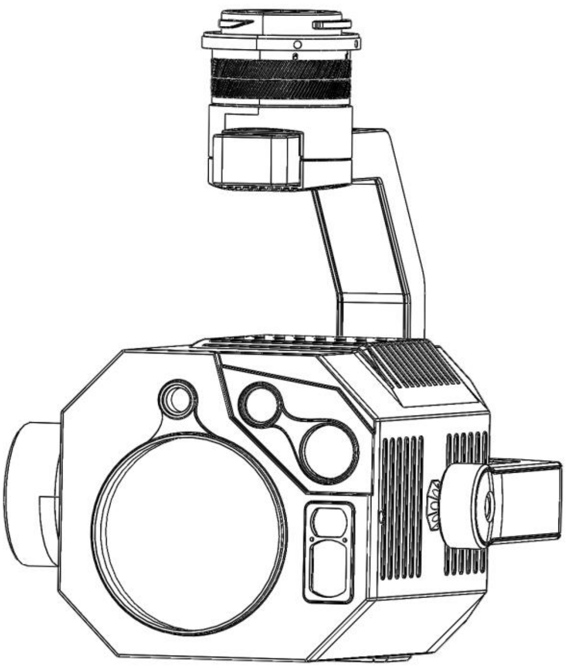
BL-CH-4 UAV Laser Methane Leak Detector

User Manual V1.0

2024.07.05



深 圳 市 无 疆 智 造 科 技 有 限 公 司

SHENZHEN BLV TECHNOLOGY CO.,LTD

<u>Please read this manual carefully before installation and use of the product, and keep it safe for reference again.</u>

Precautions for safe use, storage and maintenance:

- Do not open or close the equipment frequently during use, in order to avoid damage to the product.
- When using, avoid focusing the product on strong light (such as large lamps, sunlight, etc.), otherwise the detection performance or optical device life may be affected.
- Do not direct the indicator light to your eyes when using, otherwise it may cause damage to your eyes.
- The storage place of the product should not be extremely hot (above +60℃), extremely cold (below -30℃), violent vibration or strong electromagnetic radiation.
- Before maintenance and repair of this product, be sure to disconnect the power supply.
- When cleaning the surface of the product or the lens, do not use corrosive solvents or abrasive cleaners; otherwise, the surface of the product may be damaged or the detection performance may be affected.

Other safety warnings:

- Do not disassemble this product by yourself. There are no parts in the equipment that can be replaced or repaired by users.
- The installation and maintenance of this product should be carried out by professional service personnel, only the spare parts specified by the manufacturer.

Disclaimer:

The actual product shall prevail. This manual is for reference only.
The Company can guarantee the accuracy of the contents of the manual. However, due to differences in actual environment and other reasons, the actual values of some data may be different from the values provided in the manual. In case of any doubt or dispute, the Company's final interpretation shall prevail.
Any loss caused by failure to follow the instructions in this manual during installation and use shall be borne by the user, and the Company shall not assume any responsibility; The company does not assume any responsibility for product damage or problems caused by external factors (such as improper use, accidents, natural disasters, etc.).
This manual may not contain all potential installation and maintenance problems, so the company reserves the right to modify the content of this manual without prior notice, if you need to modify the updated manual or further detailed help, please contact us.
The product is subject to update or upgrade without prior notice, and some features of the product are allowed to differ slightly before and after the update. Due to technical updates or improvements, the performance and function of the product may change, the manual will also be updated to new versions, for new versions of the product, the company is not responsible for the old version of the manual.

Contents

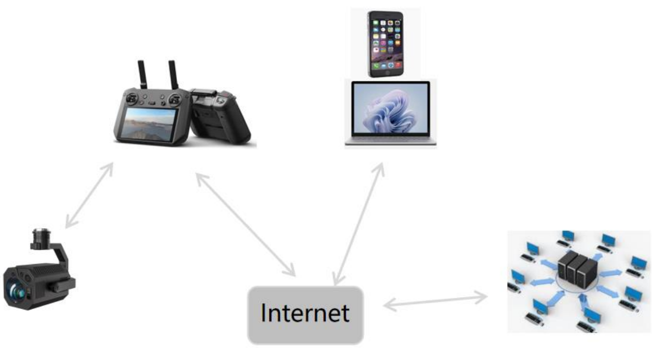
1. Introduction

BLV Tech is a High -Tech company dedicated to the development, design, and manufacture the products for the drone industry.

Our company engaged in surveying and mapping geographic information data acquisition equipment, Inspection products research and development, sales, and technical support. BL-CH4 laser methane detector is a customized methane gas concentration detection UAV application equipment for users in the oil and gas industry based on many years of experience in the development of methane gas leakage detection instruments and the actual situation of the field. According to the application characteristics of UAV, this series of products has made targeted optimization design in terms of volume, weight, power consumption and electromagnetic interference. The response time of 5 milli seconds ensures that the UAV can still maintain stable and reliable data output at high speed.

BL-CH4 laser methane detector has the characteristics of high sensitivity, high measurement accuracy, low detection limit, fast response speed, and almost no maintenance and calibration of field measurements.

Compared with the traditional electrochemical sensor detection method, BL-CH4 laser methane detector can realize non-contact measurement, quickly find trace methane gas in the air, the longest detection distance of up to 300 meters, and is not affected by environmental factors such as temperature, humidity and pressure, with very high stability.BL-CH4 laser methane detector can be mounted to DJI Matrice M300RTK and 350 for use, and the methane concentration data collected by the sensor can be transmitted to the remote control APP or cloud platform web page display through 4G module, DJI SDK and others.



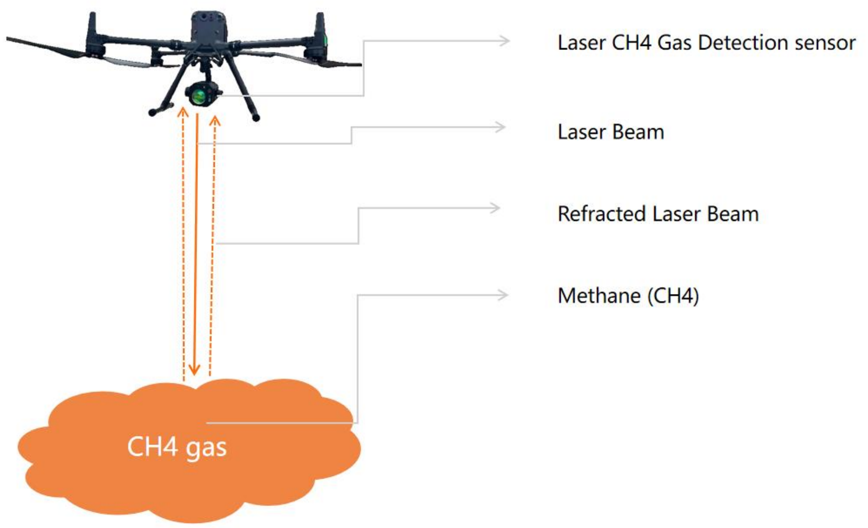
P 1-1 Application composition of laser methane detector

The implementation standards of this product are:
GB7247.1-2012 "Safety of Laser products Part 1: Equipment classification, requirements"
Indicating the laser level of the laser: Class III (continuous type, wavelength 525nm±5nm), harm to the human eye, please do not look directly at.
The laser class of the measurement laser: Class I (pulse type, wavelength 1653nm±5nm), belonging to the human eye safety.
This series of laser methane detector supports the maximum detection distance of 80 meters, 100 meters, 150 meters, and can be customized to carry different head mounted on other types of multi-rotor UAV or vertical take-off and landing fixed wing UAV to meet the detection needs of different customers.

2. Product Overview

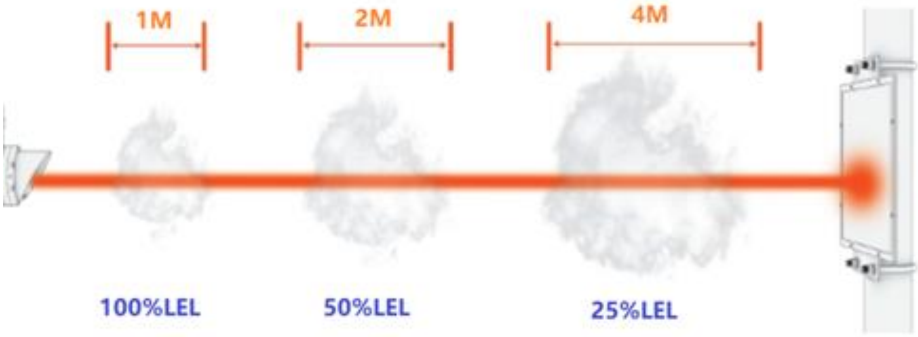
2.1 Detection Technology

The laser methane detector adopts the tunable semiconductor laser absorption spectroscopy technology TDLAS principle, which is based on the molecular structure of methane has absorption properties for specific wavelengths of light. When a laser passes through the methane gas mass, the absorption degree of the methane molecular absorption spectrum line is analyzed, so as to calculate the methane concentration of the gas mass.



P 2-1 Principle of laser methane detector

When the instrument is working, the detection laser of a specific wavelength range is emitted externally, and the detection laser is diffused after encountering the reflector, and some of the laser is returned to the detection unit of the instrument. Generally, the reflective beam detector system does not distinguish the gas concentration in the local interval of the working optical path, that is, the effect of a small range of high concentration gas and a large range of low concentration gas is the same. The unit of the sensor is the average concentration of the gas ppm • m or %LEL • m, that is, the product of the gas concentration ppm and the size of the air mass m. Figure 2-2 shows that the test results of 1 meter 100%LEL air mass and 2 meter 50%LEL air mass and 4 meter 25%LEL air mass are equal: 100%LEL*1M=50%LEL*2M=25%LEL*4M.

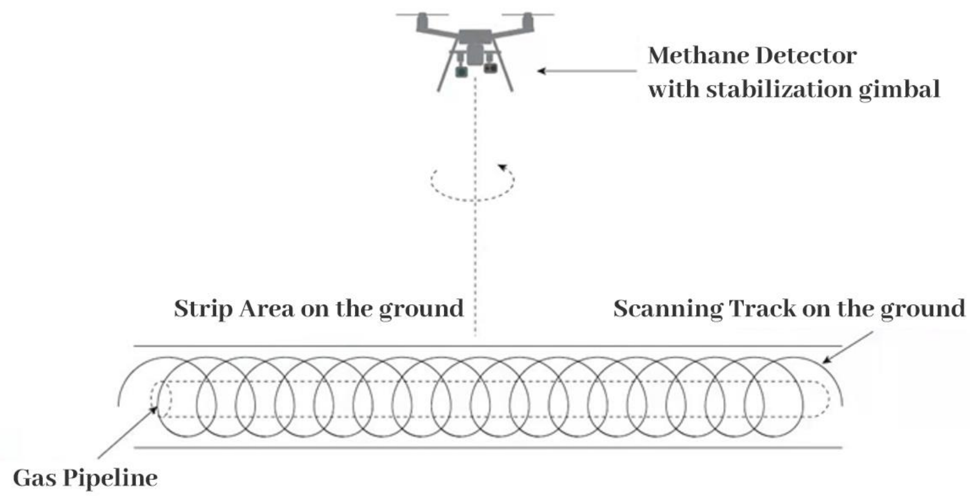


P 2-2 Equivalence principle of methane concentration value

2.2 Detection Method

In the UAV automatic route flight inspection, the point laser projection on the ground along with the UAV's flight direction is a line, the width is the diameter of the laser spot, usually no more than 20cm, while the diameter of the high-pressure natural gas pipeline is mostly more than 50cm, coupled with the UAV flight error, the UAV needs to fly repeatedly. In order to cover the pipeline that needs inspection, it is very inconvenient.

In order to make up for the limitations of the use of laser methane detector, we developed this set of laser ground scanning head. The UAV flies above the pipeline, the three-axis enhanced stability PTZ keeps the laser irradiation direction perpendicular to the ground, and the scanning controller controls the rotation of the PTZ. The projection of the laser irradiation on the ground shows a spiral shape and sweeps over a certain width (about 3 ~ 10m). Thus, the UAV can cover the scope of the pipeline to be inspected in one flight, make up for the flight position error, and capture the leaking air mass deviating from the pipeline, improving the success rate of instant detection and inspection efficiency.



P 2-3 Schematic diagram of automatic rotating scan of PTZ

2.3 Applications

2.3.1 Natural gas industry pipeline inspection

According to the natural gas transportation pipeline route, the ground station software is used to make route planning, which can easily realize middle and long distance pipeline inspection. During the inspection process, the current inspection status (UAV status, methane measurement results) can be viewed in real time. In case of pipeline natural gas leakage, the system will automatically alarm and record data (time, coordinates, leakage concentration, and on-site photos). The inspection report can be automatically generated in the later period.

2.3.2 Residential gas leakage safety detection

The automatic inspection path is designed according to the building condition, and the detection laser can penetrate the kitchen glass for detection without the presence of the resident. It only takes 1S to complete the gas leak detection at the target point, and the drone does not stop during the inspection process, and displays the gas concentration in the current household kitchen in real time.

2.3.3 Natural gas station inspection

The station area is selected in the frame, the inspection route is automatically produced, and the inspection density can be adjusted according to the actual situation. This scheme can also be used in methane leakage detection of landfill sites and methane leakage detection of LNG carriers before they enter the port. After the inspection is completed, methane leakage points in the inspection process are marked, and users can observe the overall concentration distribution map of the inspection area of the station through the app or website.

2.4 Product Features

* High integration, small size, light weight.

* Advanced TDLAS sensor technology, high sensitivity, high measurement accuracy, low detection limit, fast response, stable performance.

* Lens aspherical design, infrared anti-reflection film, built-in narrow and with filter can effectively prevent the interference of sunlight on the signal.

* Designed for DJI industrial aircraft, based on the excellent performance of drones, especially suitable for long-distance, mountain, bridge and high-rise residential applications.

* Use DJI built-in data link to achieve 15KM transmission control distance.

* No additional display device is required, support DJI remote control APP display data curve, record abnormal GPS location.

* DJI SkyPort adapter ring quick disassembly structure, non-destructive, convenient installation.
* Support TF memory card to record sensor data and aircraft GPS position information.
* Maintenance-free, no field calibration required.
* Support the collaboration of DJI H20 series cameras to take high-definition visible and infrared photos at the location of recording methane concentration outliers.
* Support TF card to save methane anomaly concentration value and gps location, recording frequency 50 times/second.

2.5 Technical Parameters

Detected gas: methane
Detection principle: Laser absorption spectroscopy TDLAS
Detection mode: PTZ sweep type, sweep radius, sweep speed adjustable
Sweep Angle: 1°, 2°, 3°, etc
Sweep speed: 1 SEC/turn, 1.5 SEC/turn, 2 SEC/turn
Applicable models: DJI M200, M210, M300RTK
Electrical interface: DJI SkyPort adapter ring
Gimbal type: three-axis stability enhancement
Gimbal Angle: ±0.01°
Detection distance: 1 ~ 300m
Response time: 5ms
Sampling frequency: 500khz
Sensitivity: ≤5ppm•m
Detection range: 0 ~ 99999ppm•m
Detection error: ±100ppm(0-1000ppm • m), ±10%(1000-99999ppm • m)
Waterproof class: PTZ IP44 main IP43
Detection laser: Class I, eye safety
Indicating laser: Class III, eye damage
Operating temperature: -25-60 ℃
Working humidity: ≤ 95%RH (+25℃)
Size (including head) : 145*130*190mm
Weight (including head) : 760g
Power consumption: 2W

Methane concentration data show: DJI remote control (drone link), mobile phone, computer browser (optional 4G module)
Methane concentration data transmission distance: 15Km(UAV link), unlimited distance (optional 4G module)
Surveillance video shows: DJI remote control (drone link), mobile phone, computer

browser (remote control push stream live)
Surveillance video transmission distance: 15Km(UAV link), unlimited distance (remote control push stream live)

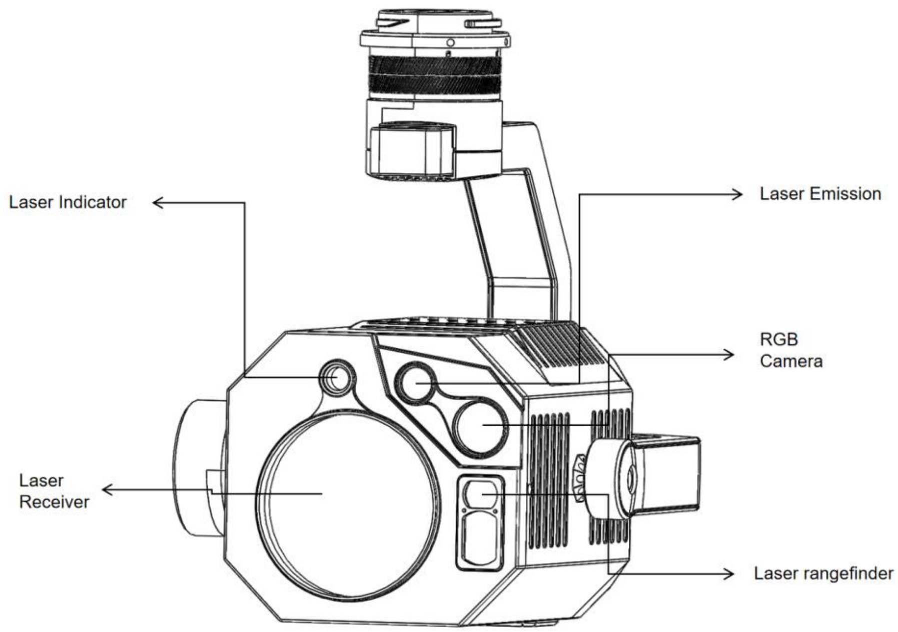
3. Installation And Usage

3.1 Structural Introduction

The laser transmitting and receiving module is integrated inside the probe, and the receiving unit inside the probe contains the signal receiving circuit, the amplifying circuit, and the processing circuit. The central processor uses dual processors, one is a DSP processor for floating point operation, which can accurately and high-speed test the gas concentration, and the other processor is used for the functional control of the entire system, state detection, communication and so on.

The measurement laser is emitted after the collimator is twice concentrated to ensure that the diameter of the spot is less than 20cm outside 150M, and ensure that the light signal sent is strong enough to reduce the interference of sunlight on the received light signal and improve the signal-to-noise ratio.

The outer part of the probe is composed of a three-axis head, a measuring laser hole, an indication laser hole and a receiving window. The specific position is shown in Figure 3-1.



Pic 3-1 Schematic diagram of product exterior composition

Remark: The measurement laser is invisible light, no harm to human eyes, indicating that the green light is visible light, please do not look directly

3.2 Installation and Removal

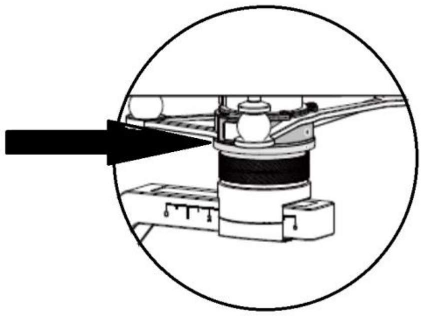
3.2.1 Installation Method

1. Align the white dot on the head with the red dot on the interface, and embed it in the installation position.
2. Rotate the head quickly disassemble the interface to the locking position to fix the head.

Pic 3-2-1 Installation and positioning diagram

3.2.2 Removal Method

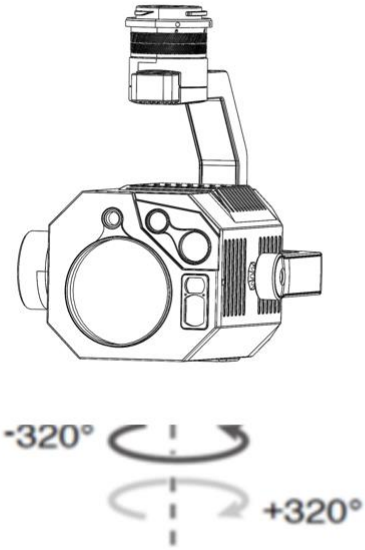
When removing the head, you need to hold down the unlock button to rotate the quick release interface of the head. For the convenience of the next installation, when removing the head, be sure to rotate the interface in place before removing the head.



Pic 3-2-2 Remove button diagram

3.3 Power-on Of Equipment

After the device is connected to the UAV, turn on the UAV power supply. At this time, please keep the UAV stable and do not touch the methane detector in the self-test rotation with your hand. Wait until the self-test passes after the rotation is over, and the power indicator is on and the data indicator is blinking.



Pic 3-3-1 Gimbal self-test to select the direction

3.4 Function Test

The gas storage device (such as transparent gas bag, transparent gas cylinder, etc.) is filled with methane gas, placed on the beam path, and the change of concentration and light intensity is observed to confirm that the methane gas in the gas storage device can be effectively detected.

Pic 3-4 Methane gas test

Note:In the test process, the reflection plane distance from the device is better than 3 meters, because the receiving window and the measurement light have a certain

Angle, greater than 3 meters test effect is best.

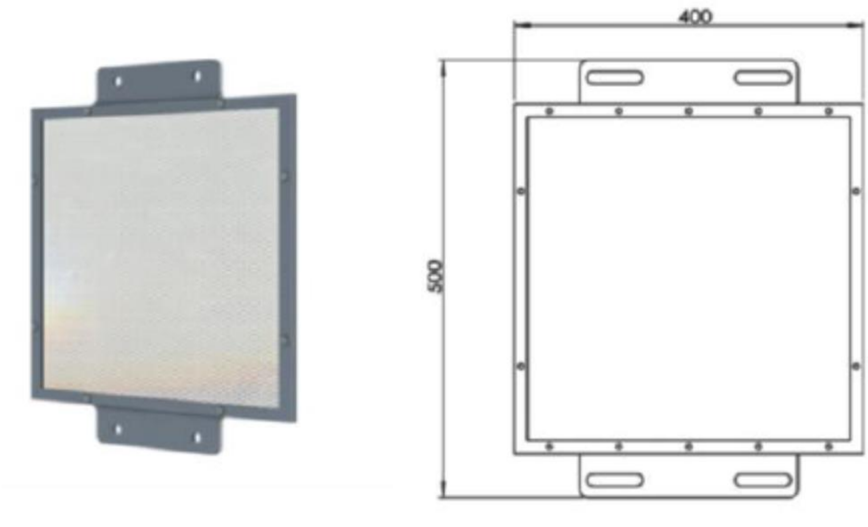
3.5 Usage Precautions

For the best results, please note the following:

1. Avoid laser damage to human or animal eyes.
2. Stay away from chimneys.
3. Keep away from steam vents and feathers.
4. Keep away from spatter and spray, such as mobile spray equipment, cooling towers, etc.
5. Do not face the sun light test, if the environment requirements must face the sun test, do a good job of installing shading equipment.
6. If any structural damage is found, stop using the device immediately and contact the manufacturer for maintenance.

Remote test method

If the customer uses the environmental detection distance is relatively far or more than 150 meters, it is recommended to use a standard reflector.



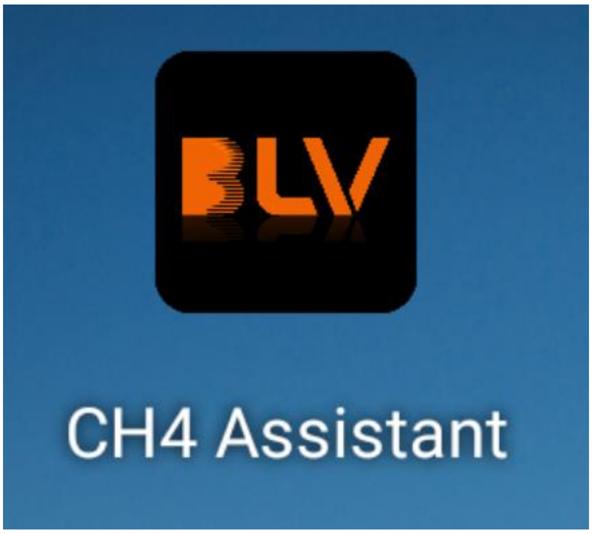
Pic 3-5 Standard reflector

4. Software and Cloud Platform Functions

The methane detection APP can view the UAV status and methane measurement data during inspection in real time. In case of pipeline leakage, the terminal device will automatically alarm and record the data (time, coordinates, leakage concentration, and on-site photos) so as to automatically generate inspection reports in the later stage.
The cloud platform receives real-time detection data and live broadcast of drone images; Data real-time display, route management, flight record management, media library management and other functions.

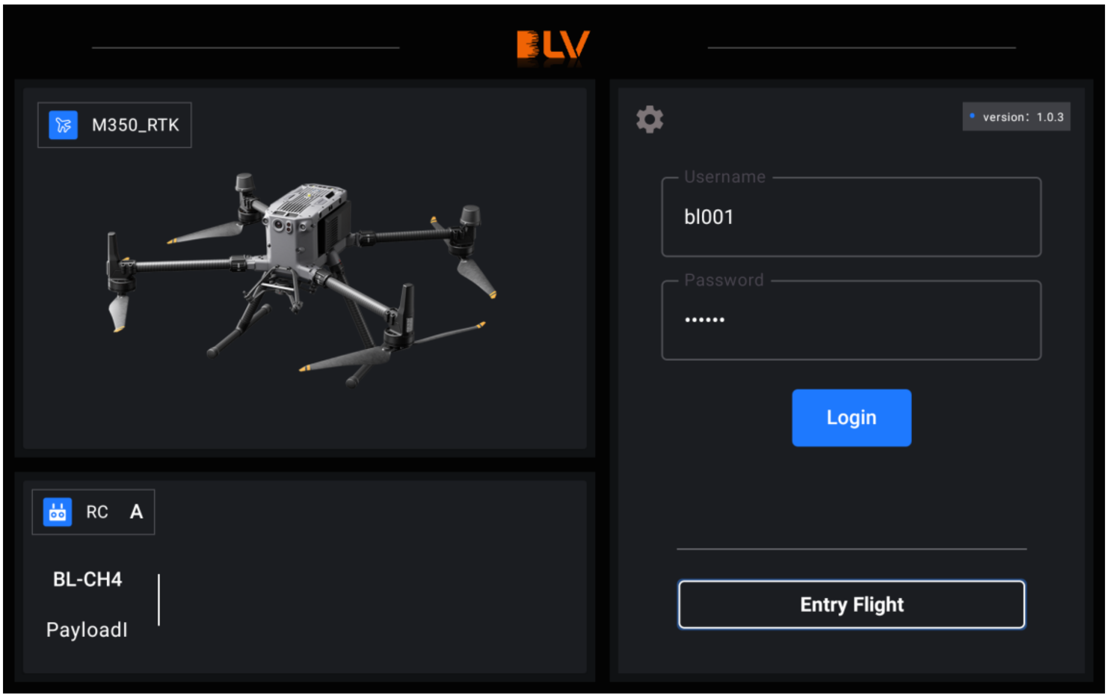
4.1 BLV Assistant APP Log-In

Open the Android desktop icon as shown in Pic 4-1 to enter the Laser Methane APP login interface.



Pic 4-1

As shown in Pic 4-1-2, the main page is divided into three areas: model display, device identification, and login account.



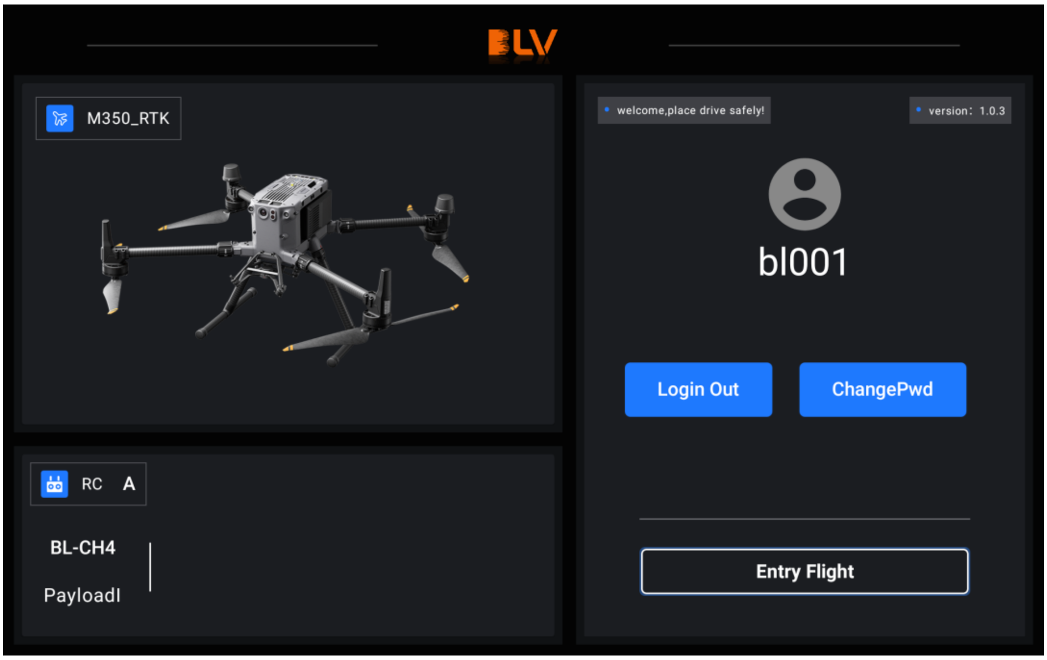
Pic 4-1-2

Model display: When the remote control is connected to the drone, the corresponding model picture can be displayed in this area.

Device identification: When the methane device or DJI H20 series camera is connected to the aircraft, this area can display the identified device. Due to the slow startup speed of DJI SDK, the device recognition is slightly delayed, please wait patiently for the device recognition to appear.

Login area: Only after entering the correct account, you can access the subsequent page of the app. You can change the password, log out, and change the login account in account operation. The interface after successful login is shown in Pic 4-1-3.

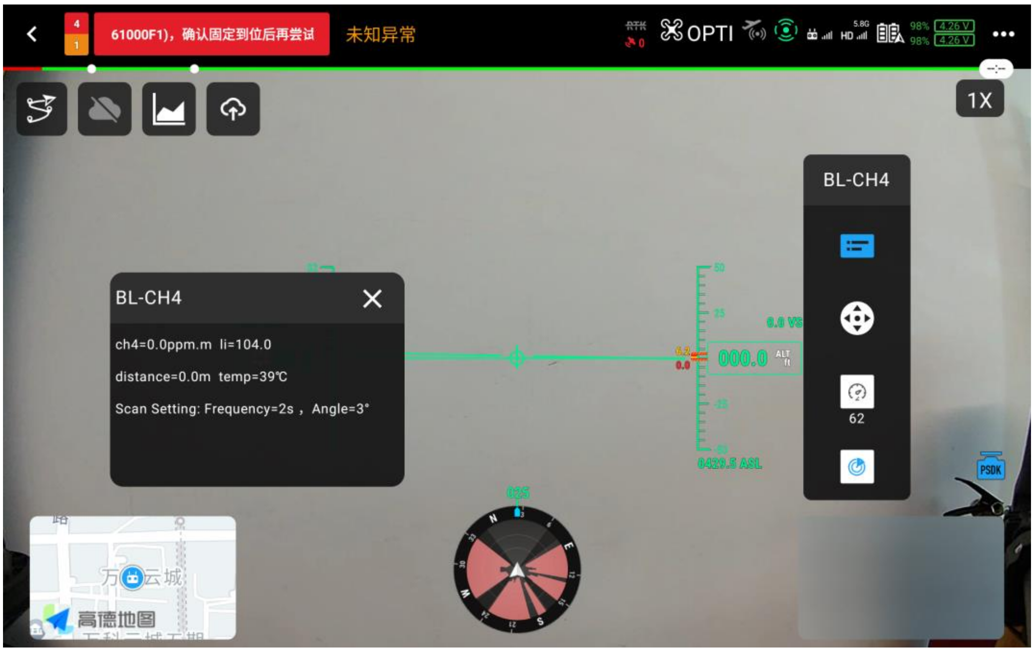
Login account: Cloud Platform - Device management - Device login account and password



Pic 4-1-3

4.2 BLV Assistant APP Operation

The laser methane APP software is developed based on DJI MSDK5.5. The overall functional layout and style refer to the design of DJI Pilot software. The operation page is mainly composed of four parts, namely sdk control, camera display, map display and function button, as shown in Pic 4-2-1. This note is mainly for the optimization and modification of the place to be detailed, other calls of the DJI control can refer to the DJI APP manual to understand.

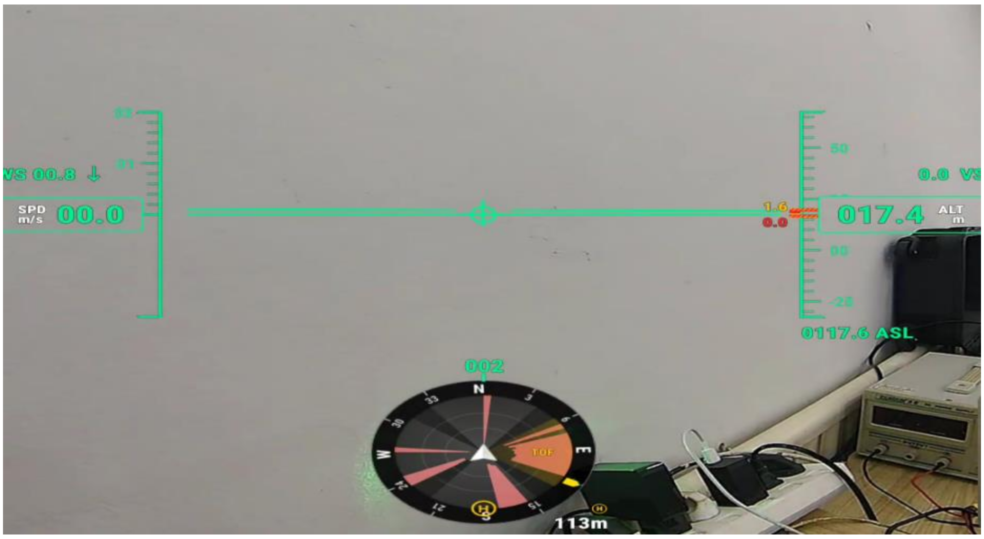


Pic 4-2-1

4.2.1 SDK Control

The SDK control is a control provided by DJI with the same functions as the DJI polit software. The upper part of the screen is the aircraft status and remaining power indicator bar as shown in Figure 4-2-2, and the lower part of the screen is the flight assistance indicator bar and navigation information indicator bar as shown in Pic 4-2-3.

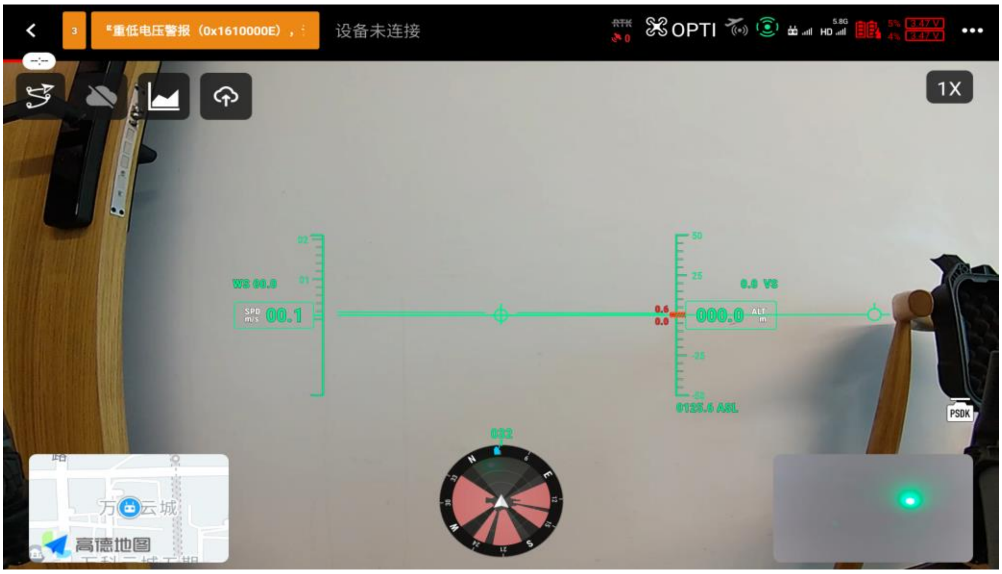
Pic 4-2-2



Pic 4-2-3

4.2.2 Camera Display

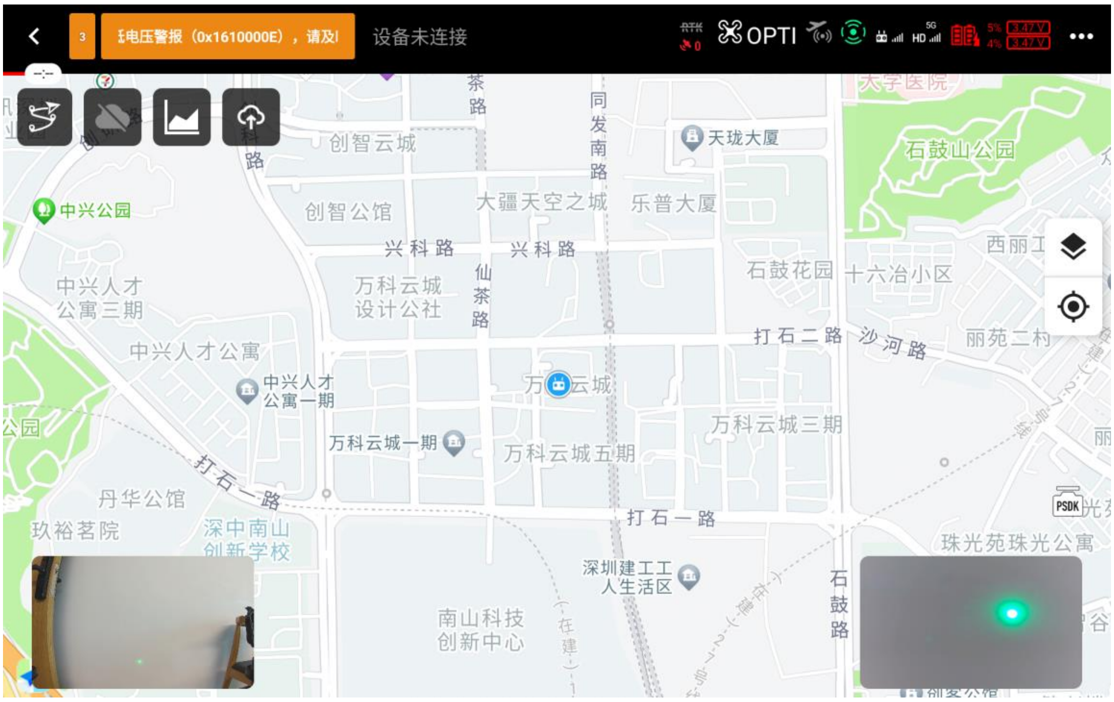
As shown in Pic 4-2-4, it supports switching between different lenses of FPV and H20 series cameras, and supports laser ranging, infrared temperature measurement, photography, zoom, video recording and other functions.



P4-2-4

4.2.3 Map Display

After the aircraft enters the flight path, the lower part of the screen can display the status information box as shown in Pic 4-2-5, which contains the aircraft information, route information, and methane detection information (blue represents methane in the graph directly below the screen, green represents light intensity).



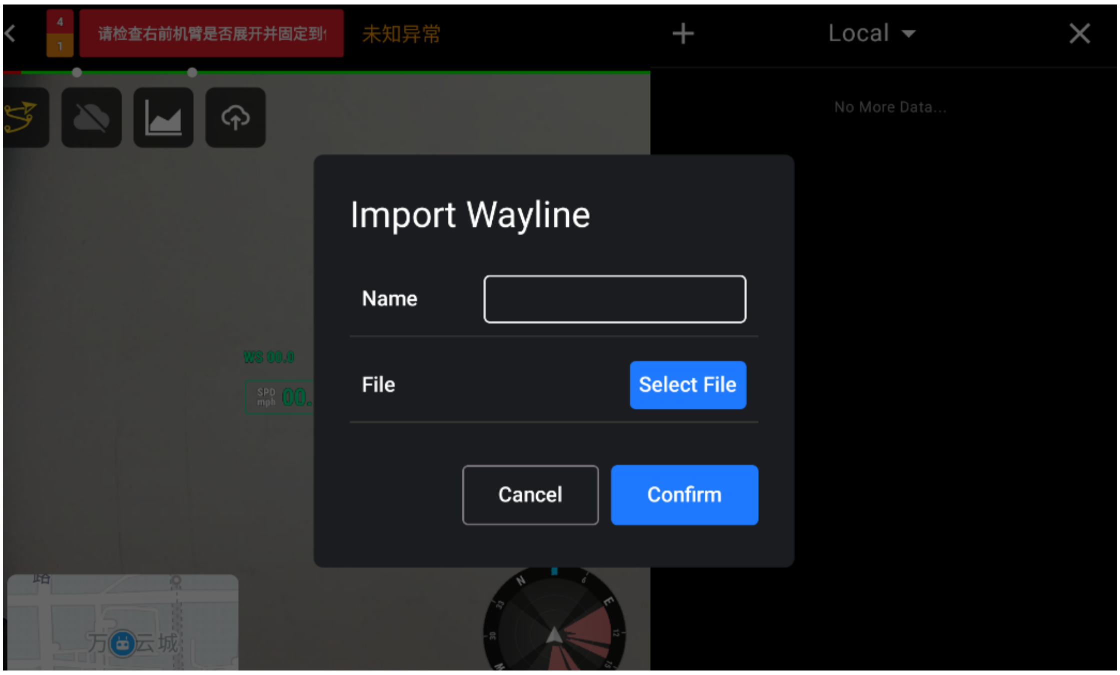
Pic 4-2-5

4.2.4 Function Button

4.2.4.1 Route Function

Before the flight, you can click the route button to select the local route as shown in Pic. 4-2-6, and then click "+" in the middle of the top screen to select the route as shown in Pic 4-2-7. After the route is uploaded, the UAV can conduct automatic flight inspection according to the route.

Pic 4-2-6



Pic 4-2-7

4.2.4.2 The Curve for the real-time concentration

Open the button  on the left side and the real-time curve display function shown in Pic 4-2-8. The curve display window can be freely dragged to any position on the screen, showing the maximum and real-time methane concentration values detected during the mission

Pic 4-2-8

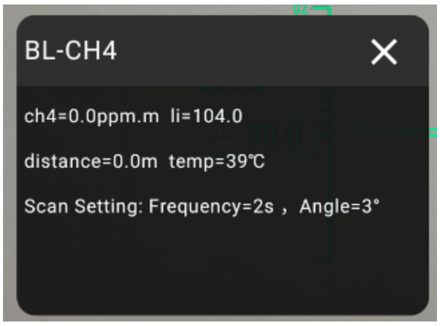
Due to the device's rapid response speed, it can output data 200 times per second. To facilitate the detection of instantaneous concentration values during the drone flight, it is recommended to enable the real-time curve function.

4.2.4.3 Parameter Setting

Click the button  for parameter setting as the picture 4-2-9 shown below.

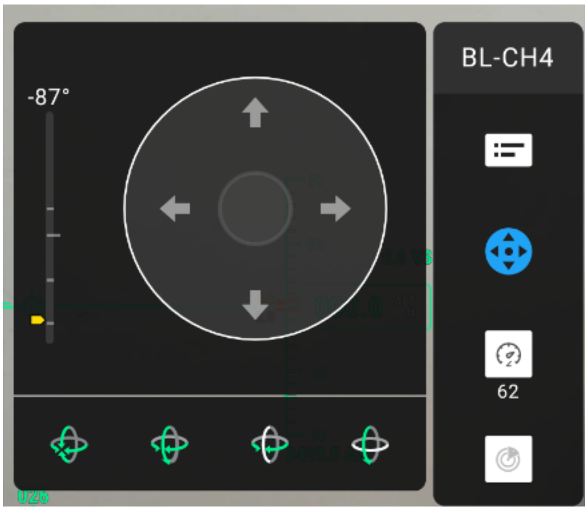
Pic 4-2-9

Click the button  and it will show the window below



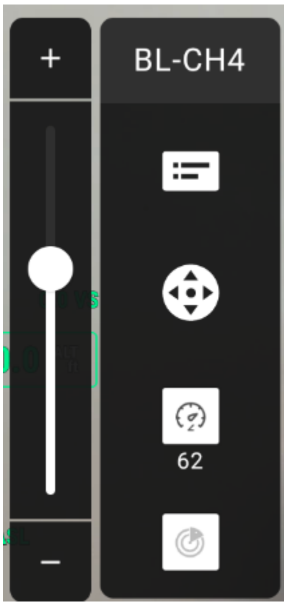
Pic 4-2-10

Clicking the button  and show the function bar as shown in picture 4-2-11.The indicators  (up,down, left, right) for manual adjustment of the gimbal angle. Below these indicators are four icons for quickly adjusting the gimbal to specific angles.



Pic 4-2-11

Clicking the button  and show the gimbal rotation speed adjustment bar as shown in Pic 4-2-12. Adjusting the gimbal rotation speed appropriately allows for quickly locating distant laser aiming points.

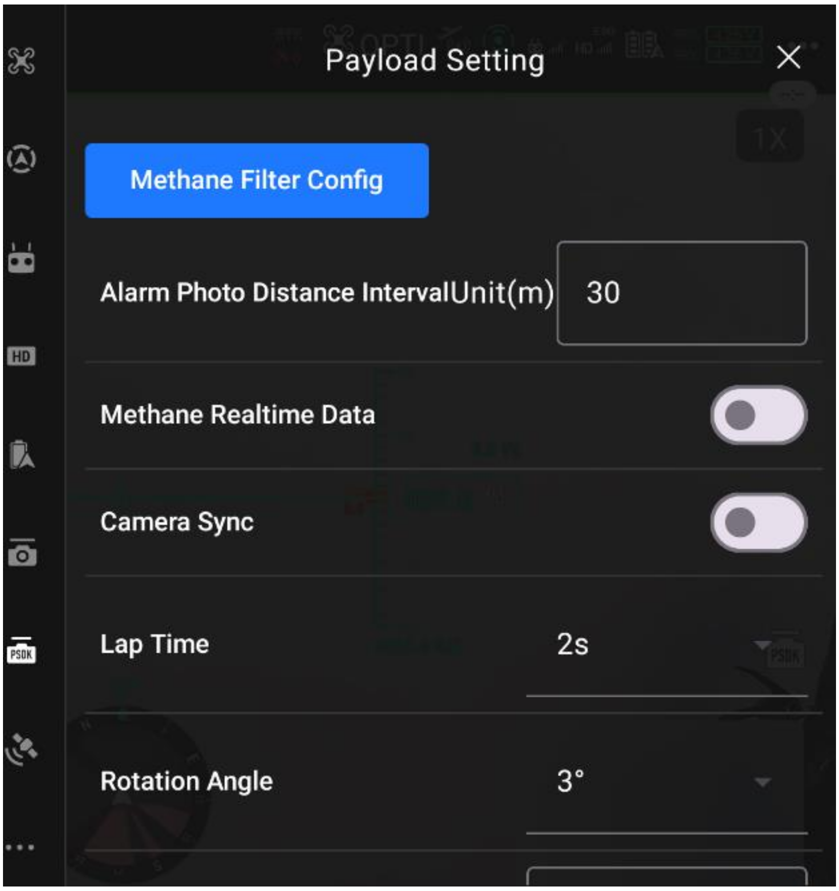


Pic 4-2-12

Clicking the button  and activate the rotating detection mode.It is essential to activate the gimbal rotating mode to enhance the success rate of methane detection during flight mission.

Remark: The button  only adjusts the gimbal speed in manual control mode and does not affect the speed of the gimbal in rotating mode.

Clicking the button in the top-right corner of the menu for the payload parameters setting. Specific parameters are shown in picture 4-2-13.



Pic 4-2-13

-Time for a single cycle: Set the time for a single round.

-Rotated degree:Set the angle for the sensor rotation

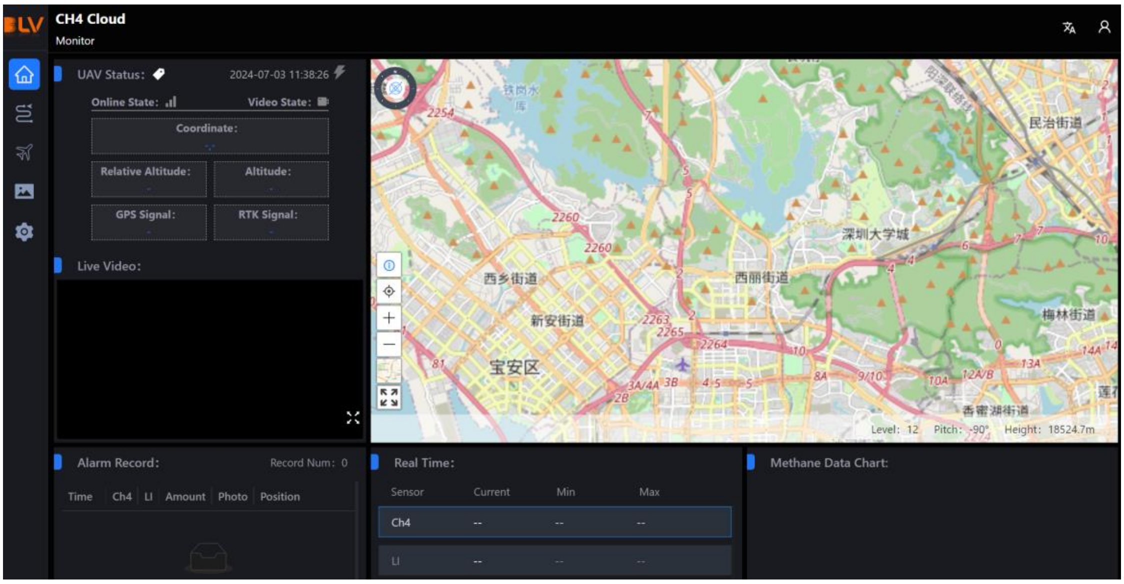
-Input route altitude: Input the rotation angle and relative altitude of the flight route, the diameter of the ground projection area can be calculated to determine whether the aircraft altitude and rotation angle settings are reasonable.

-Calculate the ground projection diameter: The ground projection diameter is the diameter of the circular area rotating detection by the methane sensor on the ground. It can be used to verify the detection area whether it is fully covered or not.

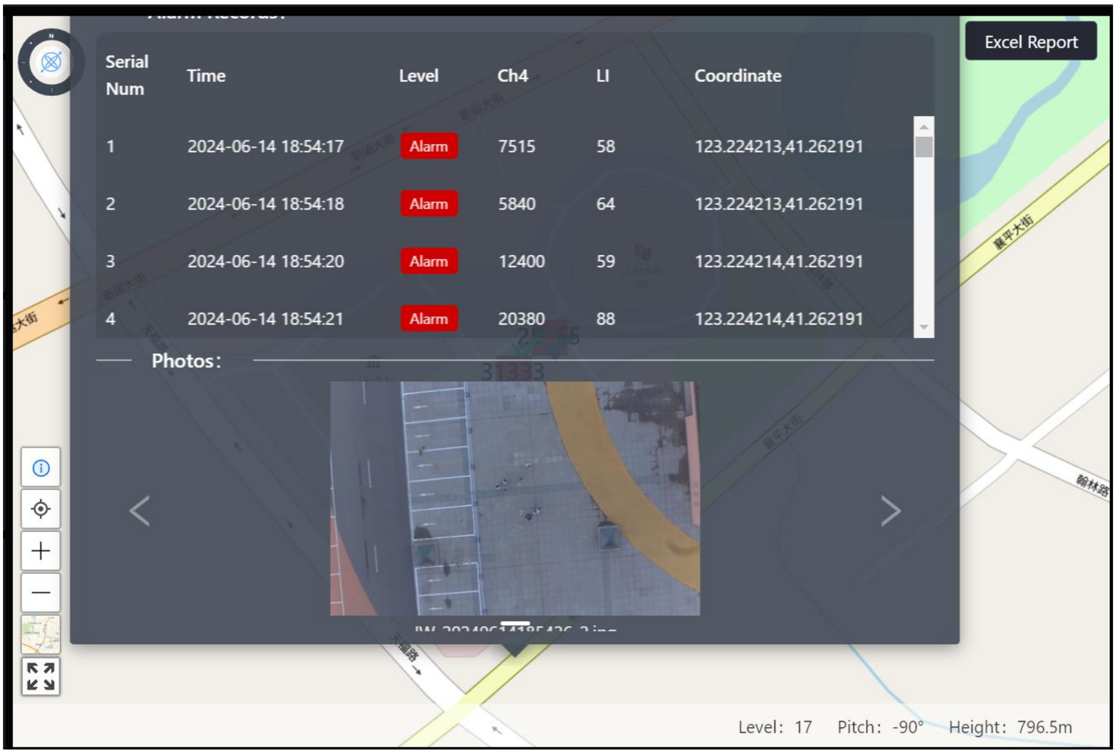
4.3 Cloud Platform Introduction

4.3.1 Homepage introduction

On the homepage, it shows the flight route, flight data, live video, methane concentration, methane data curve, alarm records in the real-time, and the interface is shown in pic 4-3-1 and 4-3-2.



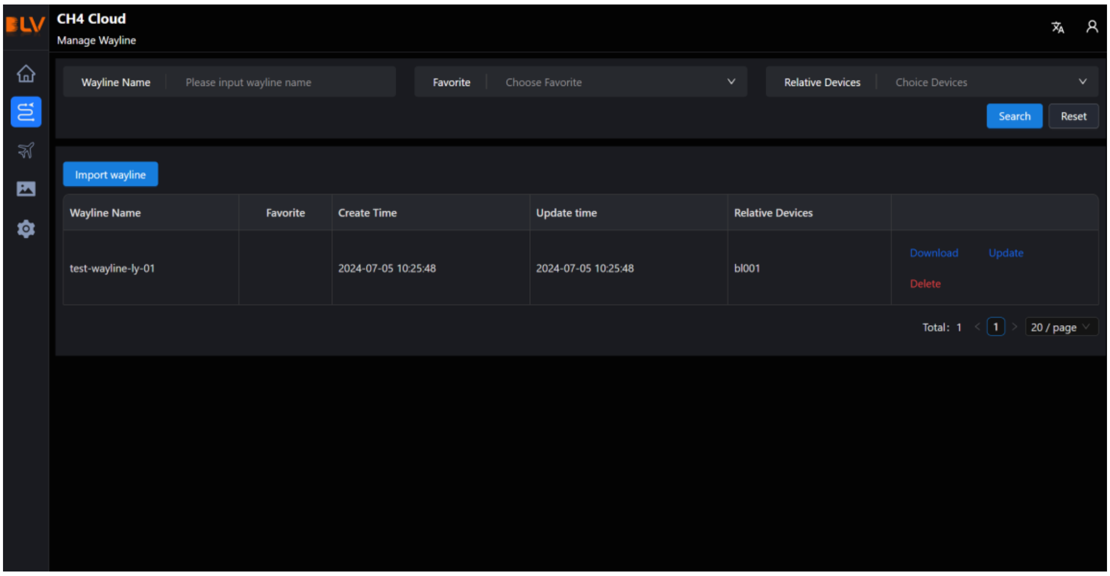
Pic 4-3-1



Pic 4-3-2

4.3.2 Flight Management

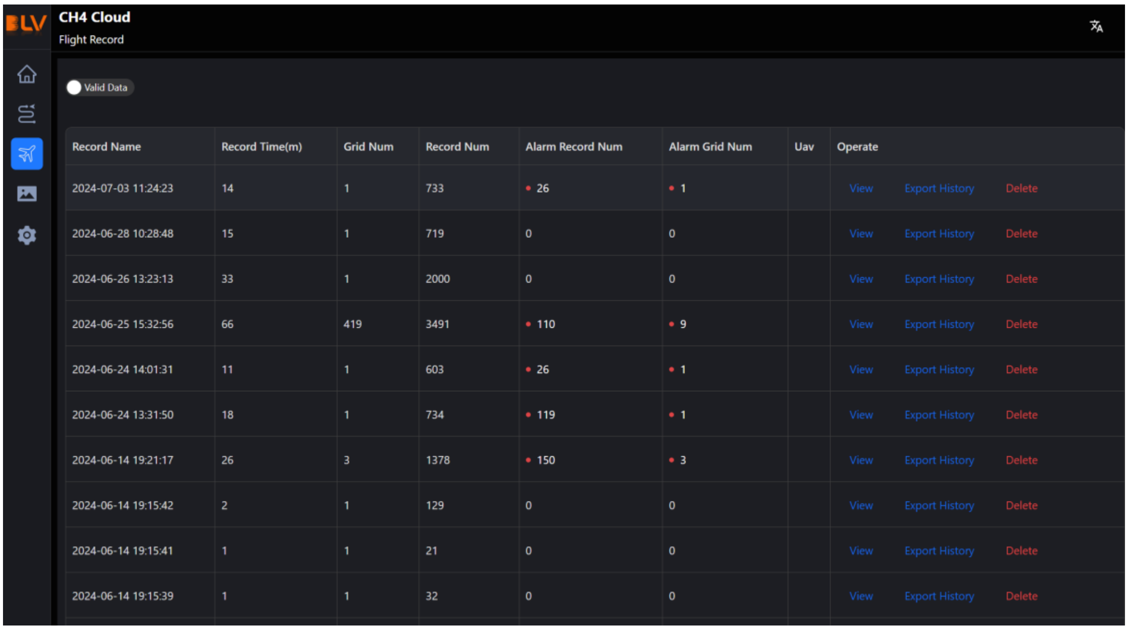
The function of flight management support to import the KMZ and KML files. As shown in pic 4-3-3, it can real-time synchronization to the App in the RC for mission plan.



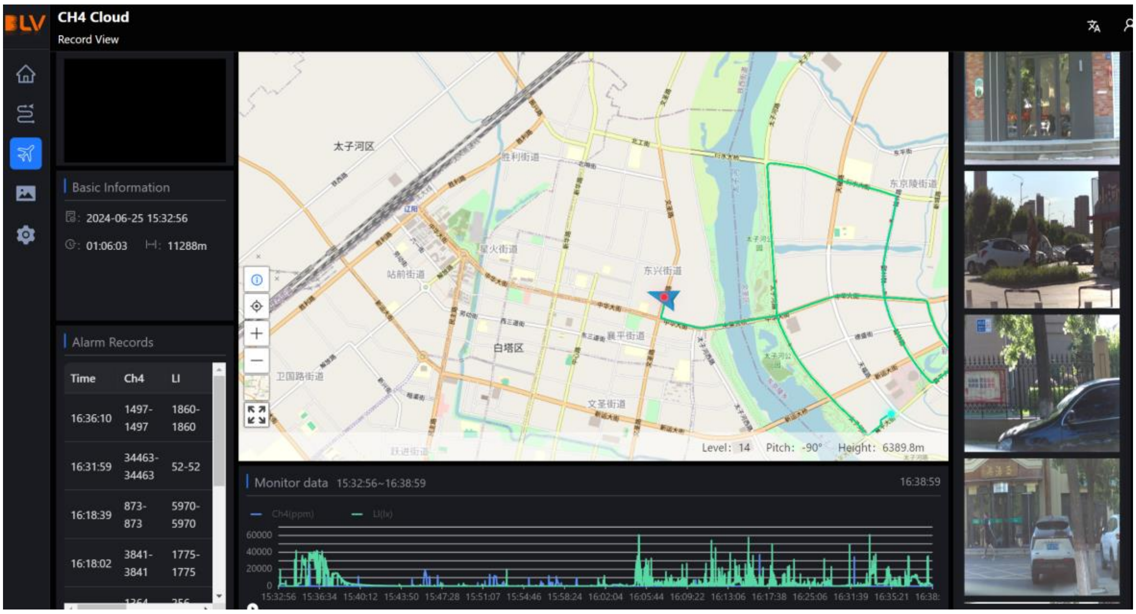
Pic 4-3-3

4.3.3 Flight record

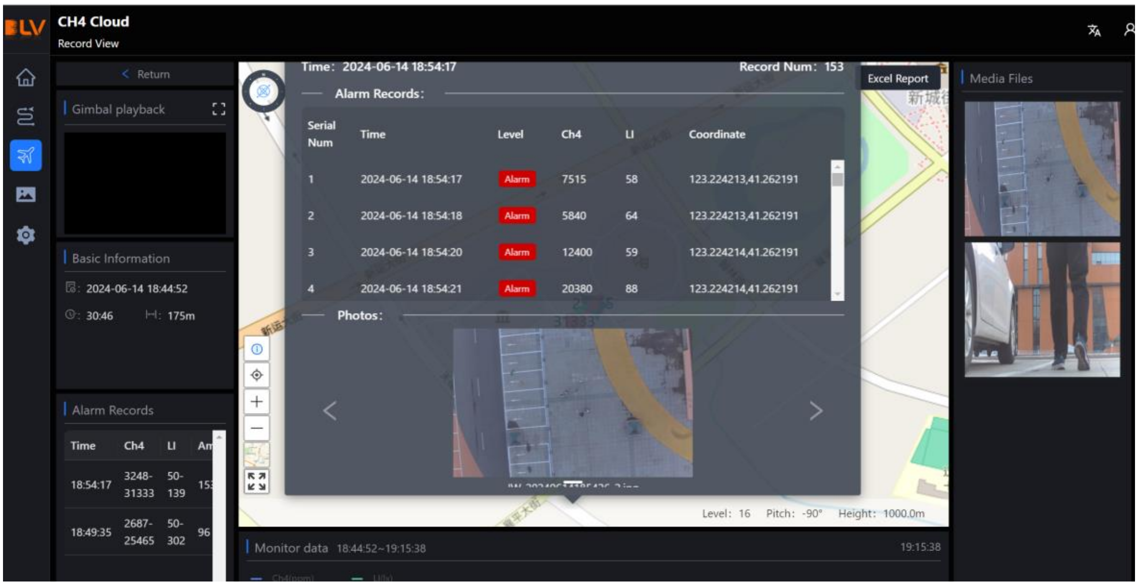
This function support to view the data by flight, and the flight data includes the flight route, methane detection result, report export, etc. As shown in pic 4-3-4, pic 4-3-5, and pic 4-3-6.



Pic 4-3-4



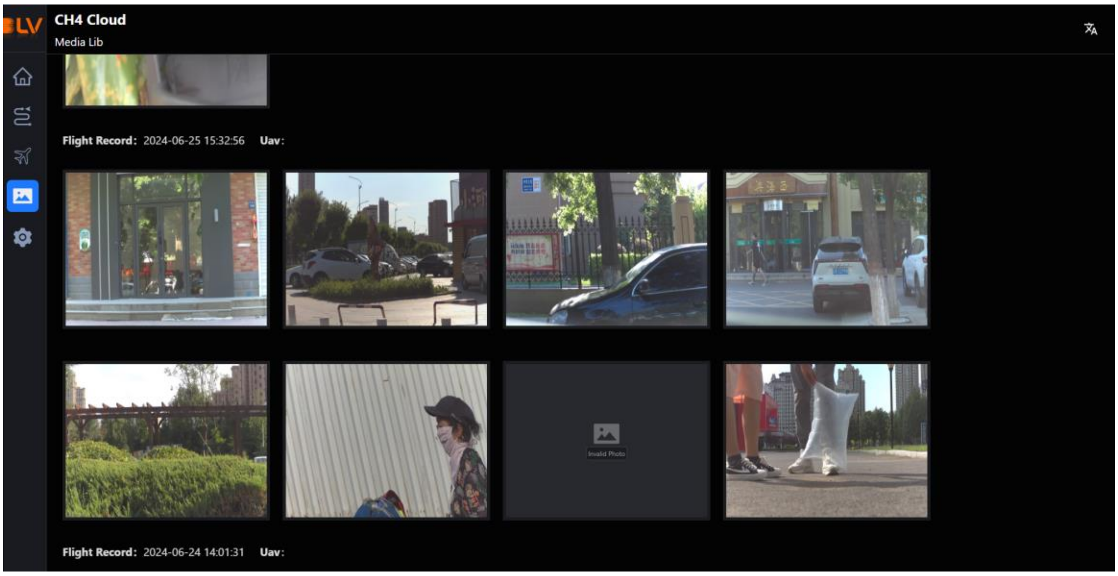
Pic 4-3-5



Pic 4-3-6

4.3.4 Media Library

It record the pictures taken by the BL-CH4 when it detects the methane leakage.

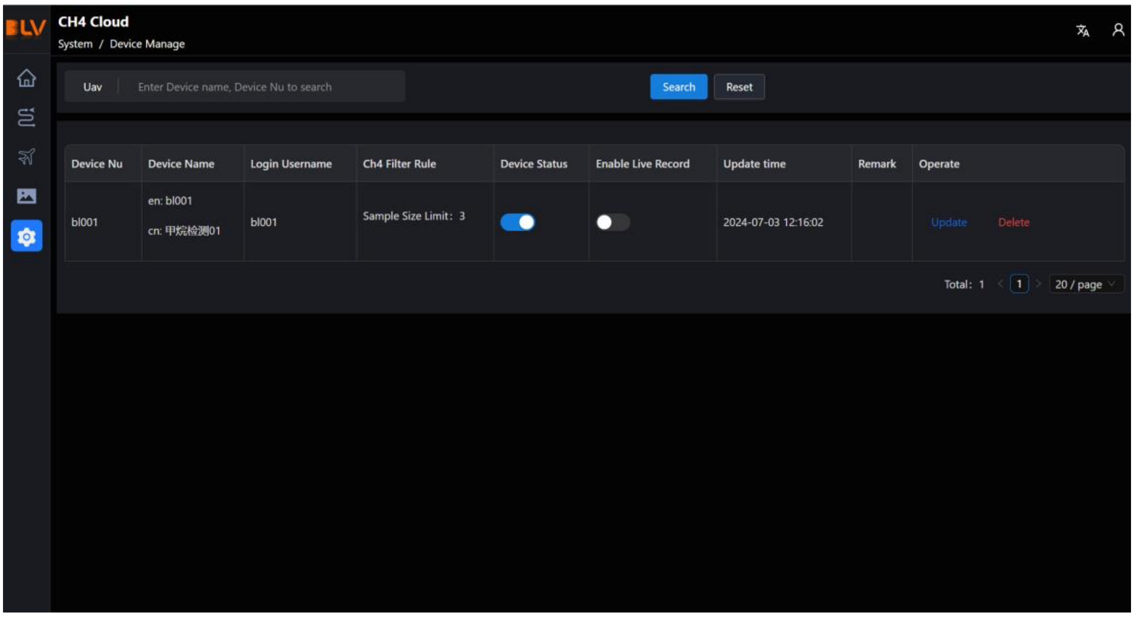


Pic 4-3-7

4.3.5 System Management

Description

It support the adding/removing the equipment, login ID/password setting, warming value setting.



5. Firmware Upgrade

5.1 Description for the Led status

Led light	Status	Description
Data record	Off	No TF card insertion detected, or abnormal methane sensor
	On	TF card insertion detected, no abnormal methane data
	Flash	TF card insertion is detected, methane has abnormal data, the storage record is completed
Initialization	Off	The system is failed to initiate
	On	The system is initiated successfully
	Flash	Detect the methane leakage, and alarming

Remark: If the device is tested indoors, the GPS cannot be searched and a record file named after time cannot be generated. In this case, even if there is abnormal methane data, it will not be recorded, and the storage LED will remain on and will not flash.

5.2 Firmware upgrade

It support upgrade the firmware on the App on the remote controller, when there is any new version for the firmware, it will be a reminder on the APP and click it to upgrade automatically.

6. After-sales Service and Maintenance

It recommends to send back the device to the manufacturer for calibration every 2 years. This device is a precision electronic product. A correct using habits will help protect the device’s performance and extend its service life. Please pay attention to the following points:

1. Wipe with a soft cloth to avoid scratching the device, especially the laser receiving lens.
2. The device should be handled with care and must not be dropped or pressed heavily, otherwise the device will be deformed and the internal circuit board will be damaged.
3. Please do not disassemble or modify the device without permission.
4. Please do not modify the parameters of the equipment without permission. If modification is required, please operate under the guidance of the manufacturer's technical staff.

Remark: When performing routine maintenance, the device needs to be powered off.

7. Warranty

Warranty Commitment: For all laser methane products purchased through our official distributor, the product warranty period is 12 months from the delivery date.
The warranty does not cover normal wear and tear of the product, nor does it cover defects caused by abuse, accident, misuse, modification, or defects caused by failure to install, maintain or use the product in accordance with the instructions in this manual. We assume no liability.
During the warranty period, we provide free maintenance services, but if the following circumstances occur, the material cost and labor time fee will be charged as appropriate:

1. Damage caused by failure to operate.
2. Damage caused by unauthorized disassembly;
3. Damage caused by the irresistible natural disasters

Warranty service: Regulations on after-sales service of BLV Tech

Party A: Buyer of Products Party B: Shenzhen BLV Technology Co., Ltd

The after-sales service content shall refer to the after-sales service regulations of BLV Tech;
If you have any questions, please contact our after-sales service and technical support tel: +86 135 90241527 (working days 9:00-18:00 Beijing time)

If you have any questions about the product

Please contact us via email：

INFO@BLVGEOTECH.COM

SHENZHEN BLV TECHNOLOGY CO.,LTD