115.9982834	39.7838129	219.4	0	-6.1	171.9	0
18	19/12/15 8:30:10	115.9982965	39.7837418	220.5	0	-6.2	171.9	0
19	19/12/15 8:30:10	115.9983103	39.7836671	221.7	-0.4	-6.1	171.9	0
20	19/12/15 8:30:10	115.9983236	39.7835951	222.9	0	-6.2	171.9	0
21	19/12/15 8:30:10	115.9983365	39.7835246	224	-0.1	-6.1	171.9	0
22	19/12/15 8:30:10	115.9983505	39.783449	225.2	-0.2	-6.1	171.9	0
23	19/12/15 8:30:10	115.99836	39.7833976	226	0	-6.1	171.9	0
24	19/12/15 8:30:10	115.9983771	39.7833046	227.5	0	-4.9	171.9	0
25	19/12/15 8:30:10	115.9983906	39.7832311	228.7	-0.1	-3.6	171.9	0
26	19/12/15 8:30:10	115.998404	39.7831585	229.9	0	-2.6	171.9	0
27	19/12/15 8:30:10	115.9984175	39.7830853	231.1	0	-1.9	171.9	0
28	19/12/15 8:30:10	115.9984304	39.7830154	232.2	0	-1.3	171.9	0
29	19/12/15 8:30:10	115.998444	39.7829414	233.3	-0.1	-0.8	171.9	0
30	19/12/15 8:30:10	115.9984573	39.7828691	234.5	-0.1	-0.4	171.9	0
31	19/12/15 8:30:10	115.9984707	39.7827967	235.6	-0.1	-0.1	171.9	0
32	19/12/15 8:30:10	115.998484	39.7827243	236.7	-0.1	0	171.9	0
33	19/12/15 8:30:10	115.9984973	39.7826518	237.9	0	0.2	171.9	0
34	19/12/15 8:30:10	115.9985107	39.7825795	239	0.1	0.3	171.9	0
35	19/12/15 8:30:10	115.998524	39.7825072	240.2	-0.1	0.4	171.9	0
36	19/12/15 8:30:10	115.9985373	39.782435	241.3	0	0.5	171.9	0
37	19/12/15 8:30:10	115.9985506	39.782363	242.4	0.1	0.5	171.9	0
38	19/12/15 8:30:10	115.9985638	39.782291	243.6	0.1	0.6	171.9	0
39	19/12/15 8:30:10	115.9985771	39.782219	244.7	0.1	0.6	171.9	0

Chart- 37 POS Data File Format

2) Download Flight Data

The V7-PRO flight controller has an internal data storage black box. It can save flight data for up to 50 sorties (each unlock and lock is one flight). Number 1 represents the last sortie, number 2 represents the penultimate sortie, and so on.

Power up the flight controller and connect the ground station to the flight controller. Click "Download Flight Data" to download the flight data saved inside the flight controller to the local PC.

The flight data details the system's GNSS positioning, sensors, magnetic compass, remote control input, motor output, and other information. and is the most important means of analyzing flight accidents. Flight data is the most important tool for the detailed

analysis of flight accidents. This data can be played back and analyzed by the ground station (please disconnect the communication link with the flight controller before playing it back).

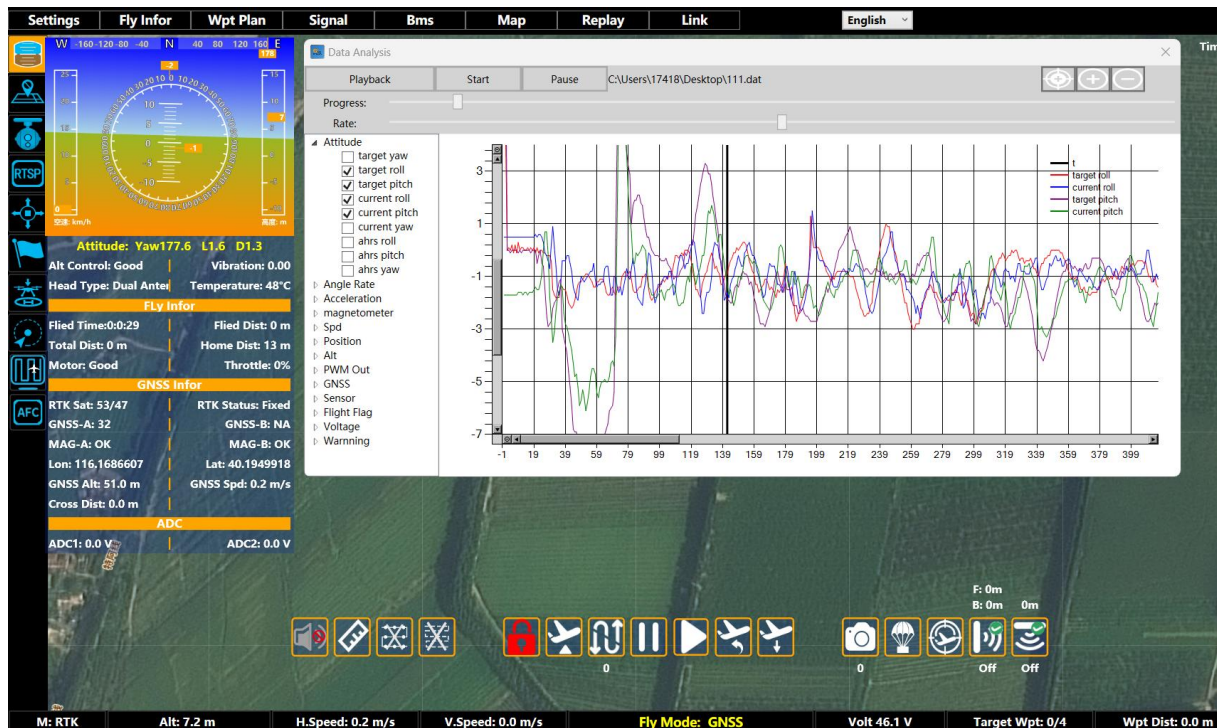


Chart- 38 Illustration of The Flight Data Playback

8. Follow the Flight

VK's RTK system was installed to enable dynamic takeoff landing and follow flight functions in vehicle or shipboard scenarios. The steps are as follows:

- 1) Install VK's RTK Base Station App on your Android mobile phone. Connect the base station via Bluetooth and set the RTK base station to mobile base station mode. As shown below:

RTK基站



搜索RTK基站

基站型号: VK-RTK-B-S
基站ID: 22090046
基站固件版本: 221018 升级 检查

进入踩点模式

39.7803210, 116.5476915, 52.6
定位类型: 单点, 卫星数: 10

移动基站模式

开启云基站功能

Chart- 39 RTK Base Station APP

2) Connect the base station to the ground directional antenna as follows:



Chart- 40 Schematic Diagram of RTK Dynamic Base Station

3) Mount the mobile base station and the detection direction antenna on the mobile platform. Base station antenna installation direction: the angle between the line connecting the base station to the direction-finding antenna and the forward direction of the platform. According to the installation position in the figure below, the base station antenna installation direction is set to 90 degrees.

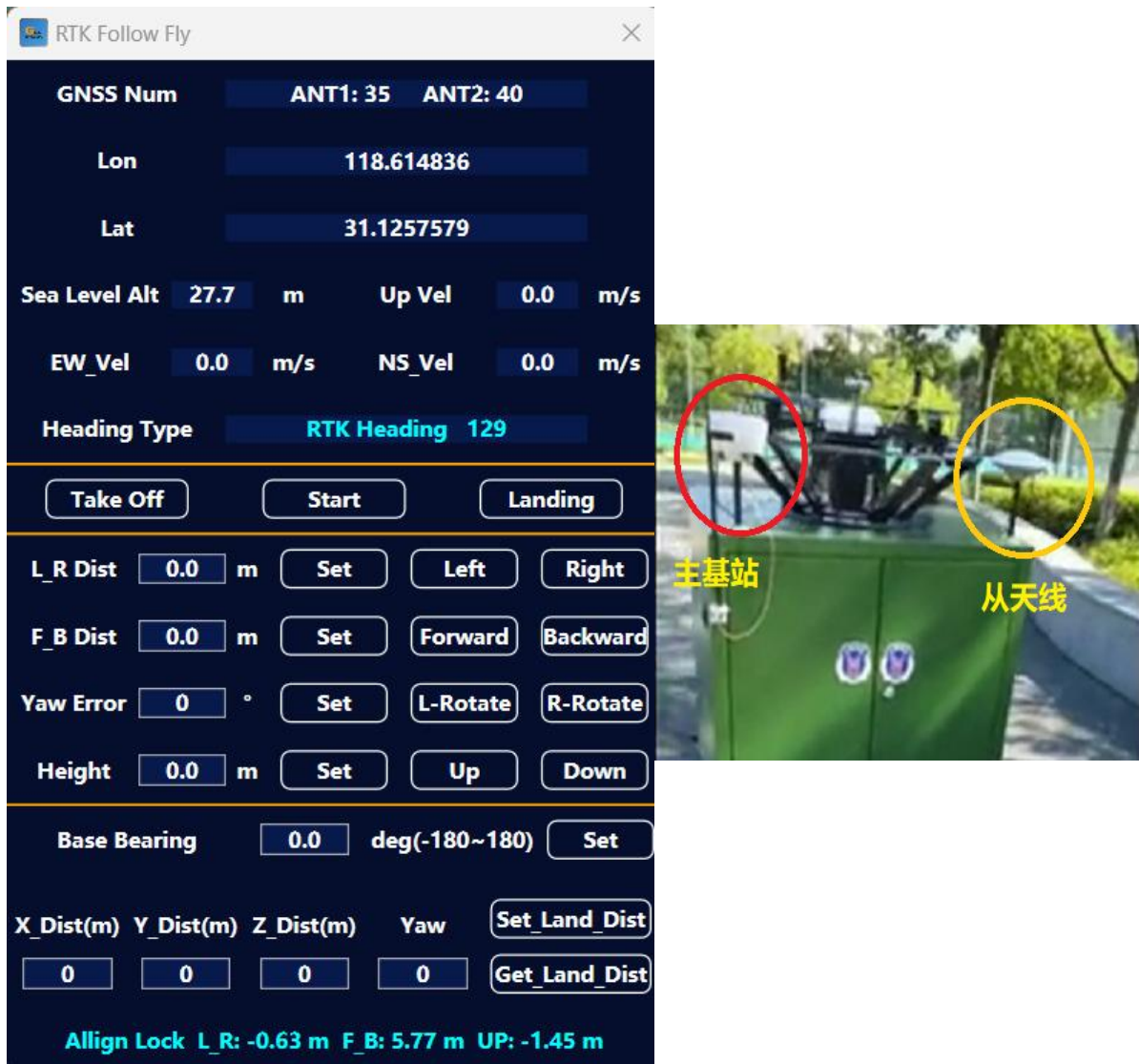


Chart- 45 RTK Moving Base Mode

4) There are two conditions for the aircraft to fly with the vehicle: one is that the base station's survey direction is locked, and the other is that the position of the airborne RTK and the ground is also locked. This is especially important to confirm that the yellow font in the figure below shows the locked status.







5) The flight supports manual takeoff. If the aircraft takes off on a moving platform, it needs to click on the vehicle to take off.

Click Start Following after takeoff, and the drone enters following mode. The maximum following speed is 80 km/h.

6) During the flight, the position, altitude, and heading of the aircraft can be adjusted in real time using the buttons in the blue box above.

7) After the following flight is completed, the vehicle can be clicked to land. The drone will automatically land in the takeoff position on the ground platform. The aircraft supports dynamic landing under the condition that the moving speed of the ground mobile platform is not more than 8 m/s.

Appendix 1: Flight Controller LED Indication

	LED Status	Instruction
Red		System Initialization/Magnetometer Calibration Fail
		GNSS Not Good
		GNSS Very Poor
		Low Battery Voltage
		Aircraft Locked
Green		Magnetometer Horizontal Calibration
		Attitude Mode
		GPS Mode
		Auto Cruise Mode
		Able to Take Off Indication
Blue		Magnetometer Vertical Calibration
		IMU Communication Error
		No IMU Communication
		GPS Lost Warning
		Speed Warning
		Remoter Pwm Channel Warning
Yellow		Accelerometer Warning
		Gyro Warning
		Magnetometer Disturbance Warning
		Temperature is Higher than 65 degree
Purple		Record A Point
		Record B Point
		Remoter Calibration
		ESC Calibration
Cyan		Altitude Control Poor
		Motor Balance Poor
White		Radar Altimeter Available
		IMU Firmware Update

 Long Bright  Flash

Appendix 2: RTK Base Station LED Indication



BT: Flash Quickly indicate bluetooth not be connected, Long bright indicate bluetooth connectwell to APP.

RX: RTK base station send one CORS message with this LED flash once, normally it will flash with frequency of 1HZ.

TX: RTK base receive one message with this LED flash once.

FIX: RTK base station work status, definition as below.

Flash quickly: APP set station's coordinates successfully, and work at base mode.

4 flash: No GNSS.

3 flash: Location type is single.

2 flash: Location type is float.

1 flash: Location type is fixed RTK.

P_L: Bluetooth and RTK initialization indication, definition as below.

Flash quickly: Enter rover mode.

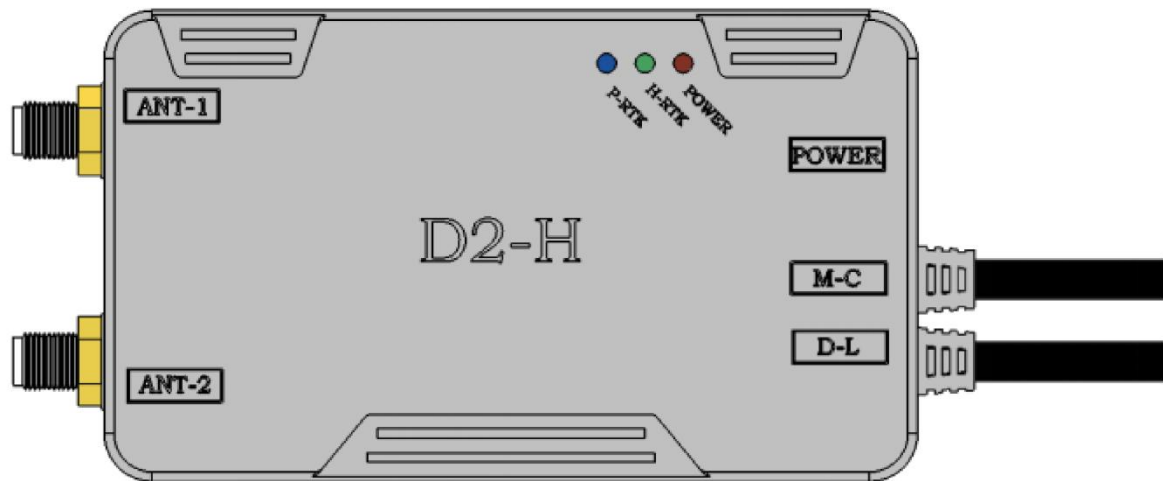
2 flash: Bluetooth initialization fail.

Long bright: NormalGPS: Flash indicate the GNSS is now searching stars.

GPS: Flash indicate the GNSS is now searching stars.

RTK: NA

Appendix 3 : Dual Antenna RTK LED Indication



P_RTK: Position work status, defined as below.

- 4 flash: ANT-1 no GNSS signal.
- 3 flash: ANT-1 location type is single.
- 2 flash: ANT-1 location type is float RTK.
- 1 flash: ANT-1 location type is fixed RTK.

H_RTK: Heading work status, defined as below.

- Long bright: RTK module initialization is fail.
- 3 flash: ANT-2 no GNSS signal.
- 2 flash: ANT-2 has GNSS signal, but no heading output.
- 1 flash: dual antenna heading output.