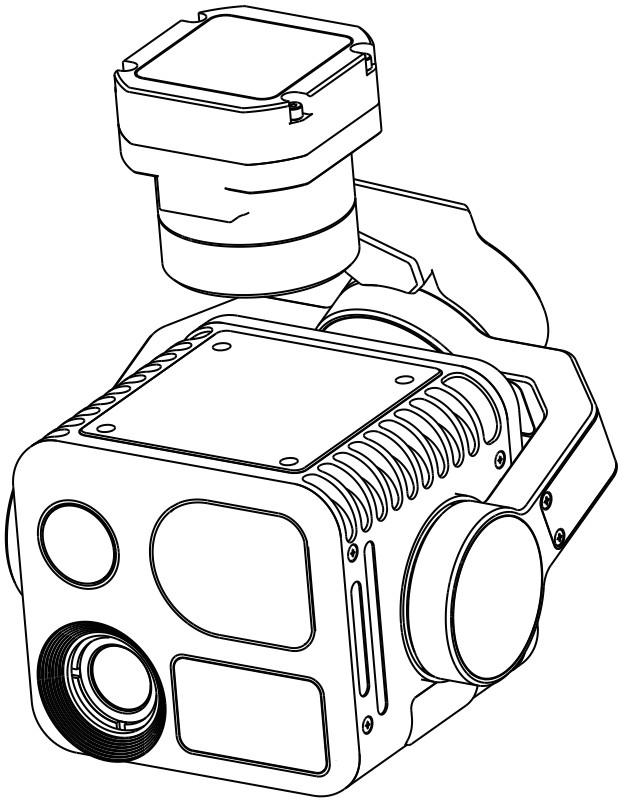
# K40T 4-Sensor AI Gimbal Camera User Manual

V1.0 202506



Shenzhen HEQ Intelligent Technology Co.,Ltd.

# CONTENT

# 1、Product Introduction

The K40T four-sensor AI gimbal camera is a professional drone inspection payload that integrates a high-precision, lightweight three-axis stabilization system, multiple sensors, and 6TOPS computing power. The K40T four-sensor AI gimbal camera has high resolution and long observation distance, and has a control stability of ±0.005°. The whole machine weighs only 290g (±5g). The system includes multi-dimensional dedicated sensors: 48MP telephoto camera, 48MP wide-angle camera, 640×512 resolution thermal imager and 1.2km laser rangefinder (±1m accuracy), supporting all-time and complex environment inspection operations. The K40T has built-in computing power, which can realize real-time personnel/vehicle/vessel identification, dynamic target tracking, fire heat source warning, and face/license plate recognition under regulatory conditions. Users can flexibly configure multi-screen split-screen output, and simultaneously store H.264/H.265 videos and JPEG and other format images, which significantly improves the operation efficiency of scenes such as security inspection, disaster monitoring and engineering survey.

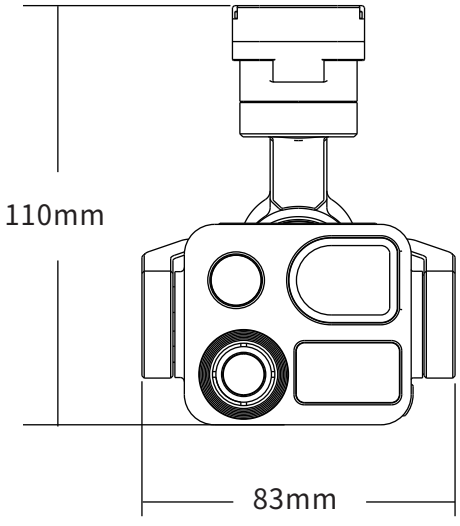
# 2、Product Function Parameter

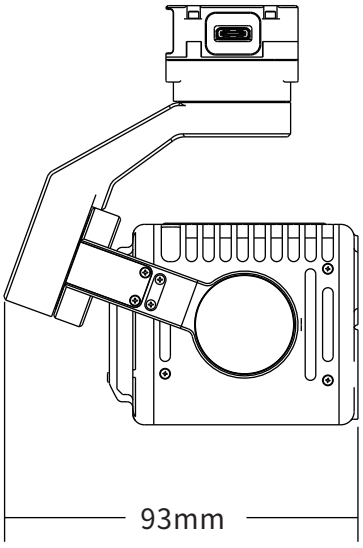
| | | |
|---|---|---|
| **Basic Parameters** | Voltage | 12V-18V |
| | Weight | 290g±5g |
| | Conventional Power Consumption | 12W |
| | AI Power Consumption | 20W |
| | Optical Zoom | 11X |
| | Hybrid Zoom | 160160X |
| | Thermal Imaging Resolution | 640*512 |
| | Range Finder | 5m~1200m |
| | Visible Light Resolution | 48MP (wide angle, telephoto) |
| | Operating Environment | -20℃~+55℃ |
| | Control Method | Serial port TTL/Sbus/Network |
| | TF Card Image Storage Format | JPG (default 12M, maximum 48M) |
| | TF Card Video Storage Format | MP4 (default 1200W) |
| | Encoding Format | H264、H265 |
| | Private Model Embedding | supported |
| | Recognition and Tracking | supported |
| **Wide-Angle Camera Parameters** | Size | 1/2"CMOS |
| | Effective Pixels | 48MP |
| | Resolution | 8000(H)x6000(V) |
| | Wide-Angle Focal Length | 4.49mm Equivalent to 24mm |
| | Field of View | DFOV 83.4° |
| | Focus | 5m~infinity |
| | Wide-Angle Aperture | F2.8 |

| | | |
|---|---|---|
| **Hybrid Zoom Camera Parameters** | Size | 1/2"CMOS |
| | Pixels | 48MP |
| | Resolution | 8000(H)x6000(V） |
| | Focal Length | f:15~50mm<br>Equivalent focal length 81~270mm |
| | Aperture | FNo: 3.7~4 .5 |
| | Minimum Focus | 5m |
| | Field of View | 24.1°~7.3° |
| **Thermal Imaging Parameters** | Spectral Range | 8 μm~14 μm |
| | Resolution | 640x512 |
| | Focal Length | 13.1mm |
| | Thermal Sensitivity | ≤50mK@f1.0(@25℃) |
| | Measurement Operating Temperature | -10℃~+50℃ |
| | Sensing Range | -20℃~+150℃， +100℃~+550℃ |
| **Range Finder Parameters** | Measuring Range | 5-1200m |
| | Measurement Accuracy | ±1m |
| | Measurement Resolution | 0.1 m |
| | Laser Divergence Angle | 3.2 mrad |
| | Laser Band | 905nm |
| | Measurement Frequency | 1~10Hz |

| | | |
|---|---|---|
| **Gimbal Parameters** | Working Mode | Three-axis stabilization |
| | Software Limit Angle | Pitch: -90° to +30° |
| | | Yaw: -120° to +120° |
| | Mechanical Structure Angle | Pitch: -125° to +85° |
| | | Roll: -45° to +45° |
| | | Yaw: -135° to +135° |
| | Angle Jitter | ±0.005° |
| | Gimbal Mode | Supports one-key return to center, one-key down, auto-tracking |

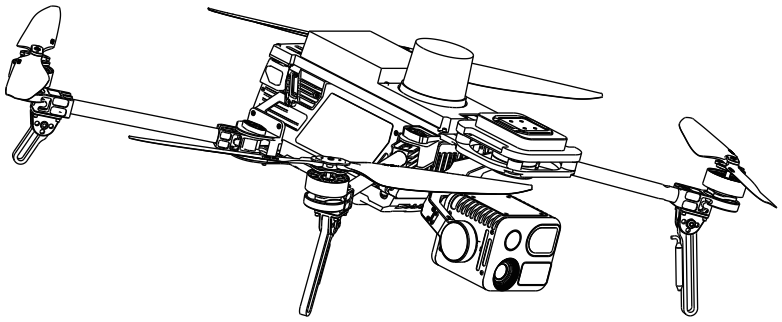
## 3、Gimbal Appearance Dimensions



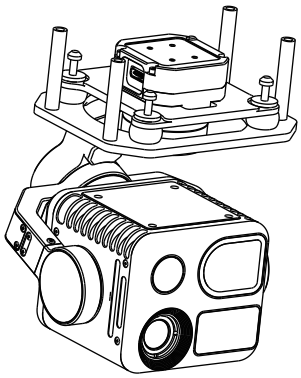
# 4、Product Installation

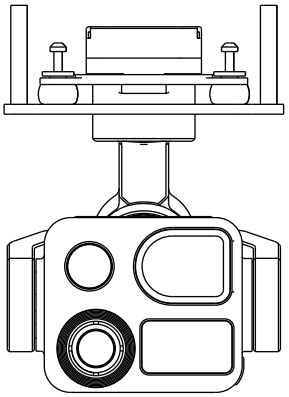
**Please go to the official website "Download Center" to download the product 3D model: https://www.hequavtech.com/**

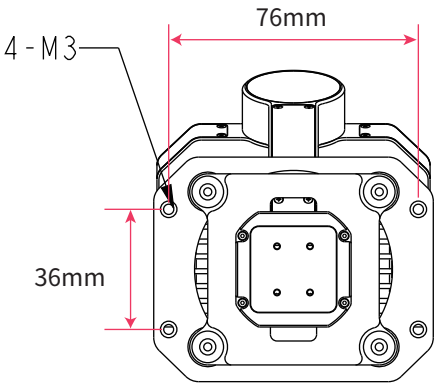


**Installation Example 1**

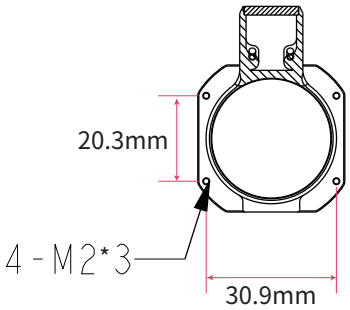
**Installation Example 2**





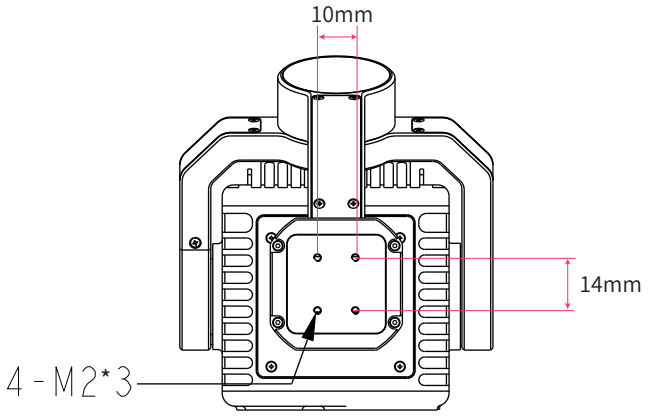



**Installation Method 1**



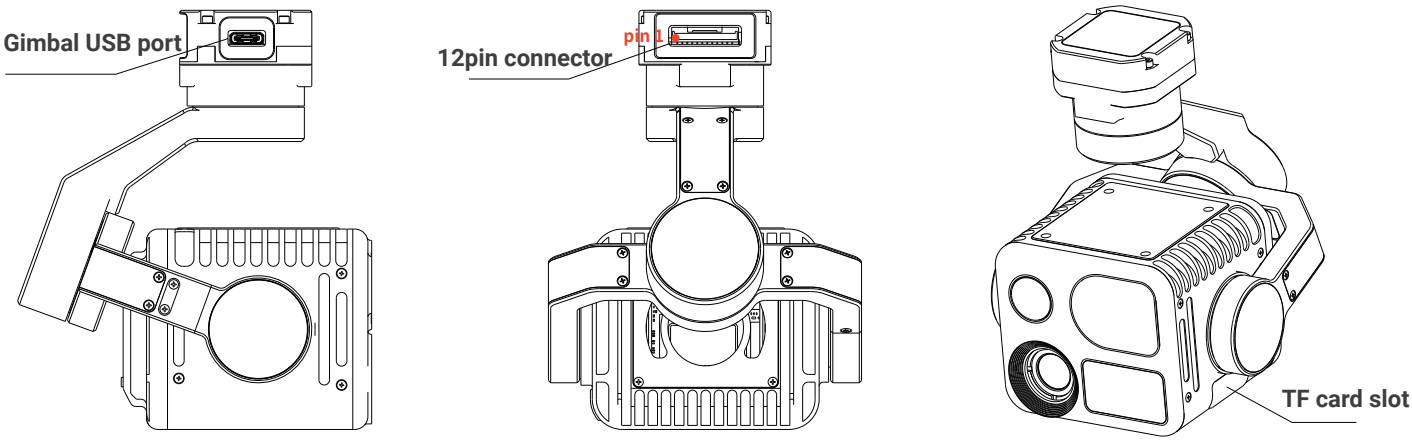

**The upper bracket installation holes, 4 M2*3mm screws, the hole spacing is 20.3mm and 30.9mm respectively.**

**Installation Method 2**




**The upper bracket installation holes, 4 M2*3mm screws, the hole spacing is 10mm and 14mm respectively.**

# 5、Product Hardware Interface




| Model | Interface Type | Function |
|---|---|---|
| Gimbal USB | USB Port | Gimbal upgrade and debugging |
| Memory card interface | TF card interface | Store photos and videos/upgrade camera and gimbal firmware |

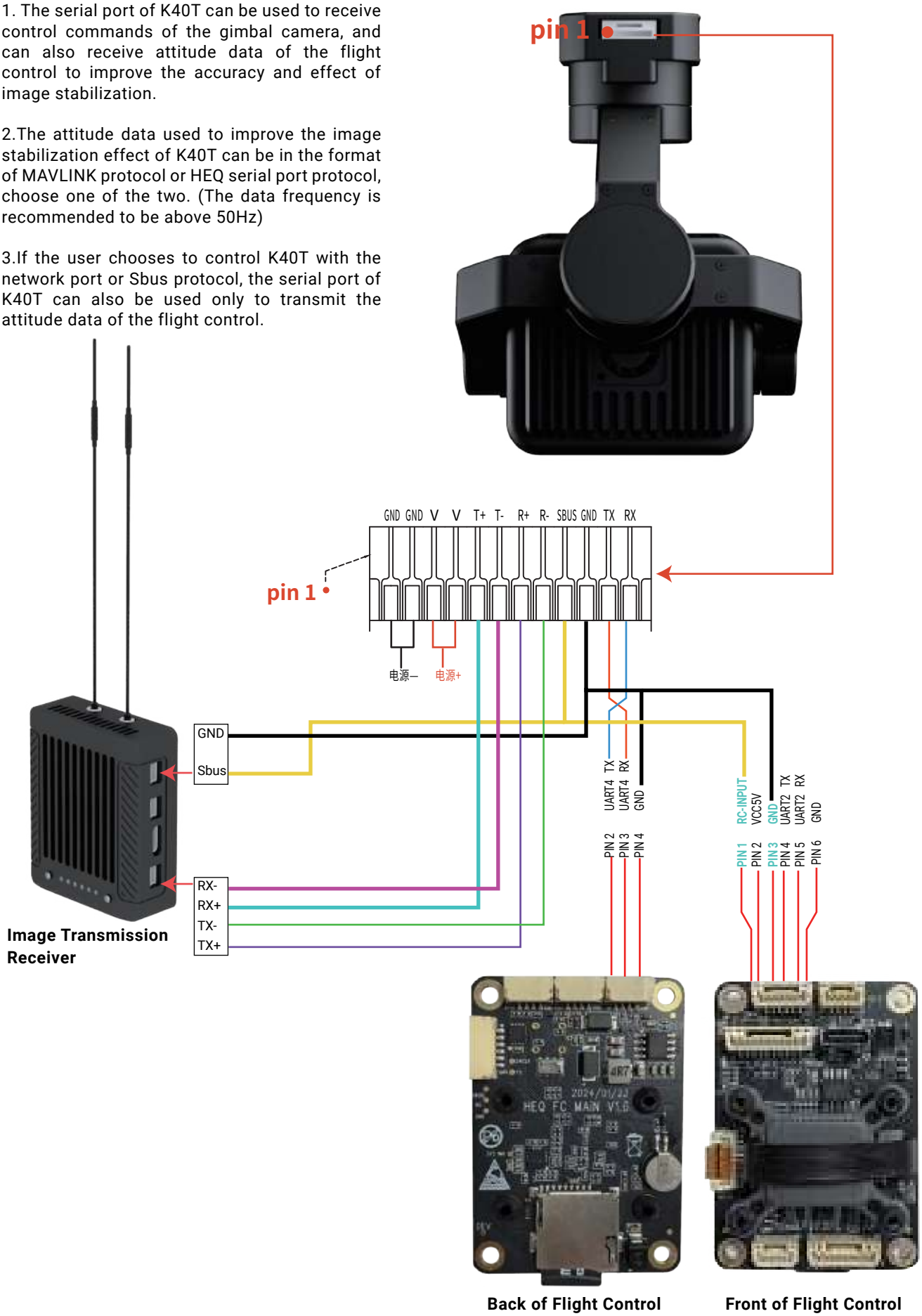
| No. | Model | Interface Type | Interface Definition | Function |
|---|---|---|---|---|
| 1 | 12PIN(GH1.25mm) Connector | Power Interface | GND | GND |
| 2 | | Power Interface | GND | GND |
| 3 | | Power Interface | 12V-18V | Power Input |
| 4 | | Power Interface | 12V-18V | Power Input |
| 5 | | Communication Interface | T+ | Network Interface |
| 6 | | Communication Interface | T- | Network Interface |
| 7 | | Communication Interface | R+ | Network Interface |
| 8 | | Communication Interface | R- | Network Interface |
| 9 | | Communication Interface | SBUS | |
| 10 | | Communication Interface | GND | |
| 11 | | Communication Interface | TX | TTL Serial Port |
| 12 | | Communication Interface | RX | TTL Serial Port |

**Gimbal and UAV System Connection Diagram**

Important Notes:
1. The serial port of K40T can be used to receive control commands of the gimbal camera, and can also receive attitude data of the flight control to improve the accuracy and effect of image stabilization.

2.The attitude data used to improve the image stabilization effect of K40T can be in the format of MAVLINK protocol or HEQ serial port protocol, choose one of the two. (The data frequency is recommended to be above 50Hz)

3.If the user chooses to control K40T with the network port or Sbus protocol, the serial port of K40T can also be used only to transmit the attitude data of the flight control.



# 6、Product Control Interface and Protocol

| Control Type | Interface | Protocol |
|---|---|---|
| Gimbal control | Network/serial port/Sbus | Please go to the official website: https://www.hequavtech.com/ “Download Center” to download the network/serial port protocol; Sbus protocol is a universal standard protocol for drone remote controllers. For specific setting methods, refer to 7. Product Assistant Software Usage Guide of this document for setting. |
| Video stream | Network | Default RTSP push stream, pull stream address : rtsp:// 192.168.144.64:558/live/single , Before starting the video, please make sure that the network segment of the device is consistent with that of the K40T gimbal camera. (The K40T Assistant Software supports IP address settings. For details, please refer to 7. Product Assistant Software Usage Guide) |

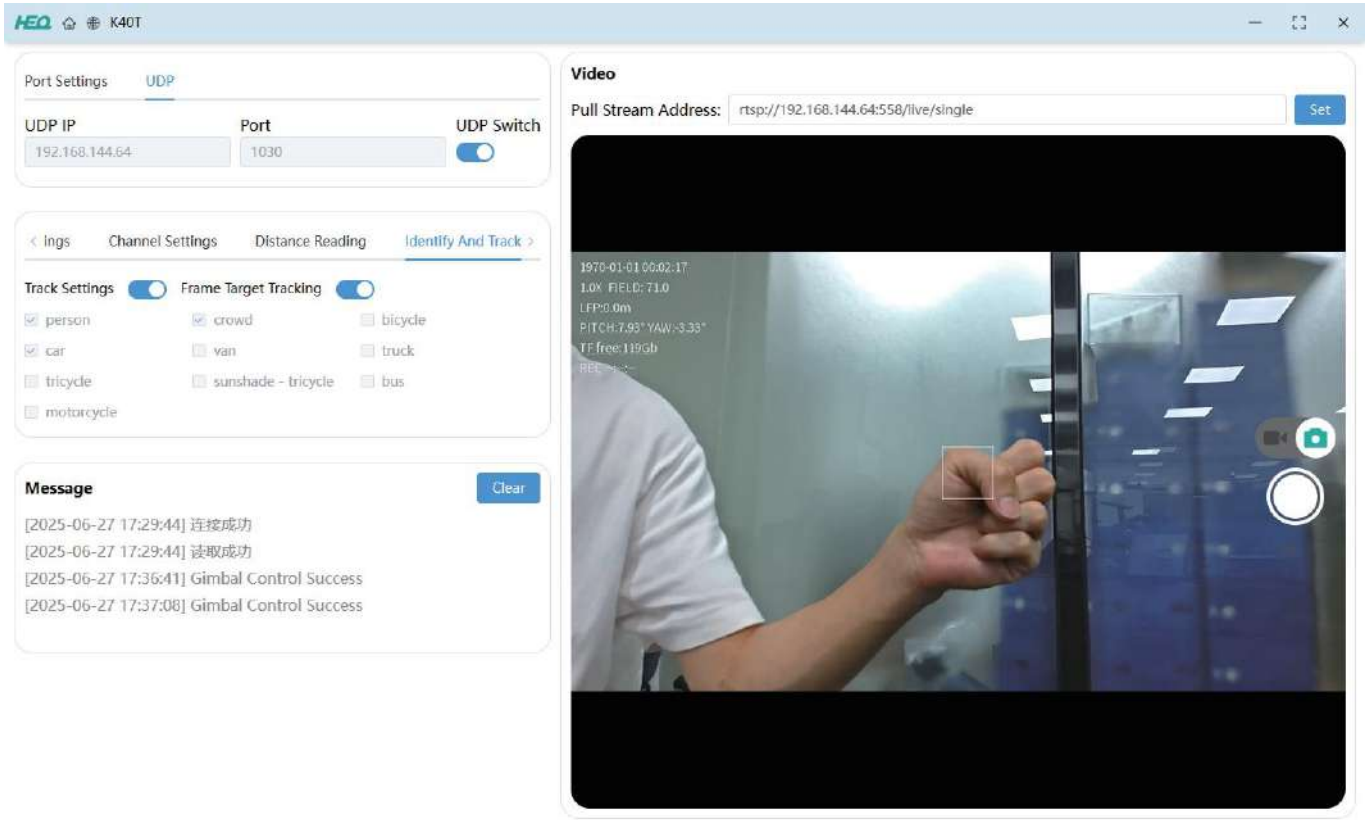
# 7、Product Assistant Software Usage Guide

Please go to the official website "Download Center" to download the assistant software: https://www.hequavtech.com/

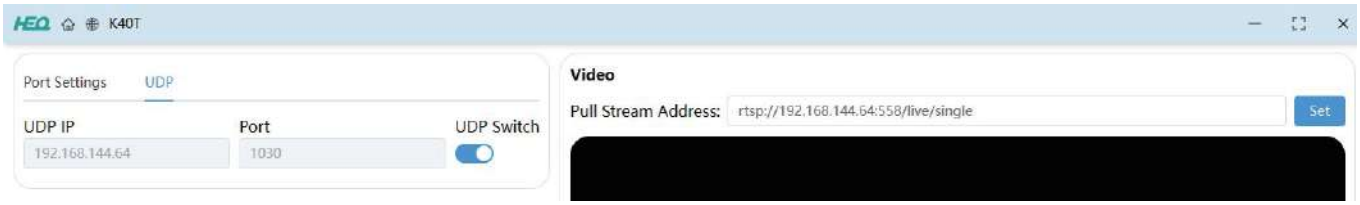
### 7.1 Assistant Software Interface


Enter the assistant software page and select the corresponding product model. If you need to switch the language version, please click the icon below to set it.

After entering the page of the corresponding product model, the interface is as follows:



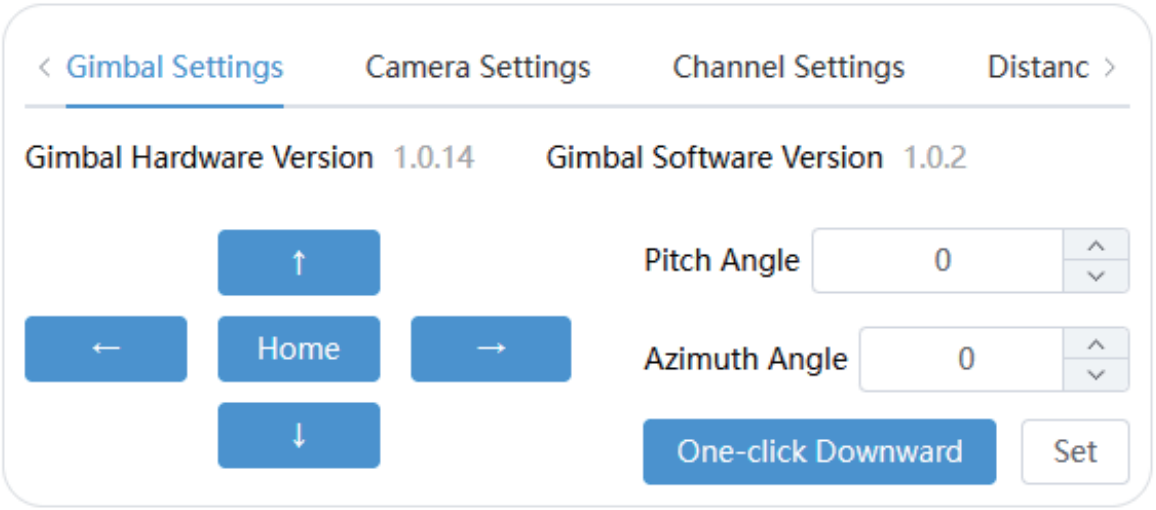

### 7.2 Connection Settings




Users can choose serial port or UDP connection mode according to actual conditions.
For specific parameter settings, refer to the table below:

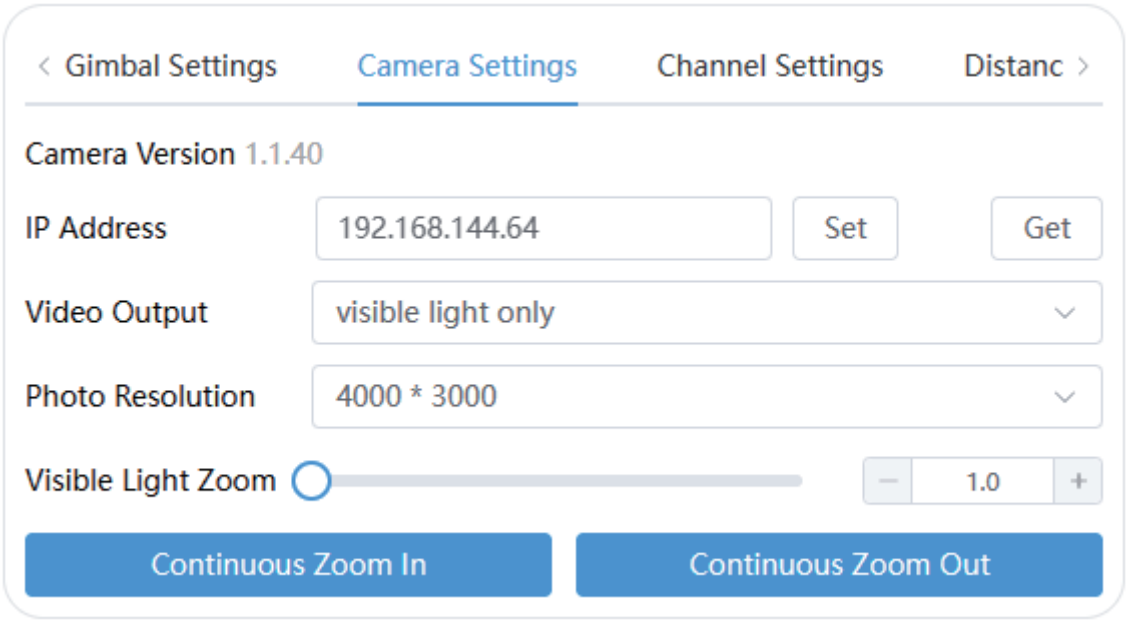
| Interface Type | Parameters/Settings | User Settings Supported Or Not |
|---|---|---|
| Serial port baud rate | Default：115200 | NO |
| UDP address | Default：192.168.144.64 | Yes (IP address) |
| Video playback address | Default ： rtsp://192.168.144.64:558/live/single | Yes (IP address) |

### 7.3 Gimbal Control



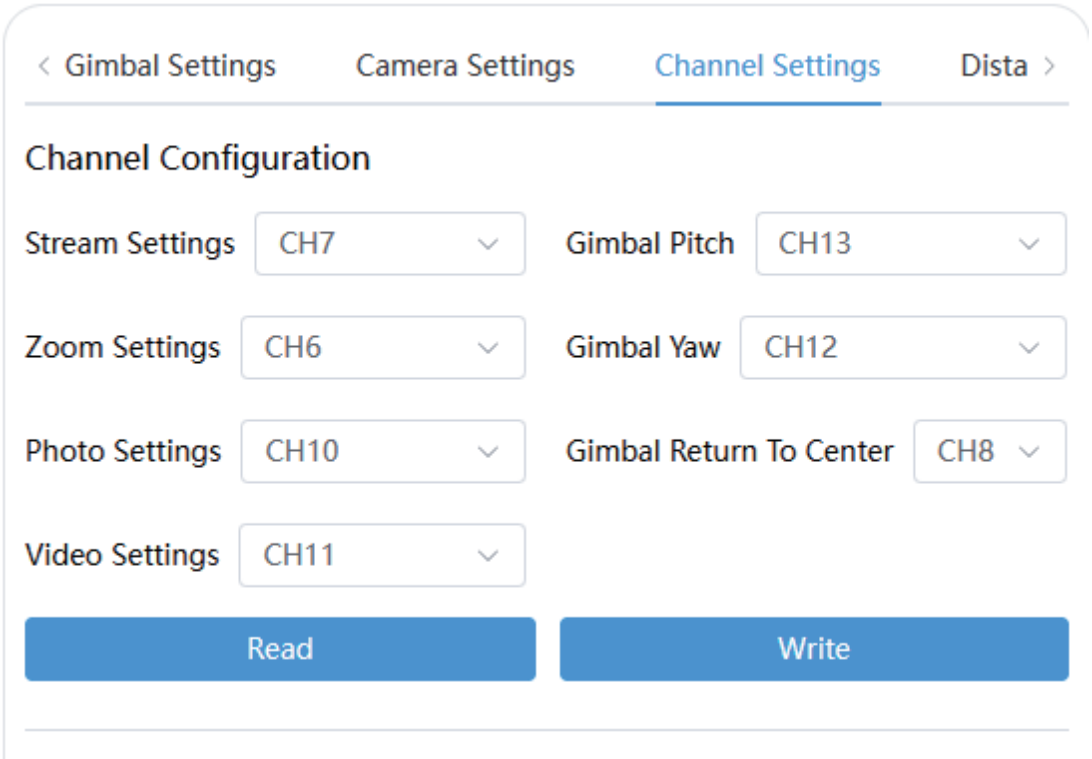

Users can click the gimbal control button to control the gimbal speed and angle. The gimbal control speed will have an adaptive relationship with the zoom ratio. For example, the higher the zoom ratio, the lower the gimbal movement speed.

### 7.4 Video Stream Camera Type Settings



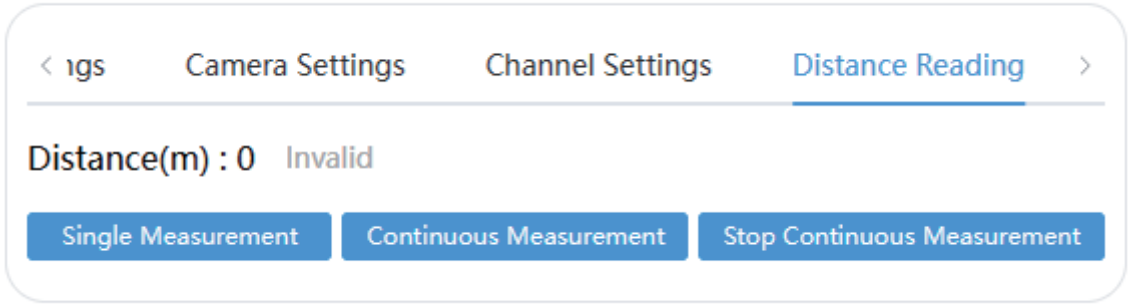

The assistant software can select the camera type of the video stream (such as wide-angle, telephoto and thermal imaging), and can perform zoom operations. For example, in the thermal imaging type, color palettes can be switched.

### 7.5 Sbus Function Settings



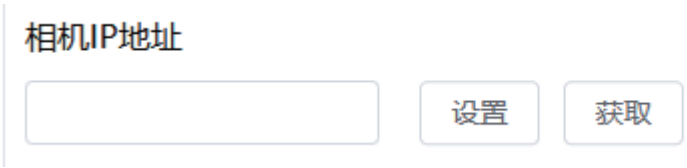

If the user uses Sbus for gimbal camera control, the user can enter the interface shown above to set the channel mapping. After setting the corresponding channel, click "Write" to save the setting. Click "Read" to obtain the current mapping status.

### 7.6 Distance Measurement Function




The assistant software provides single distance measurement, continuous distance measurement and stop continuous distance measurement buttons, and users can perform functional tests according to their needs.
Note: The reference range of the K40T rangefinder is 5m~1200m, and the actual test data may vary due to the environment.

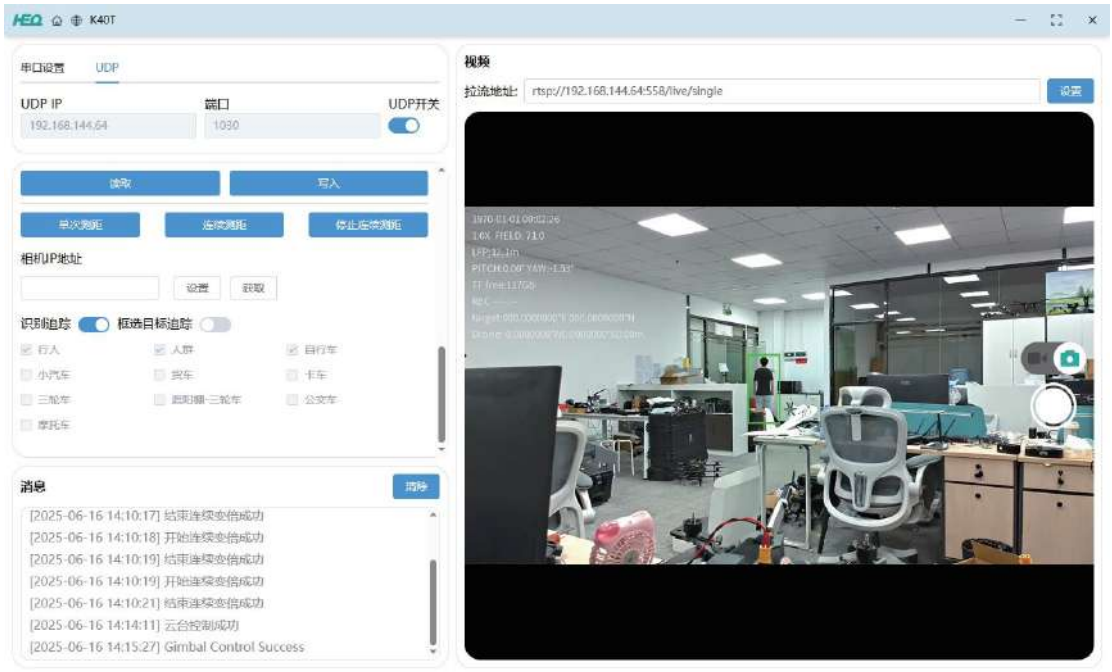
### 7.7 Camera IP Address Setting



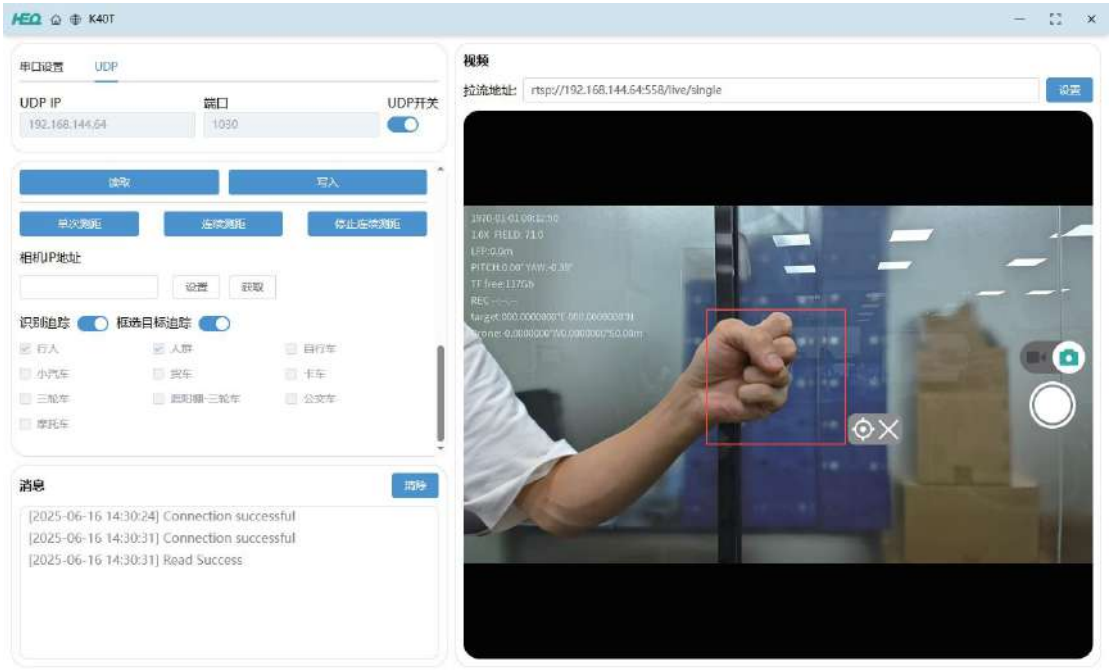

Users can set the IP address according to actual needs.
Note: Please keep a record after setting the IP address to avoid device connection failure. If you forget the IP address, please contact HEQ official for support.

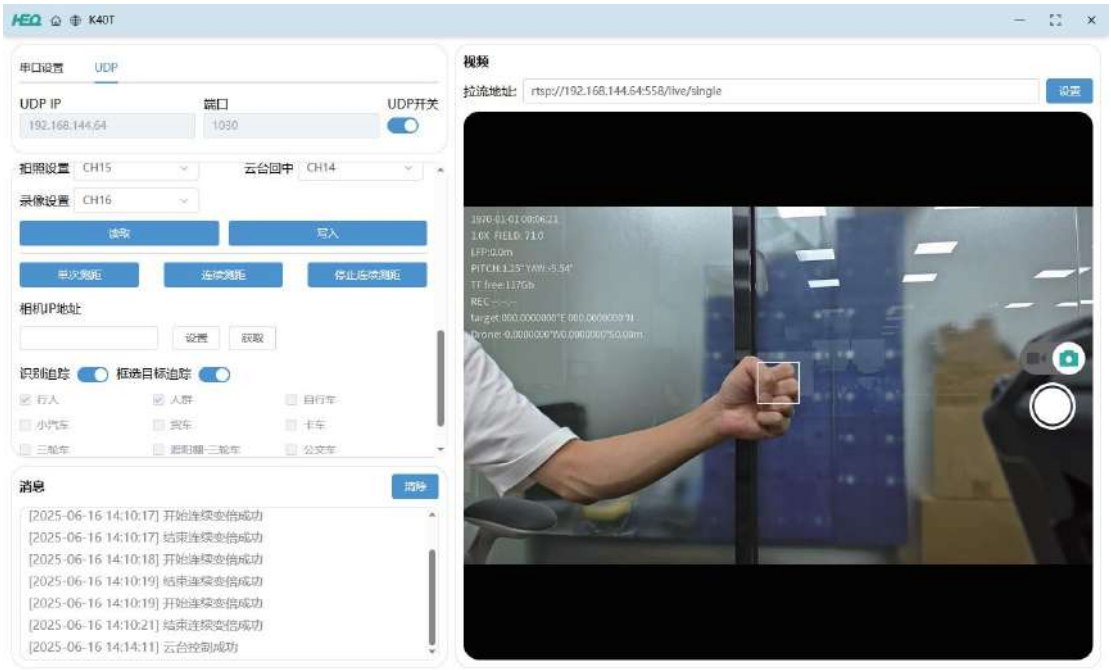
### 7.8 AI Recognition And Tracking Function


K40T has multiple common models built in and provides two tracking modes.




Identification and tracking: Check the required model before use, and then turn on identification and tracking. In the identification and tracking mode, the identified target will be marked in green, click the green box to directly to the tracking mode (the tracking box is white)




Frame target tracking: If you choose the frame target tracking method, you need to use the left mouse button to click the upper left corner to the lower right corner of the target or area of interest to complete the target selection (the dynamic box is marked in red during the process), and the device automatically enters the tracking mode (the tracking box is white).

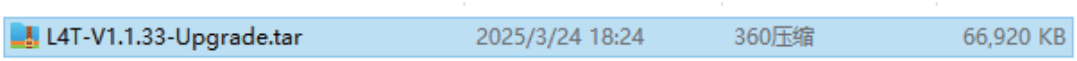
(Some functions are continuously iterating and optimizing, and new recognition models will be added in the future. Users in need can download the latest assistant software, device firmware, 3D images and user manuals from the "Download Center" of the official website: www.hequavtech.com.
We apologize for any trouble or inconvenience caused to you!)

# 8、Product Firmware Upgrade

The upgrade of the K40T four-sensor AI gimbal camera is divided into two parts: camera firmware upgrade and gimbal firmware upgrade.

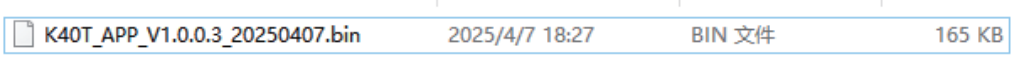
### 8.1 Camera Firmware Upgrade Method

After puttting the file in the root directory of the SD card and powering on, there is no need to unzip the file, just wait for about 3 minutes.




### 8.2 Gimbal Firmware Upgrade Method

Put the file in the root directory of the SD card and power on. During the upgrade process, the gimbal motor will stop. After the upgrade is successful, the gimbal will re-self check and stabilize.




# 9、Product Usage Precautions

9.1 Please store the gimbal camera in a dry and ventilated area at room temperature to avoid camera fogging due to high ambient humidity. If the camera fogs up, the water vapor will usually dissipate after the device is turned on for a while. The recommended storage environment is at a temperature of 20±5℃ and a relative humidity of less than 40%.

9.2 Do not expose the infrared camera camera to strong energy sources such as the sun, lava, or laser beams. The temperature of the observed target must not exceed 800℃, otherwise it will burn the camera and cause permanent damage.

9.3 Do not place the product in direct sunlight, in a poorly ventilated area, or near a heat source such as a heater. Do not turn the product on and off frequently. After turning it off, wait at least 30 seconds before turning it back on, otherwise it will affect the life of the product.

9.4 Under stable laboratory conditions, the K40T achieves the IP44 protection level of the IEC60529 standard. However, this protection level is not permanent and may degrade over time after long-term use.

9.5 Do not touch the surface of the camera lens and keep it away from hard objects, as this may cause the image to blur and affect the image quality. Use a soft, dry, clean cloth to clean the surface of the camera lens, and do not use alkaline detergent.

9.6 If there are other unclear points, please feel free to contact HEQ official, we will provide you with full technical support.

**HEQ Official Website:** www.hequavtech.com

**HEQ Contact Email:**
Email 1: sales@hequavtech.com
Email 2: support@hequavtech.com

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# K40T四光AI云台相机
# 用户手册

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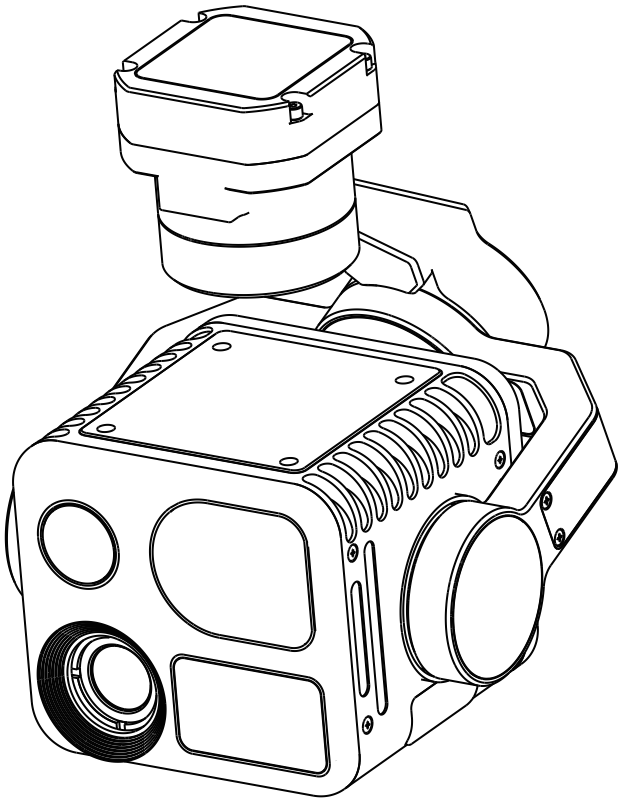


深圳市禾启智能科技有限公司

# CONTENT

## 目录

# 1、产品简介

K40T四光AI云台相机是一款集成高精度轻量化三轴稳定系统、多传感器与6TOPS算力的专业无人机巡检负载。K40T四光AI云台相机分辨率高、观测距离远，同时具备 ±0.005° 的控制稳定度，整机重量仅290g（±5g）。系统包含多维度专用传感器：4800万像素长焦相机、4800万像素广角相机、640×512分辨率热成像仪及1.2km激光测距仪（±1m精度），支持全时段、复杂环境巡检作业。K40T内置6TOPS AI 算力，可实现实时人员/车辆/船只识别、动态目标追踪、火灾热源预警等功能。用户可灵活配置多画面分屏输出，同步存储H.264/H.265视频及JPEG等格式图像，显著提升安防巡检、灾害监测与工程勘测等场景的作业效能。

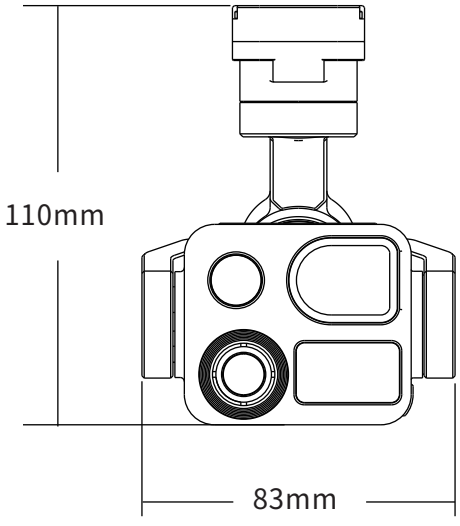
# 2、产品功能参数表

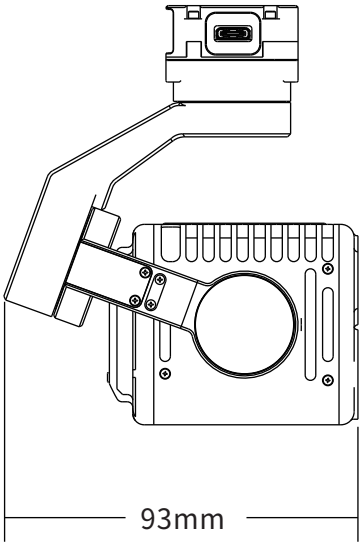
| | | |
|---|---|---|
| **基础参数** | 电压 | 12V-18V |
| | 重量 | 290g±5g |
| | 常规功耗 | 12W |
| | AI功耗 | 20W |
| | 光学变倍 | 11倍率 |
| | 混合变倍 | 160倍 |
| | 热成像分辨 | 640*512 |
| | 测距仪 | 5m~1200m |
| | 可见光分辨率 | 4800W(广角、长焦) |
| | 工作环境 | -20℃~+55℃ |
| | 控制方式 | 串口 TTL/Sbus/网络 |
| | TF 卡图片存储格式 | JPG (默认 12M 最高48M) |
| | TF 卡视频存储格式 | MP4 (默认1200W) |
| | 编码格式 | H264、H265 |
| | 私有化模型嵌入 | 支持 |
| | 识别跟踪 | 支持 |
| **广角镜头参数** | 尺寸 | 1/2"CMOS |
| | 有效像素 | 4800w |
| | 分辨率 | 8000(H)x6000(V) |
| | 广角焦距 | 4.49mm 等效 24mm |
| | 视场角 | DFOV 83.4° |
| | 对焦 | 5m~无穷远 |
| | 广角光圈 | F2.8 |

| | | |
|---|---|---|
| **变焦相机参数** | 尺寸 | 1/2"CMOS |
| | 像素 | 4800w |
| | 分辨率 | 8000(H)x6000(V) |
| | 焦距 | f:15~50mm<br>等效焦距81~270mm |
| | 孔径 | FNo: 3.7~4 .5 |
| | 最小焦点 | 5m |
| | 视场角 | 24.1°~7.3° |
| **热成像参数** | 光谱范围 | 8 μm~14 μm |
| | 分辨率 | 640x512 |
| | 焦距 | 13.1mm |
| | 热灵敏度 | ≤50mK@f1.0(@25℃) |
| | 测量工作温度 | -10℃~+50℃ |
| | 感测范围 | -20℃~+150℃,+100℃~+550℃ |
| **测距模块参数** | 测距范围 | 5-1200m |
| | 测距精度 | ±1m |
| | 测距分辨率 | 0.1 m |
| | 激光发散角 | 3.2 mrad |
| | 激光类型 | 905nm |
| | 测距频率 | 1~10Hz |

| | | |
|---|---|---|
| **云台参数** | 工作模式 | 三轴增稳 |
| | 软件限位角度 | 俯仰:-90°至 +30° |
| | | 偏航:-120°至 +120° |
| | 机械结构角度 | 俯仰:-135°至 +45° |
| | | 横滚:-45°至 +45° |
| | | 偏航:-135°至 +135° |
| | 角度抖动量 | ±0.005° |
| | 云台模式 | 支持一键回中、一键向下、自动跟踪 |

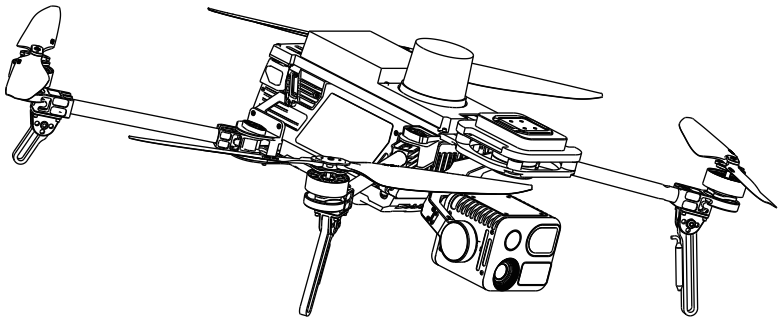
## 3、云台外观尺寸



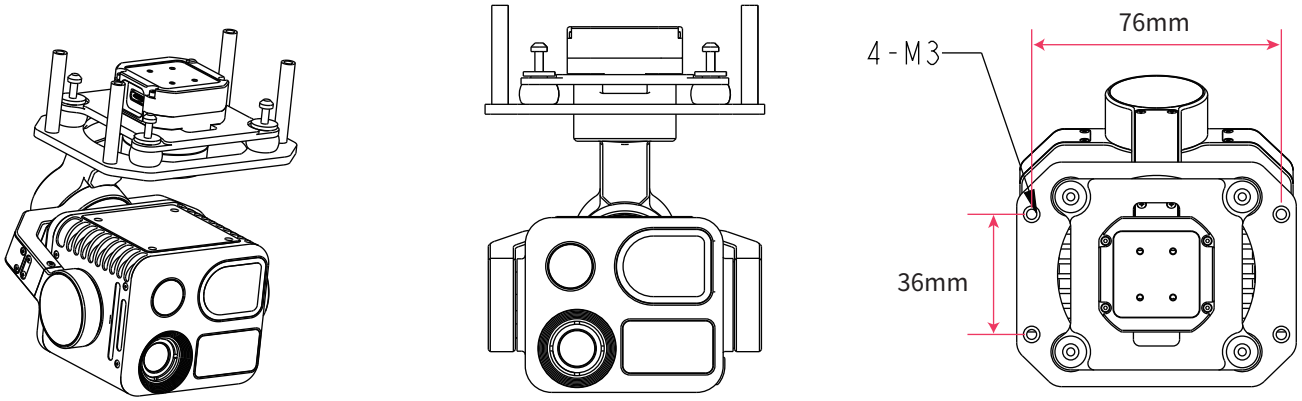
## 4、产品安装

**产品3D模型请至官网:https://www.hequavtech.com/下载中心自行下载**

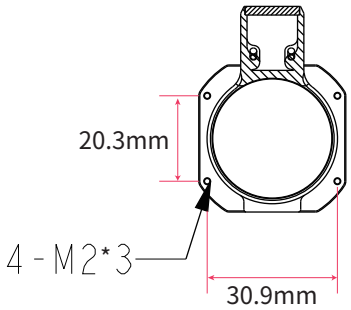


**安装示例1**

**安装示例2**

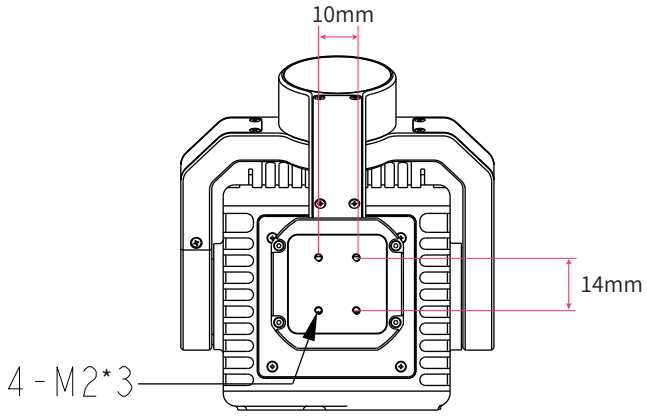



**安装方法1**



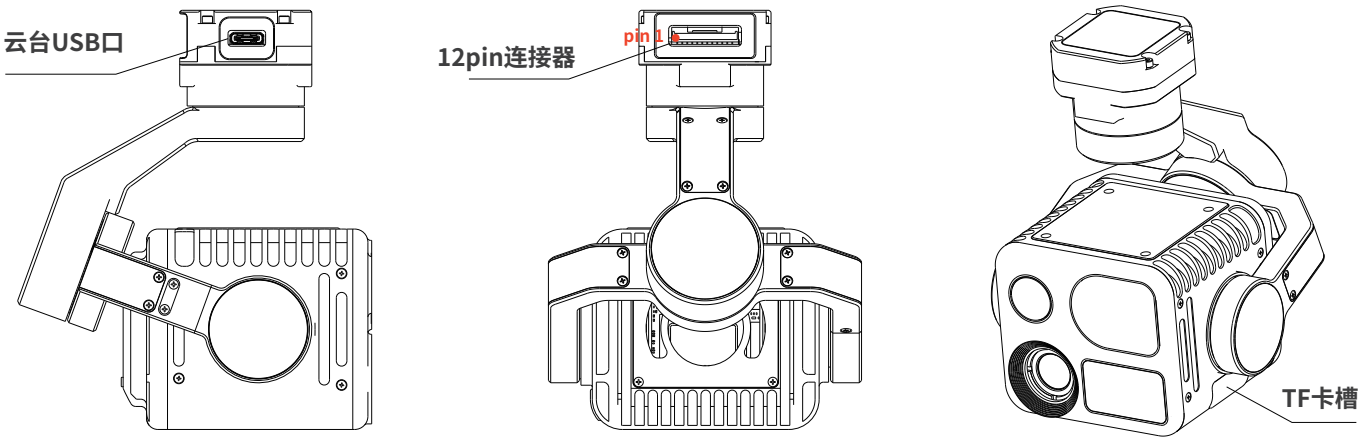

**上支架安装孔位, M2*3mm螺丝4颗**
**孔间距分别为20.3mm及30.9mm。**

**安装方法2**




**上支架安装孔位, M2*3mm螺丝4颗**
**孔间距分别为10mm及14mm。**

## 5、产品硬件接口




| 型号 | 接口类型 | 功能 |
|---|---|---|
| 云台 USB | USB 口 | 云台升级、调试 |
| 内存卡接口 | TF 卡接口 | 存储照片视频/升级相机与云台固件 |

| 序号 | 型号 | 接口类型 | 接口定义 | 功能 |
|---|---|---|---|---|
| 1 | 12PIN(GH1.25mm)<br>连接器 | 电源接口 | GND | GND |
| 2 | | 电源接口 | GND | GND |
| 3 | | 电源接口 | 12V-18V | 电源输入 |
| 4 | | 电源接口 | 12V-18V | 电源输入 |
| 5 | | 通信接口 | T+ | 网络接口 |
| 6 | | 通信接口 | T- | 网络接口 |
| 7 | | 通信接口 | R+ | 网络接口 |
| 8 | | 通信接口 | R- | 网络接口 |
| 9 | | 通信接口 | SBUS | |
| 10 | | 通信接口 | GND | |
| 11 | | 通信接口 | TX | TTL 串口 |
| 12 | | 通信接口 | RX | TTL 串口 |

## 云台与无人机系统连接图

**重要说明：**

1.K40T的串口可以用来接收云台相机的控制指令，同时也可以接收飞控的姿态数据用于提升稳像精度和效果。

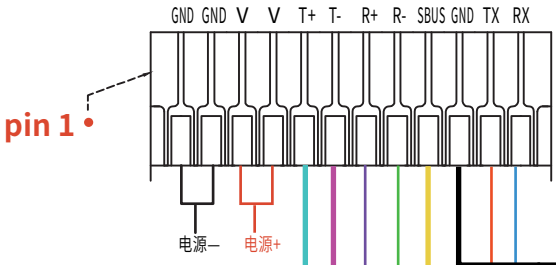
**接入是否有效的验证方法：**

正常开机后约2min，拔掉串口，如果云台锁死且不增稳，再次插入串口，恢复增稳，说明接入飞控数据成功；

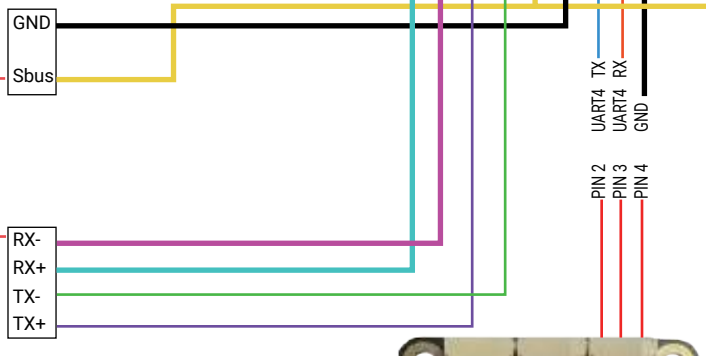
如果拔掉串口，依然增稳，说明没有正确接入，检查下飞控输出是否正确设置或者串口硬件是否接反。

2.用于提升K40T稳像效果的姿态数据可以是MAVLINK协议的格式，也可以是HEQ串口协议的格式，两者选其一。(数据频率建议50Hz以上)

3.如果用户选择用网口或者Sbus协议进行K40T的控制，则K40T的串口也可以只用作传输飞控姿态数据。

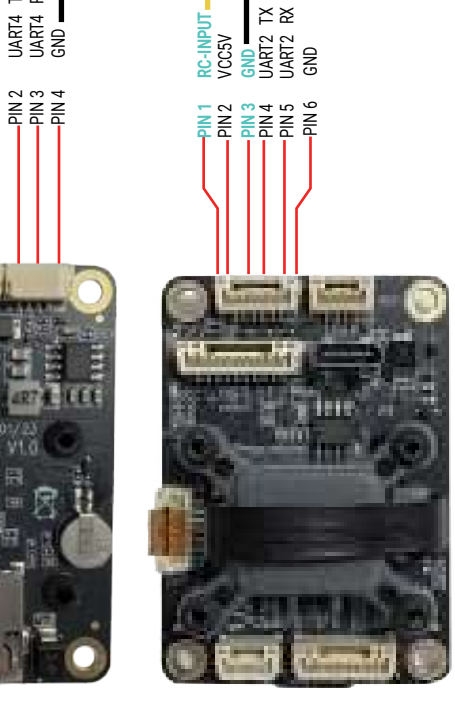




图传接收机





飞控背面




飞控正面

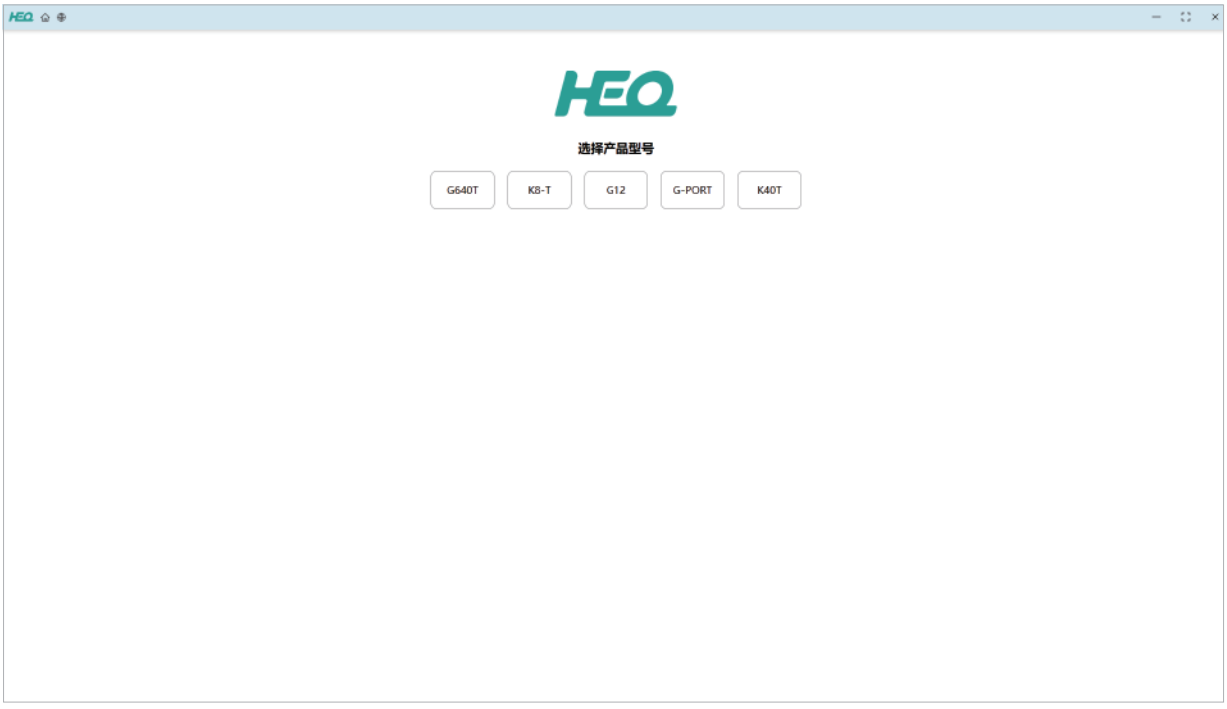
## 6、产品控制接口及协议

| 控制类型 | 接口 | 协议 |
| --- | --- | --- |
| 云台控制 | 网络/串口/Sbus | 网络/串口协议请至请至官网:https://www.hequavtech.com/下载中心进行下载；Sbus协议为无人机遥控器通用标准协议，具体设置方法参照本文档7.产品上位机使用指引进行设置。 |
| 视频流 | 网络 | 默认RTSP推流，拉流地址：rtsp://192.168.144.64:558/live/single，开启视频前请务必确保设备的网段与K40T云台相机一致。（K40T上位机支持IP地址设置，具体请参考7.产品上位机使用指引） |

## 7、产品上位机使用指引

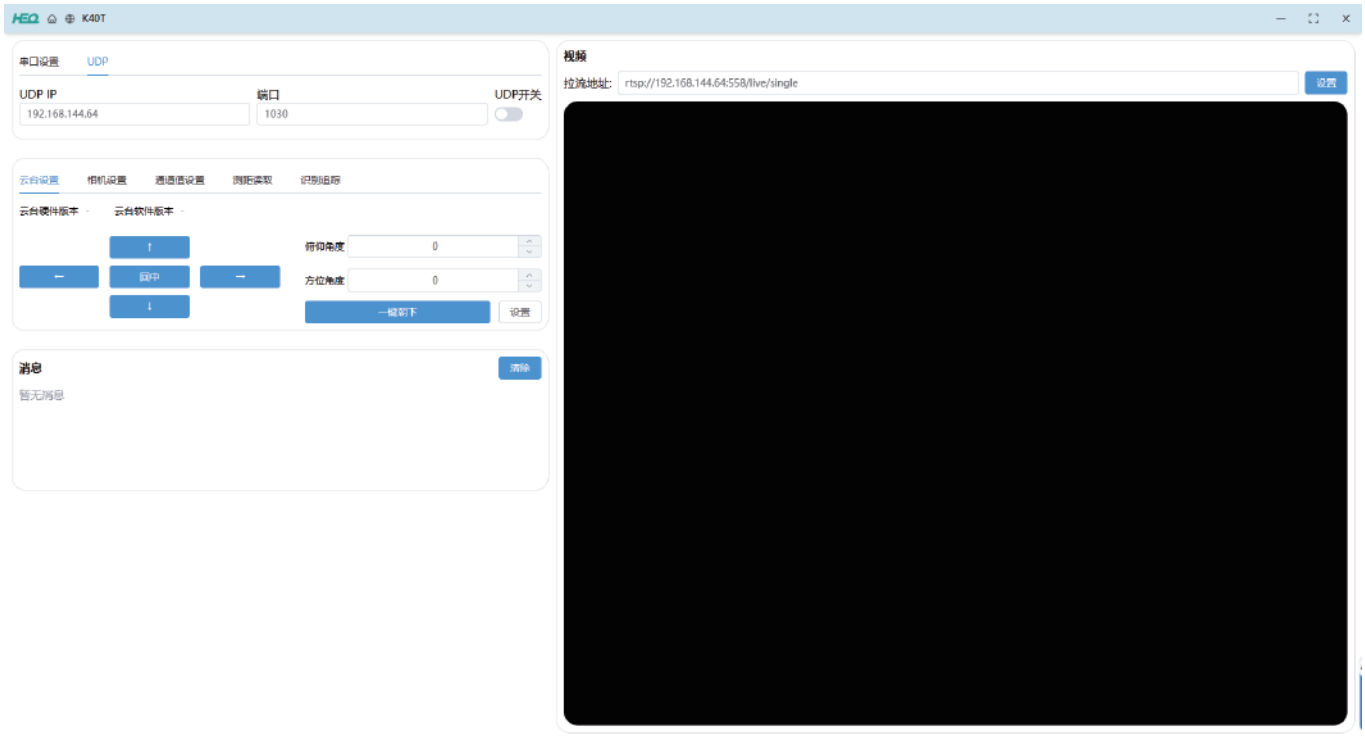
上位机请至官网:https://www.hequavtech.com/下载中心进行下载

### 7.1 上位机界面

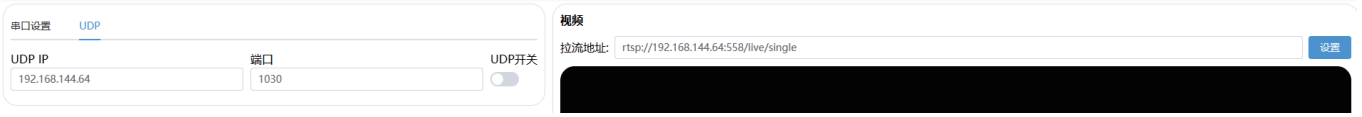



**进入上位机页面，选择对应型号的产品进入，如需要切换语言版本，请点击下示图标进行设置。**

**进入对应产品型号的页面后，界面如下：**




## 7.2 连接设置




用户可根据实际情况选择串口或者UDP连接形式，具体参数设置参考下表：

| 接口类型 | 参数/设置 | 是否支持用户设置 |
| --- | --- | --- |
| 串口波特率 | 默认：115200 | 否 |
| UDP地址 | 默认：192.168.144.64 | 是（IP地址） |
| 视频播放地址 | 默认：rtsp://192.168.144.64:558/live/single | 是（IP地址） |

### 7.3 云台控制


用户可点击云台控制按钮进行云台速度、角度控制，云台控制的速度会和变焦倍率有自适应关系，如变焦倍率越高，云台运动速度越低。

### 7.4 视频流相机类型设置


上位机可以选择视频流的相机类型（可见光、热成像及分屏），可以进行变焦操作，在热成像类型下，可以进行色板切换。

### 7.5 Sbus功能设置


用户如使用Sbus进行云台相机控制，则可进入上图界面进行通道映射设置，设置完相应通道后需要点击“ 写入”以保存设置，点击读取可获取当前映射状态。

云卓遥控器设置范围：282-1722
禾启遥控器设置范围：281-1721
思翼遥控器设置范围：272-1712

### 7.6 测距功能

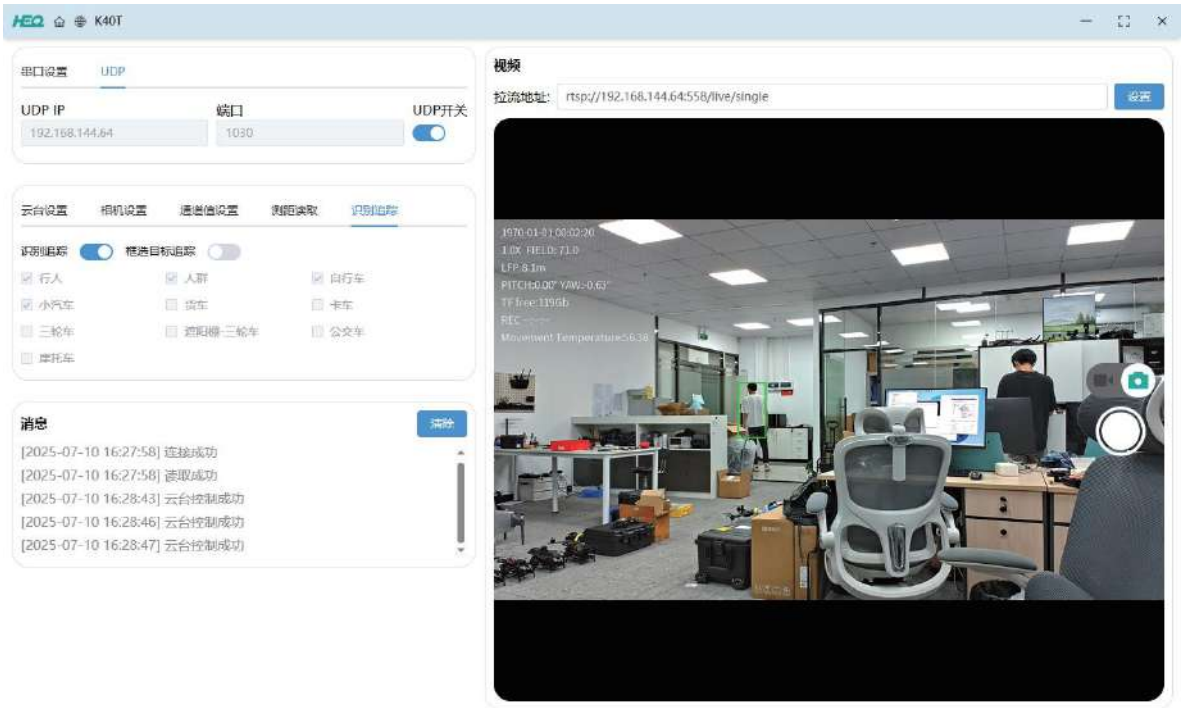

上位机提供单次测距、连续测距及停止连续测距按钮，用户可根据需求进行功能测试。
注意：K40T的测距仪参考作用范围为5m~1200m，实际测试数据可能会因为环境有所变化。

### 7.7 相机IP地址设置

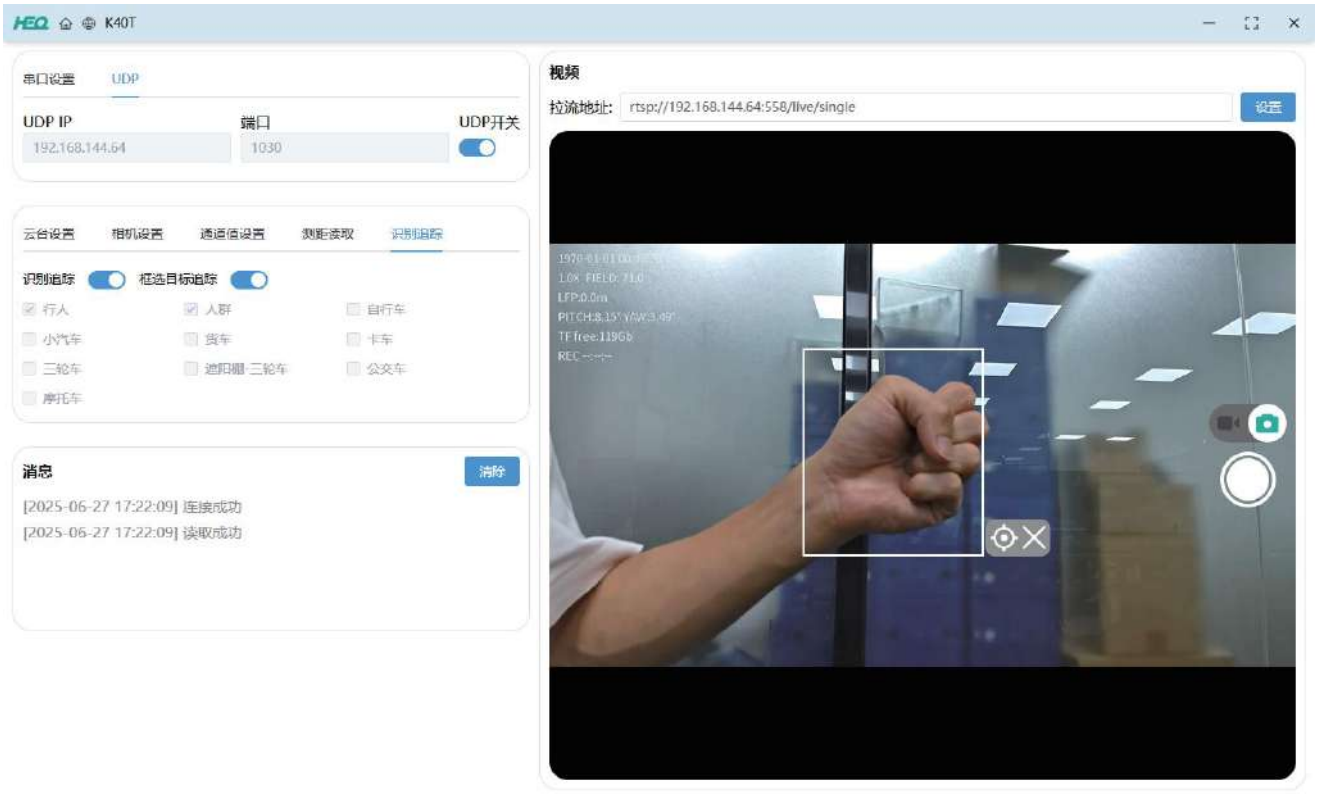

用户可根据实际需求对IP地址进行设置。注意：设置IP地址后请做好对应记录，以免造成设备无法连接，如万一遇到忘记IP地址的情况，请联系禾启智能官方获得支持。

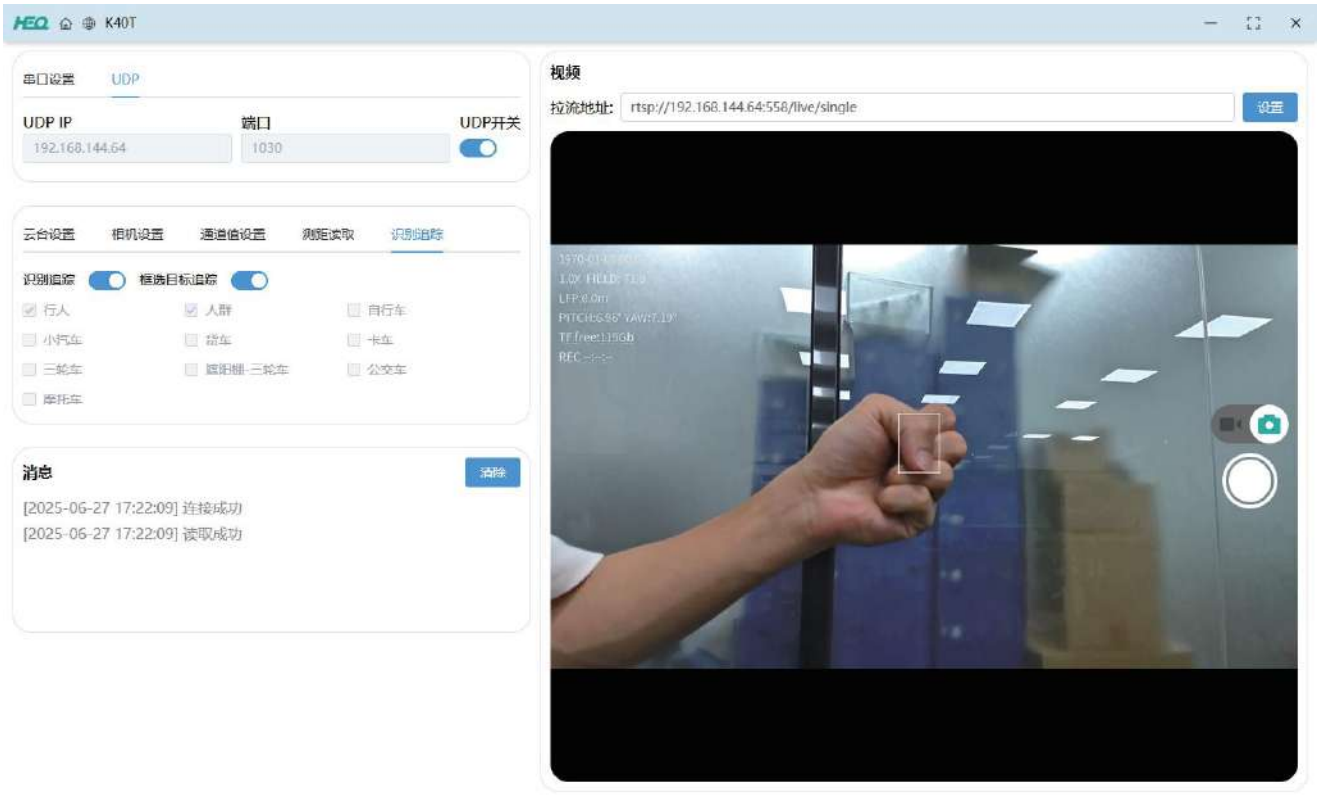
### 7.8 AI识别及追踪功能


K40T内置多种常见模型，并提供两种跟踪模式。




识别追踪：使用前勾选所需要的模型，然后打开识别追踪，在识别追踪模式下，已经被识别的目标会被标记为绿色，点击该绿色框则可直接转为跟踪模式（跟踪框颜色为白色）




框选目标跟踪：如果选择框选目标跟踪的方式，需要用鼠标左键点击感兴趣目标或区域的左上角至右下角完成目标框选（过程中动态框用白色标记），设备自动进入跟踪模式（跟踪框颜色为白色）。

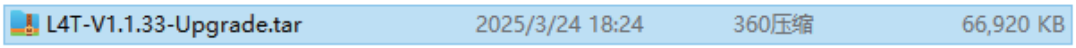
（该部分功能持续迭代优化中，后续也会陆续增加新的识别模型，有需要的用户需要自行到官网www.hequavtech.com下载中心下载最新的上位机、设备固件、3D图档及用户手册，如给您带来困扰或者不便，敬请谅解！）

# 8、产品固件升级

K40T四光AI云台相机的升级分为相机固件升级和云台固件升级两部分。

### 8.1 相机固件升级方法

文件放至SD卡根目录后上电，无需解压文件，等待约3分钟即可。




### 8.2 云台固件升级方法

将文件放至SD卡根目录后上电，升级过程中云台电机会卸力，升级成功后云台会重新自检完成并增稳。


# 9、产品使用注意事项

9.1 存储环境要求

请将相机存放在常温、干燥且通风良好的环境中，避免因湿度过高导致镜头起雾。若镜头出现起雾现象，水蒸气通常会在设备开机运行一段时间后自然消散。推荐存储环境温度为 20±5°C，相对湿度 低于40%。

9.2 避免强能量源照射

请勿将红外相机镜头直接对准强能量源（如太阳、熔岩或激光束），且观测目标的温度 不得超过800°C，否则可能导致相机烧毁，造成永久性损坏。

9.3 避免高温及频繁开关机

请勿将产品置于阳光直射、通风不良或靠近热源（如加热器）的环境中。此外，避免频繁开关机，每次关闭后 至少等待30秒 再重新开启，以免影响产品寿命。

9.4 防护等级说明

在稳定的实验室条件下，K40T 符合 IEC60529 标准的 IP44 防护等级。但该防护等级并非永久有效，长期使用后可能会逐渐降低。

9.5 镜头清洁与保护

请勿用手指或硬物触碰镜头表面，以免造成划痕或影响成像质量。清洁时，请使用 柔软、干燥且干净的布 轻轻擦拭，切勿使用碱性清洁剂。

9.6 技术支持

如有任何疑问，请随时联系 禾启智能官方客服，我们将为您提供全面的技术支持。