ZR10

OPTICAL POD USER MANUAL

SIYI Technology (Shenzhen) Co., Ltd.

SIYI.biz/en

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Thank you for purchasing SIYI's product.

ZR10 is a zoom optical pod up to 30X hybrid zoom / 10X optical zoom, carrying a 4K 1/2.7-inch Sony CMOS, 2K video recording and photography, abundant gimbal control interface compatible with both SIYI links and third-party links. High accuracy and high collaboration control algorithms ensure stable imaging and zooming ability during flight. HDR and starlight night vision extend the application scenarios to both day and night. In a word, ZR10 is a rare and good payload for multi-rotors, VTOLs, and robotics.

To ensure you a good experience of the product, please read this manual carefully. If you encounter any issue using the product, please consult the manual or check the online pages of this product on SIYI official store (https://shop.siyi.biz). You can also write an email to SIYI official A/S center (support@siyi.biz).

SIYI

Contact Us: **SIYI Official Website** *(https://SIYI.biz/en)*

SIYI User Group - Facebook	
Facebook	
Linkedln	
YouTube	

User Manual Update Log

Version	Date	Updates
1.7	2025.6	Section 1.1 states that the ZR10 does not support nose-up flight mode.
1.6	2024.4	1. SIYI Gimbal SDK 2. Correct the lens FOV specs. 3. Main firmware update log. 4. SIYI assistant update log. 5. SIYI FPV Windows update log. 6. SIYI FPV Android update log.
1.5	2024.3	1. Instruction for SIYI FPV Windows software 2. Instruction for AI follow function 3. Product features 4. Technical specifications 5. Main firmware update log. 6. SIYI FPV app update log. 7. SIYI FPV SDK Guide. 8. SIYI Gimbal SDK 9. Add diagrams in Gimbal Control chapter.
1.4	2023.8	1. Trouble shooting for abnormal gimbal attitude. 2. User manual update log. 3. Main firmware update log. 4. SIYI FPV app update log. 5. Cautions for 6S power input. 6. Necessary update for product features. 7. Necessary update for technical specifications.

CONTENT

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READ TIPS

Icons

Please pay more attention to content indicated with the following marks:

⚠ **DANGER** Dangerous manipulation probably leads to human injuries.

⚠ **WARNING** Warnings on manipulation possibly leads to human injuries.

⚠ **CAUTION** Cautions on what manipulation may lead to property loss.

🚫 **Prohibited**   ❗ **Mandatory**   ⬤ **Mark**

Safety

ZR10 optical pod is designed for professional application in specific scenes, which has been done necessary configuration before delivery, it is forbidden to disassemble the gimbal or to change its mechanical structure. And don't add more payload to the gimbal other than its own camera. Gimbal camera is designed with very precise structure, users who approach to the equipment should have the basic knowledge of how to operate it. Irregular or irresponsible manipulations to the device may cause damage, property loss, or human injuries, and SIYI Technology is not obliged to any of the damage, loss, or injury. It is prohibited to use SIYI products for military purpose. Users under 14 years' old should

follow an experienced trainer's guide. Disassembling or modification to the system is prohibited without permission from its manufacturer, SIYI Technology.

Storage/Carrying/Recycling

When your SIYI products are stand idle, or you are bringing it outdoors, or the system reached service life, then please do read the precautions below.

⚠ CAUTION

Always place your SIYI products at places where babies or kids do not reach.

⚠ DANGER

SIYI products should be placed in places with below conditions:

Not too hot (above 60°C) or too cold (under -20°C).

Not under direct sunshine or too dusty or too wet.

Not on an unstable holder which lacks solid supports or may cause vibration.

Not nearby steam or other heat sources.

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1 INTRODUCTION

1.1 Product Features

Excellent UAV Imaging System

ZR10 carries an 8 megapixels CMOS starlight night vision image sensor with excellent 2K video recording and photography. Up to 30x hybrid zoom (10x optical zoom). The scenery is clear, the algorithm is fast and accurate, and the viewpoint is automatically focused, making it easy to produce grand pictures. Silky movement, smooth zoom, distant scenery, now within reach.

*The picture files captured by ZR30 can be written with GPS location information and time attributes.

Point To Focus

Point anywhere to focus lens from zoom camera to get clear view on selected part of screen.

Focus Tracking

Zoom camera stays focusing and keeps filming smooth videos while users are scaling images.

Starlight Night Vision

The ultra-sensitive starlight CMOS keep images bright in low light environment.

HDR

HDR (High Dynamic Range) precisely captures good details of highlights and shadows in dynamic scenes to get true colors and natural brightness.

AI Enhanced Smart Identify and Tracking

ZR10 works with the optional SIYI AI tracking module, which combines SIYI's self-developed AI algorithm and collaborate with SIYI optical pods (gimbal cameras) to achieve real-time tracking and capture of targets, and real-time focusing and zooming to highlight the selected object in the picture. The target will always be in the center of the picture and maintain a clearly visible proportion of the picture.

It supports the anti-lost function. During the following process, if the target is blocked or briefly leaves the monitoring screen, the AI tracking module can automatically recognize and continue tracking when it re-enters the monitoring screen.

320-Degree Yaw Axis Rotation

The yaw axis of ZR10 rotates in a range of 320 degrees. Hanging below VTOL drones or planes, ZR10 optical pod captures pictures in a wide angle around.

Incomparable Gimbal Control Interface

SIYI optical pods' (gimbal cameras') powerful compatibility contribute to smart robotics ecology in all dimensions. They can be controlled through traditional S.Bus signal by switches and dials, or through Ethernet by touchscreen or by UDP / TCP commands based on SIYI gimbal SDK, or through UART by SIYI gimbal SDK or by mainstream open-source protocols ArduPilot and PX4 (Mavlink).

Gimbal Motion Mode

Upside Down Mode

Gimbal automatically activates upside down mode when it is placed upside down, very convenient to be mounted on multiple kinds of vehicles like UGV, USV, robot dog, and more robotics.

Follow Mode

Horizontally, gimbal follows when aircraft rotates.

Lock Mode

Horizontally, gimbal does not follow when aircraft rotates.

FPV Mode

Gimbal rotates simultaneously as aircraft rolls to get FPV view, and output enhanced stable images.

Note: The ZR10 does not support Nose-Up Mode.

High Accuracy and High Collaboration Control Algorithms

SIYI has done even more in control algorithms and stabilization algorithms.

IMU Calibration Algorithms

Compensate and correct errors of the inertial measurement unit, reduce interference factors such as zero bias, scale factor, inter-axis error, temperature drift, noise, etc., greatly improve the measurement accuracy of IMU, and improve the stability of the gimbal in large temperature differences, wide margin steering, and strong vibration environments.

Attitude Fusion Algorithms

Comprehensively utilize the data of sensors such as accelerometers and gyroscopes, obtain the pitch angle, roll angle, and yaw angle of the gimbal through mathematical models and

filtering algorithms, and fuse this information to effectively improve system performance, stability, and robustness.

Industry-Level 3-Axis Stabilization Algorithms

Deeply integrate and utilize 3-axis gyroscopes, 3-axis accelerometers, PID controllers, motors, and magnetic encoders to achieve gimbal attitude stabilization control and continuously output stable high-definition video images during motion.

High-Precision FOC Motor Control Algorithms

Control the current components of the motor to control torque and magnetic field respectively, thereby achieving decoupling control of the brushless motor and greatly reducing picture jitter.

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1.2 Ports, Interface & Definition

① Power Input
   (3S to 6S)

② Control Signal Input & Output
   (S.Bus / UART)

③ Ethernet
   (Ethernet video stream and SDK protocol control)

④ Type-C
   (Upgrade and configure)

⑤ TF Card Slot
   (File storage and copy)

⑥ Status Indicator

Caution: Early manufacturing lots support 3S to 4S power input only,
please carefully confirm

Video & Protocol

Gimbal Control

Power

SIYI
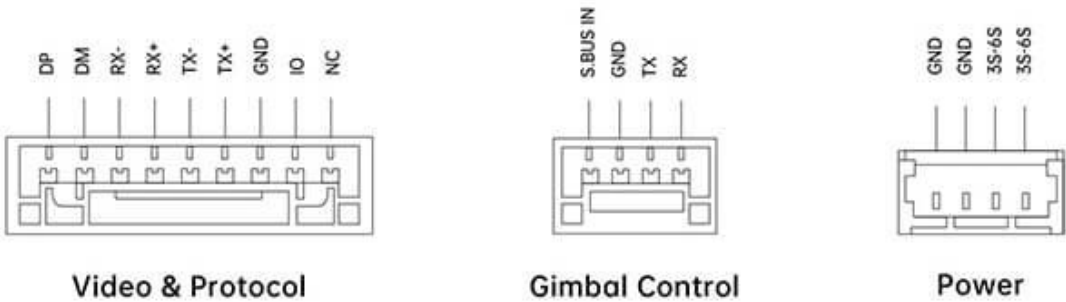
1.3 Technical Specification

Overall

Video Output Port	Ethernet
Control Signal Input Port	S.Bus UART Ethernet UDP / TCP
High Accuracy 3 Axis Stabilization	Yaw Pitch Roll
Working Voltage	11 ~ 25.2 V (3S to 6S) *Early manufacturing lots before June 2023 were 11 ~ 16.5 V, please carefully confirm
Power Consumption	Average 4 W Summit 12 W
Waterproof Level	IP4X
Working Temperature	-10 ~ 50 ℃
Dimension	121 x 101 x 78 mm
Weight	381 g

Gimbal

Angular Vibration Range	±0.01°
Controllable Pitch Angle	−90° ~+25°
Controllable Yaw Angle	-160° ~ +160°
Rotatable Roll Angle	-30° ~ +30°

Camera

Lens	10X Optical Zoom (30X Hybrid Zoom)
Focal Length	5.2 ~ 47.4 mm (±5%)
Image Sensor	1/2.7 Inch CMOS

	4 MP Effective Resolution
Aperture	F1.8 ~ 2.5 (±5%)
FOV	Without Zoom: Diagonal: 69.5°, Horizontal: 61.5° 10X Optical Zoom: Diagonal: 8°, Horizontal: 7°
Video Recording Resolution	2K (2560 x 1440) @ 30 fps 1080p (1920 x 1080) @ 30 fps 720p (1280 x 720) @ 30 fps
Still Photo Resolution	2K (2560 x 1440) @ 30 fps
Video Storage Bitrate	12 Mbps (H.265 Codec)
Supported File System	FAT32 ExFAT
Image Format	JPG
Video File Format	MP4
Supported MicroSD Cards	MicroSD Class10, max 256 GB
Still Photography Mode	Single
Metering Mode	Evaluative metering
White Balance	Automatic

⭕ **Mark**

To make sure that you get smoothly recorded video, please format the SD card, and make the minimum storage unit as 64 KB before recording.

Please format the SD card to FAT32 before camera firmware upgrade.

1.4 Packing List

1 x ZR10 Optical Pod

1 x MK15 / HM30 Air Unit S.Bus Y Cable
(Connect SIYI MK15 and HM30 air unit's S.Bus port to acquire control signal, then one connector of the cable goes to SIYI gimbal, another goes to flight controller)

1 x Control Y Cable
(Connect SIYI gimbal's control signal port with SIYI link and controller, including UART control input and S.Bus input)

1 x SIYI Gimbal Power Cable
(Power supply cable for SIYI gimbal)

1 x SIYI Gimbal Ethernet Cable
(A backup cable for customer DIY purpose to connect SIYI gimbal to third-party Ethernet devices)

1 x SIYI Gimbal to SIYI Link Cable
(An all-in-one cable for only touch screen control to SIYI gimbal through SIYI link, it can power SIYI gimbal and can also transfer video stream and control signal)

1 x SIYI Gimbal Ethernet to RJ45 Cable
(Connect SIYI gimbal with RJ45 device directly)

1 x SIYI Gimbal to PX4 / ArduPilot Flight Controller UART Cable
(A universal cable for ZT30, ZR30, and A8 mini, it connects SIYI gimbal to the UART port on PX4 / ArduPilot flight controller for data communication and gimbal control)

1 x ZR10 Screw Pack
(Using with the fixing board to mount gimbal, including 8 x Cross countersunk head machine screw KM3*12, 8 x M3 Nut Black)

1 x ZR10 Mounting Board & Damper Pack
(For mounting and fixing gimbal and stabilization)

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1.5 Indicator Definition

The status indicator on SIYI gimbal uses three different colors and different blinking frequencies to indicate the system's working or abnormal status.

🟢 Solid Green: Normally working.

🟢 Slow Green Blinks: S.Bus signal input is normal.

🟢 🟢 Double Green Blinks: Integrating flight controller attitude data is normal.

🔴 Slow Red Blinks: Firmware does not match (camera firmware or gimbal firmware or neither).

🔴 🔴 🔴 Triple Red Blinks: Failed to identify zoom module (for optical zoom gimbal camera only).

🔴 🔴 🟡 Red-Red-Yellow Blinks Continuously: Fail to identify camera board.

🟡 Yellow Blinks: Power input voltage is low (lower than 10 V).

🔴 🔴 Double Red Blinks: IMU temperature rising is abnormal.

🟡 🟡 Double Yellow Blinks: IMU temperature is rising.

🟡 🟡 🟡 Triple Yellow Blinks: IMU temperature is abnormal.

SIYI

2 GET READY TO USE ZR10

2.1 Installation

Screw Holes' Position and Distance
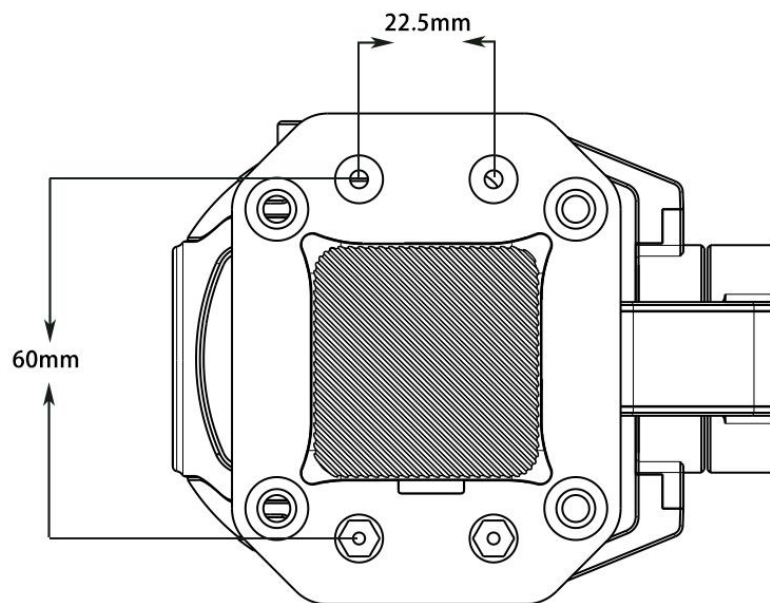
🔴 **Mark**

The specs of the screws for fixing the four tube screws are M3*8 mm. Quantity: 4.

Welcome to contact SIYI to get the SIYI Gimbal 3D Model for pre-installation.

2.2 Connection and Power

SIYI optical pod and gimbal camera can be powered in many ways. If you plan to carry SIYI gimbal by your plane and the plane may roll in a wide margin, then please use connect SIYI gimbal's power port directly by a 3S to 6S power battery, not through power distribution board or air unit.

● **Mark**

The manufacturing lots of ZR10 after June 2023 start to support 6S input, please refer to the product sticker and carefully use.

2.3 Interesting Functions and Cautions

SIYI optical pod and gimbal camera can save time and location information into captured pictures in EXIF format. The preconditions that the function will work are:

● Time Information: The ground station must connect to internet and run the latest SIYI FPV app.

● Location Information: Gimbal must communicate to flight controller through UART.

Mark

Location information can only be acquired from Mavlink protocol at this moment.

The above functions are only available in SIYI optical pods and gimbal cameras which support capturing pictures and TF card recording.

2.3.2 Point to Focus & Focus Tracking

Point to Focus

The zoom camera in ZT30 four-sensor optical pod support selecting focus and focusing to a point on any place in the image while SIYI FPV or SIYI QGroundControl app is running. Fast and accurate.

Focus Tracking

The zoom camera in ZT30 four-sensor optical pod automatically adjust focal length during optical zooming to keep filming smooth and clear images.

2.3.3 Output Four Video Streams from the Same RTSP Addresses

SIYI optical pod (gimbal camera) can output up to four video streams from the same RTSP addresses.
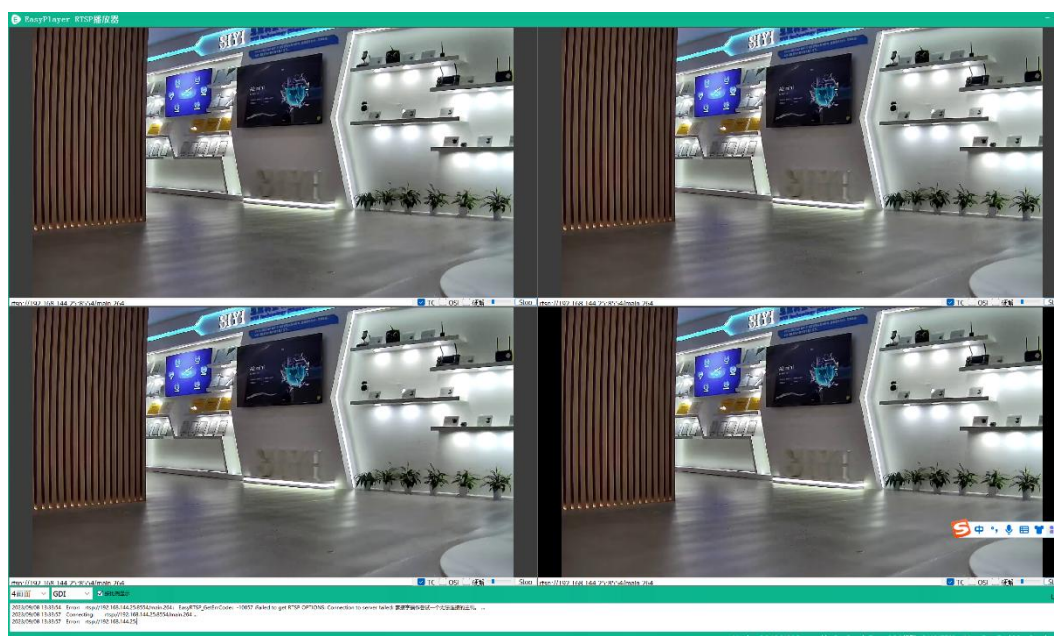
SIYI

3 GIMBAL CONTROL

SIYI optical pod and gimbal camera support multiple methods to control.

3.1 Enable AI Recognition, Tracking, and Follow through SIYI AI Tracking Module Using SIYI Optical Pod (Gimbal Camera) and SIYI Link

SIYI optical pod (gimbal camera) can connect to SIYI link through SIYI AI tracking module and enable AI recognition, tracking, and follow feature through SIYI FPV app or SIYI QGC app while the air unit is communicating with the ground unit.

It is necessary to prepare the tools, firmware, and software below before controlling gimbal camera in this way.

● SIYI Links (MK32 Standard Combo / HM30 / MK15 Enterprise Standard Combo is suggested for excellent compatibility with SIYI gimbal cameras)

● SIYI Optical Pod (Gimbal Camera)

● Flight Controller

● SIYI AI Tracking Module

🔴 **Mark**

Above products can be purchased from SIYI directly or from SIYI authorized dealers.

● SIYI Gimbal to SIYI Link Cable

🔴 **Mark**

Above tools come with product package.

● SIYI FPV App (v2.5.15.695 or latest version)

● SIYI QGC App

🔴 **Mark**

Above software can be downloaded from relevant product page on SIYI official website.

Steps

1. Confirm if gimbal camera's firmware has been upgraded to be compatible with SIYI AI tracking module and the AI follow function.

2. Confirm if SIYI FPV app has been upgraded to be compatible with SIYI AI tracking module and the AI follow function.

3. Please refer to the picture below to connect SIYI AI tracking module with SIYI gimbal camera and SIYI link.

SIYI AI Tracking Module

Standard Cable

Ethernet Video Stream
& Protocol Control

Air Unit Power Input

Standard Cable

Gimbal Power Input

ZR10 Optical Pod

MK15 / HM30 Air Unit
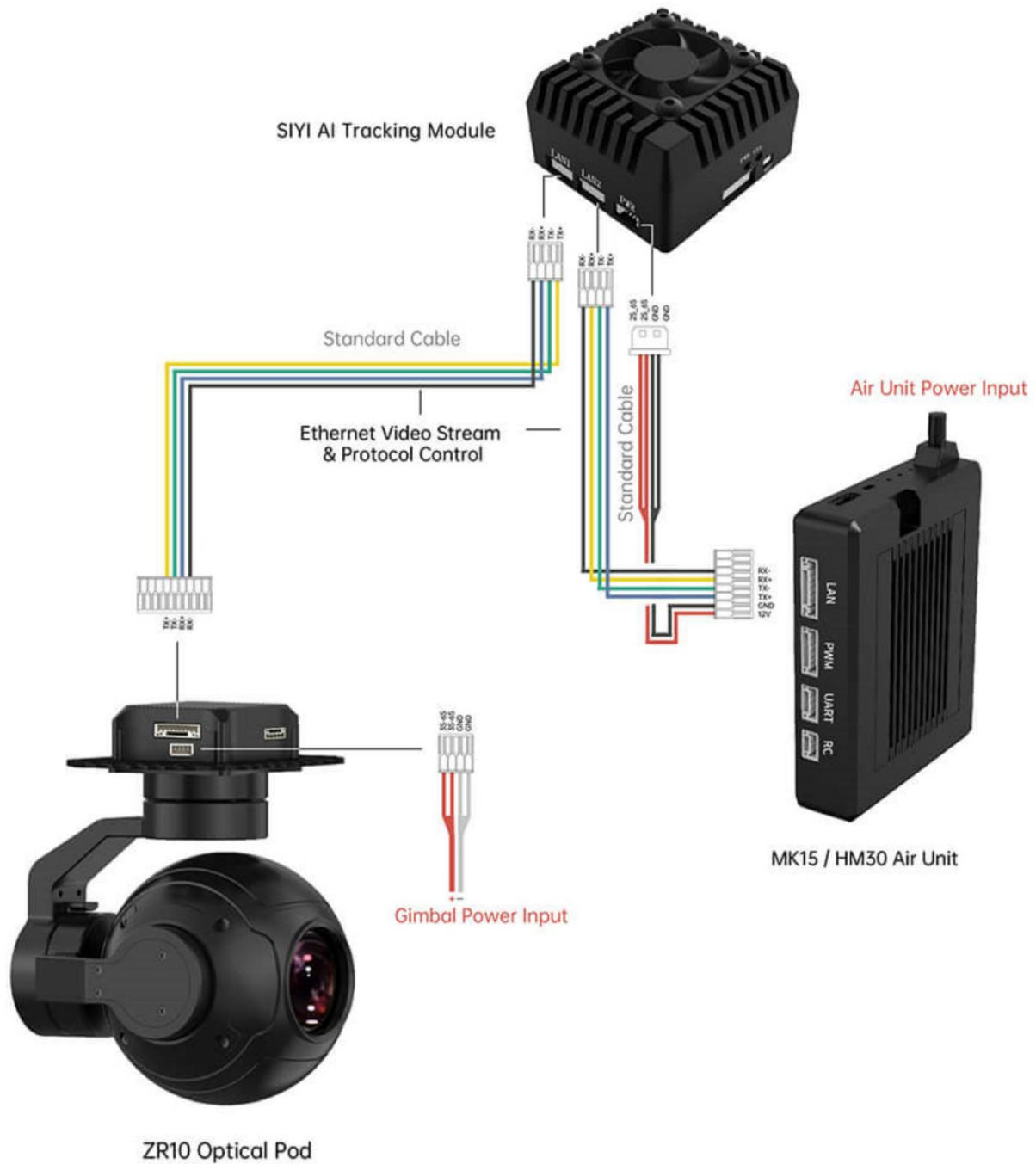
4. Please refer to the picture below to connect SIYI gimbal camera with flight controller and integrate attitude data.

N7 Autopilot

UART Control

Standard Cable

Gimbal Power Input

ZR10 Optical Pod
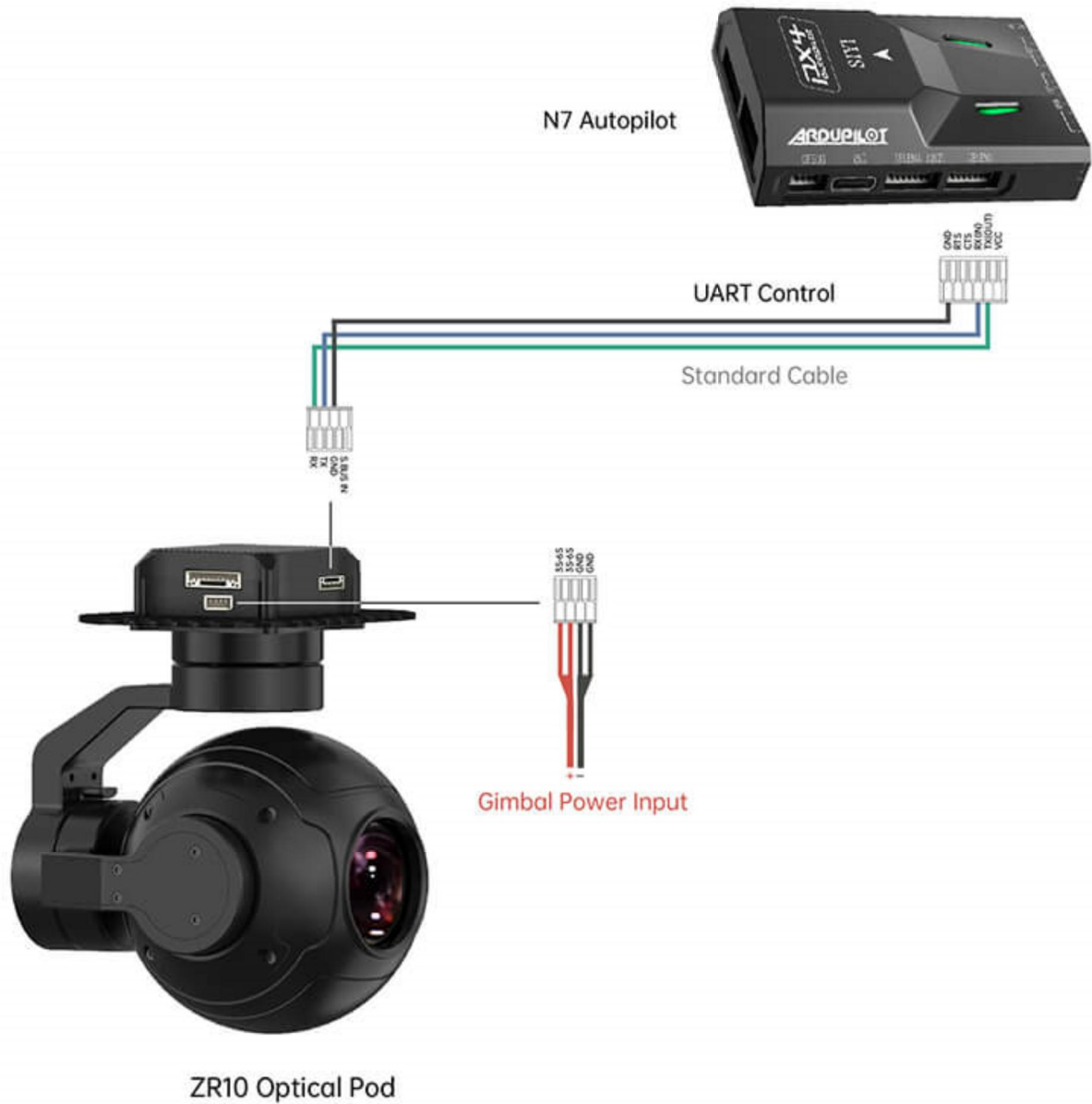
5. Run SIYI FPV app, go to "Settings - Addresses", and select "SIYI AI Camera".
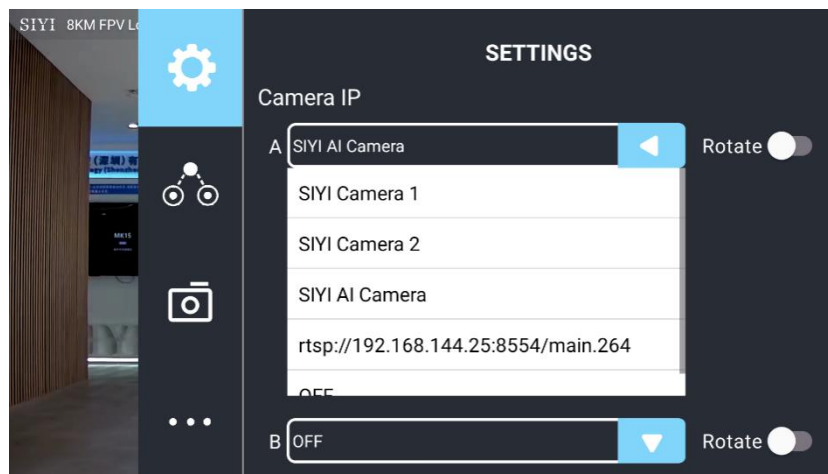
6. Return to main image, touch the AI tracking function button to enable the function.

7. Confirm if the flight controller integration button shows up (which means flight controller attitude data is integrated).

8. Switch flight mode to "Guided" and configure the max flight speed.
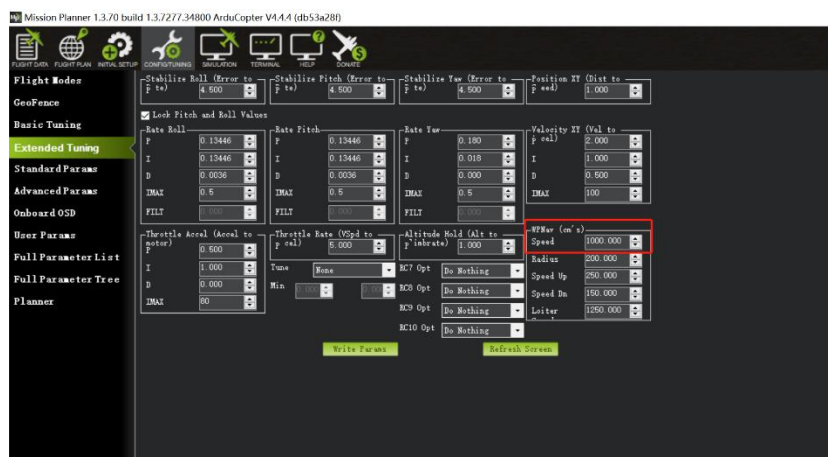
9. Touch the AI follow button to enable target follow function.

10. Touch the AI tracking / follow button again to disable the function.

⚠ DANGER

Considering flight safety, it is recommended to use the AI follow function and obstacle avoidance function together.

When the AI follow function is activated, the operator will not be able to manually control the flight, and the ground station cannot use the guided mode to control the aircraft. Switching flight mode can regain control.

When the AI follow function is activated, please ensure that the view on the follow route is clear and free of obstacles, and always pay attention to flight safety. When encountering obstacles, please immediately take over the flight manually and re-plan the route.

When the tracking target is lost, the aircraft will hover.

🔴 Mark

Using SIYI AI tracking module with multiple-sensor optical pods, in SIYI FPV app, the main stream of the optical pod should be configured as zoom camera.

When the tracked object is higher than the multi-rotor drone on the horizontal plane, AI

follow function does not work; when the tracked object and the multi-rotor drone are on the same horizontal plane, AI follow function works best.

3.2 Control SIYI Optical Pod (Gimbal Camera) in SIYI FPV App or SIYI QGC App through SIYI link

SIYI optical pod (gimbal camera) can connect to SIYI link directly to control gimbal rotation, gimbal functions, and video display in SIYI FPV app or SIYI QGC app when the air unit is communicating with the ground unit.

ZR10 Optical Pod
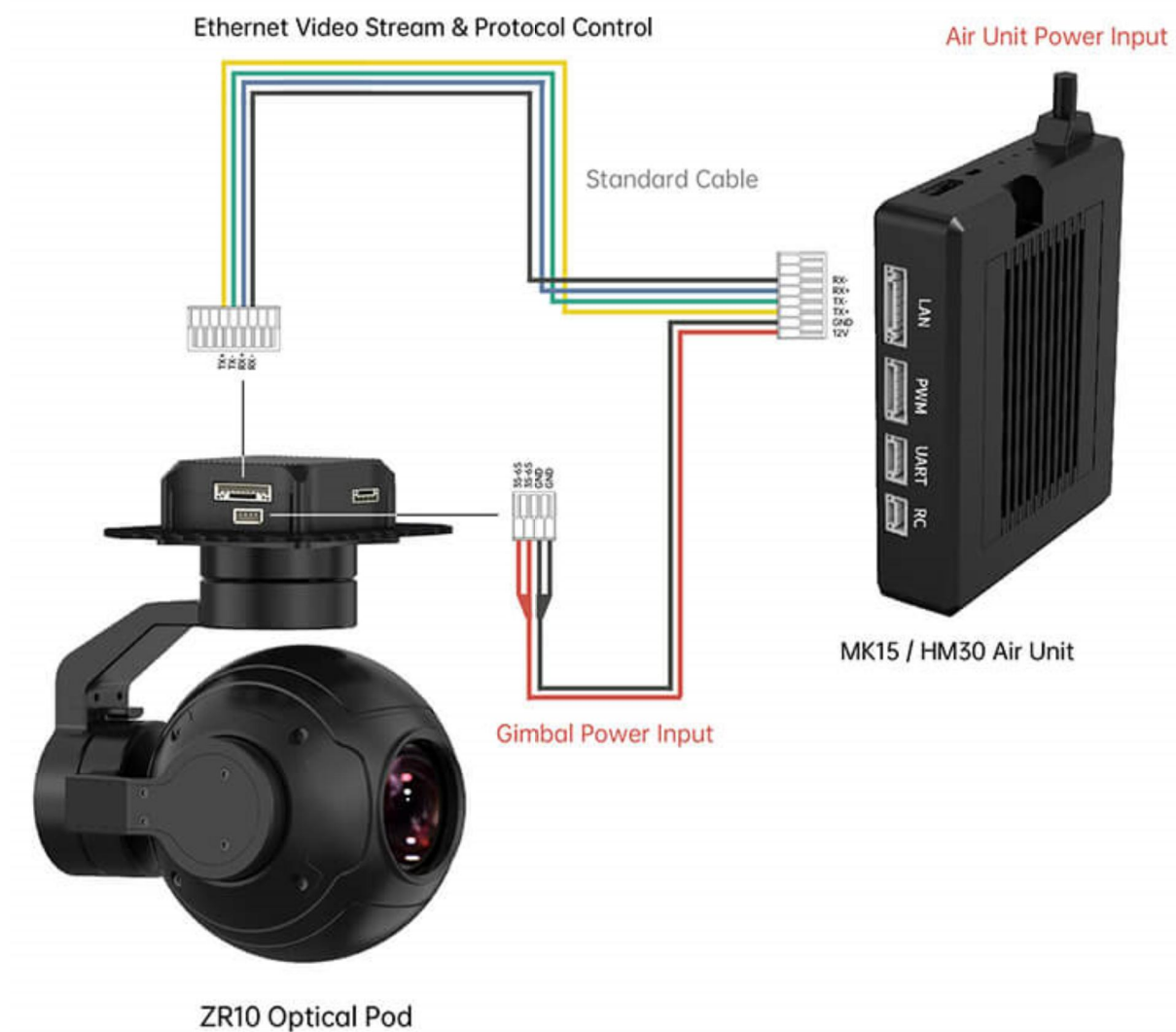
3.2.1 Preparation

It is necessary to prepare the tools, firmware, and software below before controlling gimbal camera in this way.

- SIYI Links (MK32 Standard Combo / HM30 / MK15 Enterprise Standard Combo is suggested for excellent compatibility with SIYI gimbal cameras)
- SIYI Optical Pod (Gimbal Camera)

⬤ **Mark**

Above products can be purchased from SIYI directly or from SIYI authorized dealers.

- SIYI Gimbal to SIYI Link Cable

⬤ **Mark**

Above tools come with product package.

- SIYI FPV App (v2.5.15.691 or latest version)
- SIYI QGC App

⬤ **Mark**

Above software can be downloaded from relevant product page on SIYI official website.

SIYI FPV App Steps

1. Power the air unit and bind it with the ground unit.

2. Use SIYI Gimbal to SIYI Link Cable to connect the air unit's Ethernet port to the gimbal camera's Ethernet port.

3. Update SIYI FPV app to the latest.

4. Run SIYI FPV app, go to "Settings" and select the relevant SIYI camera type with main / sub stream, video stream will display. Gimbal motion and camera functions can be controlled by the application.

SIYI QGC App Steps

1. Power the air unit and bind it with the ground unit.

2. Use SIYI Gimbal to SIYI Link Cable to connect the air unit's Ethernet port to the gimbal camera's Ethernet port.

3. Run SIYI QGC app, go to "Comm Links – Video Settings", and select "RTSP Video Stream" for "Source", then enter the default RTSP addresses of SIYI gimbal camera, video stream will display. Gimbal motion and camera functions can be controlled by the application.

3.2.2 Gimbal Pitch and Yaw Rotation

While SIYI FPV App or SIYI QGC app is running,

Sliding on touchscreen can control gimbal rotation. Sliding left and right are yaw rotation,

up and down are gimbal pitch rotation.

Double tap touchscreen, gimbal will automatically center.

⬤ **Mark**

Slide on touchscreen and hold it, gimbal will continue rotating till it reaches physical limit.

Farther that you hold it from the center of the screen, faster the gimbal rotates.

3.2.3 Zoom and Focus

While SIYI FPV App or SIYI QGC app is running,

Touching "Zoom in" or "Zoom out" icon on can control the zoom camera.

Click the touchscreen once, optical zoom gimbal camera will focus automatically.

3.2.4 Take pictures and Record Video

While SIYI FPV App or SIYI QGC app is running,

Touch "Photo" icon once on to take a picture. Touch "Record" icon to start video recording. Touch "Recording" icon to stop video recording.

⬤ **Mark**

Before taking a picture or recording video, it is necessary to insert SD card into the camera.

3.3 Control SIYI Optical Pod (Gimbal Camera) in SIYI QGC (Windows) Software through SIYI Link

SIYI optical pod (gimbal camera) can connect to SIYI link directly to control gimbal rotation, gimbal functions, and video display in SIYI QGC Windows software when the air unit is communicating with the ground unit.

ZR10 Optical Pod

3.3.1 Preparation

It is necessary to prepare tools, firmware, and software below before controlling gimbal camera in this way.

- SIYI Links (MK32 Standard Combo / HM30 / MK15 Enterprise Standard Combo is suggested for excellent compatibility with SIYI gimbal cameras)
- SIYI Optical Pod (Gimbal Camera)

🔴 **Mark**

Above products can be purchased from SIYI directly or from SIYI authorized dealers.

- SIYI Gimbal to SIYI Link Cable

🔴 **Mark**

Above tools come with product package.

- SIYI QGC Windows Software

🔴 **Mark**

Above software can be downloaded from relevant product page on SIYI official website.

Steps

1. Power the air unit and bind it with the ground unit.

2. Use SIYI Gimbal to SIYI Link Cable to connect the air unit's Ethernet port with the gimbal's Ethernet port.

3. Then connect the ground unit of the SIYI link to the Windows computer.

4. Modify the computer's Ethernet settings to have the same gateway with SIYI link and avoid IP addresses conflict.

    For example, let's assign "192.168.144.30" for the computer IP addresses.

5. Run SIYI QGC Windows software, go to "Comm Links – Video Settings", and select "RTSP Video Stream" for "Source", then enter the default RTSP addresses of SIYI gimbal camera, video stream will display. Gimbal motion and camera functions can be controlled by mouse in QGroundControl.

3.3.2 Gimbal Pitch and Yaw Rotation

While SIYI QGC Windows software is running,

Drag the mouse on screen can control gimbal rotation. Dragging the mouse left and right are yaw rotation, up and down are pitch rotation.

Double click the mouse on screen, gimbal will automatically center.

⬤ **Mark**

Drag the mouse on screen and hold it, gimbal will continue rotating unless there is a physical stop. Farther you hold it from the center of the screen, faster the gimbal rotates.

3.3.3 Zoom and Focus

While SIYI QGC Windows software is running,

Clicking "Zoom in" or "Zoom out" icon on can control the zoom camera.

Click on screen, optical zoom camera will focus automatically.

3.3.4 Take pictures and Record Video

While SIYI QGC Windows software is running,

Click "Photo" icon once on to take a picture. Click "Record" icon to start video recording.

Click "Recording" icon to stop video recording.

⬤ **Mark**

Before taking a picture or recording video, it is necessary to insert SD card into gimbal camera.

3.4 Control SIYI Optical Pod (Gimbal Camera) by S.Bus Signal and Forward S.Bus Signal to Flight Controller through SIYI Link

SIYI optical pod (gimbal camera) can be connected to the air unit of SIYI link and the flight controller simultaneously for attitude control through joysticks, dials, switches, and buttons on a remote controller or on an SIYI handheld ground station.

ZR10 Optical Pod
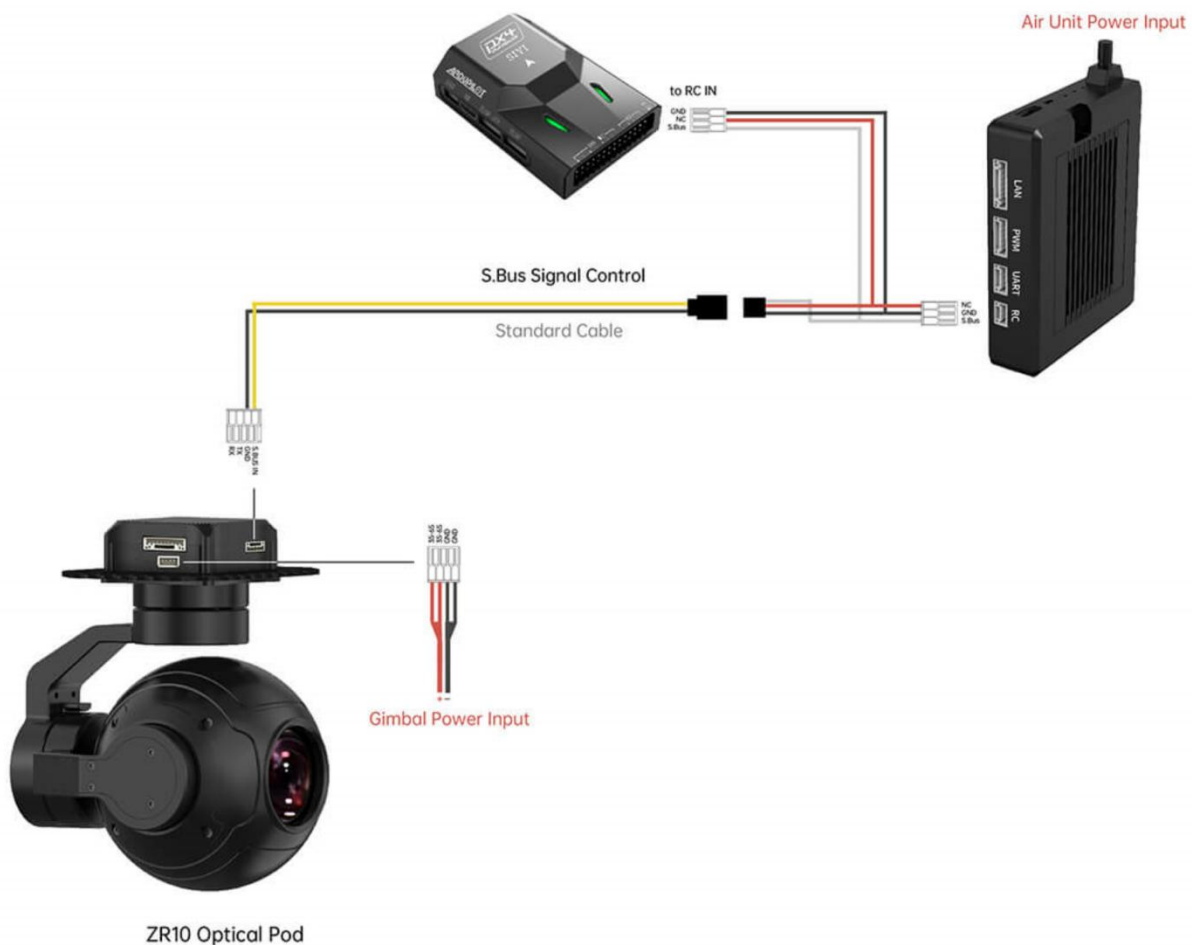
3.4.1 Preparation

It is necessary to prepare tools, firmware, and software below before controlling gimbal camera in this way.

- SIYI Links (MK32 Standard Combo / HM30 / MK15 Enterprise Standard Combo is suggested for excellent compatibility with SIYI gimbal cameras)

- SIYI Optical Pod (Gimbal Camera)

⬤ **Mark**

Above products can be purchased from SIYI directly or from SIYI authorized dealers.

- SIYI Gimbal to SIYI Link Cable

- 3 in 1 Control Cable (For ZT30, ZT6, ZR30, and A8 mini)

- MK15 / HM30 Air Unit S.Bus Y Cable

⬤ **Mark**

Above tools come with product package.

- Cable (USB-C to USB-A)

⬤ **Mark**

Above tools should be prepared by customer.

● SIYI PC Assistant (v1.3.9 or latest version)

🔴**Mark**

Above software can be downloaded from relevant product page on SIYI official website.

Steps

1. Power the air unit and bind it with the ground unit.

2. Use SIYI Gimbal to SIYI Link Cable to connect the air unit's Ethernet port with gimbal's Ethernet port.

3. Wire the 3 in 1 Control Cable with the MK15 / HM30 Air Unit S.Bus Y Cable.

4. Then use the combined cable to connect the air unit's RC port and the gimbal's control signal port.

5. Install and run SIYI PC Assistant on Windows computer.

6. Use the USB-C to USB-A cable to connect the gimbal to the computer, then run SIYI PC Assistant and go to "Gimbal Config" page.
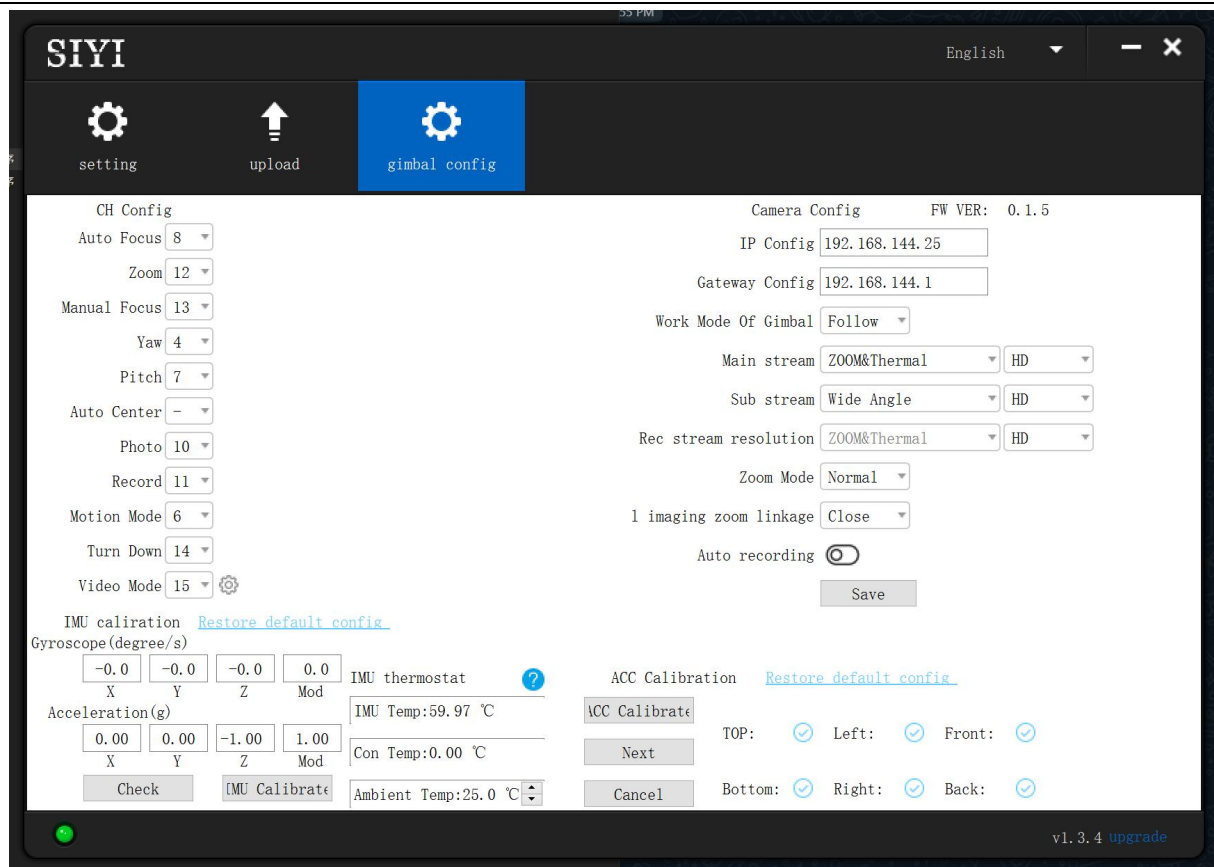
7. Under "Channel Config" page, assign the communication channel 1 to 16 to target gimbal and camera functions according to your requirement.

8. For the assigned channels, operate their mapped joysticks, dials, switches, and buttons on the handheld ground station to confirm if they are working normally.

3.4.2 Gimbal Pitch and Yaw Rotation (Taking an example of Dial Control)

Below is suggested channel mapping settings for testing, customers are free to assign channel mappings as required through SIYI TX app.

● Channel 7 = Left Dial (Reversed)

● Channel 8 = Right Dial

● Channel 12 = Any Button

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In SIYI PC Assistant, map "Yaw" function to channel 7 and "Pitch" to channel 8, "Center" to channel 12.

Then, if you operate the left dial, gimbal will rotate on yaw axis. If you operate the right dial, gimbal will rotate on pitch axis. Press the button, gimbal will center itself automatically.

🔴 **Mark**

Hold the dial from its center position, gimbal will keep rotating unless there was a physical limit. Farther you hold it away from center, faster gimbal rotates.

3.4.3 Zoom and Focus (Taking an Example of Switch Control)

Below are the suggested channel mapping settings for testing, customers are free to assign channel mappings as required through SIYI TX app.

● Channel 13 = A Switch

● Channel 14 = B Switch

In SIYI PC Assistant, map "Zoom" function to channel 13, map "Auto Focus" function to channel 14.

Then, if you operate switch A, camera will zoom in or zoom out. If you operate switch B, optical zoom camera will focus automatically.

3.4.4 Take Pictures and Record Video (Taking an Example of Button Control)

Below are the suggested channel mapping settings for testing, customers are free to assign channel mappings as required through SIYI TX app.

- Channel 9 = Button A

- Channel 10 = Button B

In SIYI PC Assistant, map "Photo" function to channel 9 and "Record" to channel 10. Then, if you press button A, camera will take a picture. If you press button B, camera will start or stop video recording.

🔴 **Mark**

Before taking pictures or recording video, it is necessary to insert SD card into the camera.

3.5 UART / UDP Control (SIYI Gimbal SDK)

SIYI gimbal camera provides control protocol for all customers. Please refer to the below guide for secondary development based on SIYI gimbal camera.

3.5.1 SDK Protocol Format

Field	Index	Bytes	Description
STX	0	2	0x6655: starting mark. Low byte in the front
CTRL	2	1	0: need_ack (if the current data pack need "ack") 1: ack_pack (if the current data pack is an "ack" package) 2-7: reserved
Data_len	3	2	Date field byte length Low byte in the front
SEQ	5	2	Frame sequence (0 ~ 65535) Low byte in the front
CMD_ID	7	1	Command ID
DATA	8	Data_len	Data
CRC16		2	CRC16 check to the complete data package. Low byte in the front

3.5.2 SDK Communication Commands

TCP Heartbeat

CMD_ID:0x00------TCP Heartbeat			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
			No ack

Mark:

1. Heartbeat pack: 55 66 01 01 00 00 00 00 00 59 8B
2. Only available for TCP protocol.

Request Gimbal Camera Firmware Version

CMD_ID:0x01------Request Gimbal Camera Firmware Version			
Send data format			
No.	Data Type	Data Name	Description

	ACK data format		
uint32_t	code_board_ver	Camera firmware version	
uint32_t	gimbal_firmware_ver	Gimbal firmware version	
uint32_t	zoom_firmware_ver	Zoom firmware version	

Eg：0x6E030203 = firmware version v3.2.3

Mark:

1. Ignore the 4th byte (higher byte)
2. Zoom firmware version is only available for optical zoom cameras such as ZR10, ZR30, and ZT30 at this moment.
3. The camera system takes about 30 seconds to start up. Valid camera firmware version cannot be obtained before the startup is completed. The camera firmware version number obtained during this period is 0.0.0.

Request Gimbal Camera Hardware ID

CMD_ID:0x02------Request Gimbal Camera Hardware ID			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
Uint8_t	hardware_id[12]	Hardware ID character string (10 digits)	

Mark:

The first two digits of the hardware ID character string indicates product model number in hexadecimal.

- 0x6B: ZR10
- 0x73: A8 mini
- 0x75: A2 mini
- 0x78: ZR30
- 0x82: ZT6
- 0x7A: ZT30

Request Gimbal Camera's Present Working Mode

CMD_ID:0x19------Request Gimbal Camera's Present Working Mode			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
1	uint8_t	gimbal_mode	00: Lock Mode 01: Follow Mode 02: FPV Mode

Auto Focus

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CMD_ID:0x04------Auto Focus			
Send data format			
No.	Data Type	Data Name	Description
	uint8_t	auto_focus	1: Start auto focus for once
	uin16_t	touch_x	x coordinates, the range is the length of the video stream resolution
	uin16_t	touch_y	y coordinates, the range is the height of the video stream resolution
ACK data format			
1	uint8_t	sta	1: Success 0: Failure

Mark:

1. Auto focus command is only available for optical zoom gimbal cameras like ZT30, ZR30, and ZR10 at this moment.
2. Under split image, the effective value of the x coordinates is a half of the length of the video stream resolution.

Manual Zoom and Auto Focus

CMD_ID:0x05------Manual Zoom and Auto Focus			
Send data format			
No.	Data Type	Data Name	Data Description
1	int8_t	zoom	1: Start zooming in 0: Stop zooming in / out (send when released from control command) -1: Start zooming out
ACK data format			
	uint16_t	zoom_multiple	Current (hybrid) zoom multiples (zoom_multiple / 10, accuracy is one decimal point)

Mark:

1. Manual zoom and auto focus command is only available for optical zoom gimbal cameras like ZT30, ZR30, and ZR10 at this moment.
2. Under this command, ZT6 and A8 mini can only do manual zoom but cannot do auto focus.

Absolute Zoom and Auto Focus

CMD_ID:0x0F------Absolute Zoom and Auto Focus			
Send data format			
No.	Data Type	Data Name	Data Description
1	uint8_t	Absolute_movement_int	Input the integer part of the target multiple (0X1 ~ 0X1E)
2	uint8_t	Absolute_movement_	Input the fractional part of the target

		float	multiple (0X0 ~ 0X9)
ACK data format			
	uint8_t	Absolute_movement_ ask	Success and return to 1

Mark:

1. Absolute zoom command is only available for optical zoom gimbal cameras like ZT30, ZR30, and ZR10 at this moment.
2. Under this command, ZT6 and A8 mini can only do absolute zoom but cannot do auto focus.

Request the Max Zoom Value in Present

CMD_ID:0x16------Request the Max Zoom Value in Present			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
	uint8_t	zoom_max_int	Integer of the max zoom value in present
	uint8_t	zoom_max_float	Float of the max zoom value in present

Mark:

This command is available for zoom gimbal cameras.

Request the Zoom Value in Present

CMD_ID:0x18------Acquire the Zoom Value in Present			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
	uint8_t	zoom_int	Integer of the zoom value in present
	uint8_t	zoom_float	Float of the zoom value in present

Mark:

This command is available for zoom gimbal cameras.

Manual Focus

CMD_ID:0x06------Manual Focus			
Send data format			
No.	Data Type	Data Name	Description
1	int8_t	focus	1: Long shot 0: Stop manual focus (send when

			released from control command)
			-1: Close shot
ACK data format			
	uint8_t	sta	1: Success 0: Fail

Mark:

Auto focus command is only available for optical zoom gimbal cameras like ZT30, ZR30, and ZR10 at this moment.

Gimbal Rotation

CMD_ID:0x07------Gimbal Rotation			
Send data format			
No.	Date Type	Date Name	Description
1	int8_t	turn_yaw	-100~0~100: Negative and positive represent two directions, higher or lower the number is away from 0, faster the rotation speed is. Send 0 when released from control command and gimbal stops rotation.
2	int8_t	turn_pitch	-100~0~100: Same as above
ACK data format			
	uint8_t	sta	1: Success 0: Fail

Center

CMD_ID:0x08------Center			
Send data format			
No.	Data Type	Data Name	Description
1	uint8_t	center_pos	1: gimbal centers to position 0
ACK data format			
1	uint8_t	sta	1: Success 0: Fail

Request Gimbal Configuration Information

CMD_ID:0x0A------Request Gimbal Configuration Information			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
1	uint8_t	reserved	

2	uint8_t	hdr_sta	0: HDR OFF 1: HDR ON
3	uint8_t	reserved	
4	uint8_t	record_sta	0: Recording OFF 1: Recording ON 2: TF card slot is empty 3: (Recording) Data loss in TF card recorded video, please check TF card
5	uint8_t	gimbal_motion_mode	0: Lock Mode 1: Follow Mode 2: FPV Mode
6	uint8_t	gimbal_mounting_dir	Gimbal Mounting Method 0: Reserved 1: Normal 2: Upside Down
7	uint8_t	video_hdmi_or_cvbs	(Only available on ZT6 and A8 mini) Video output status of HDMI and CVBS: 0: HDMI output ON CVBS output OFF 1: HDMI output OFF CVBS output ON

Function Feedback Information

CMD_ID:0x0B------Function Feedback Information			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
1	uint8_t	info_type	0: Success 1: Fail to take a photo (Please check if TF card is inserted) 2: HDR ON 3: HDR OFF 4: Fail to record a video (Please check if TF card is inserted)

Photo and Record

CMD_ID:0x0C------Photo and Record

Send data format			
No.	Data Type	Data Name	Description
	uint8_t	func_type	0: Take a picture 1: Switch on / off HDR (not supported yet) 2: Start / Stop Recording 3: Motion – Lock Mode 4: Motion – Follow Mode 5: Motion – FPV Mode 6: Set video output as HDMI (Only available on ZT6 and A8 mini, restart gimbal to take effect) 7: Set video output as CVBS (Only available on ZT6 and A8 mini, restart gimbal to take effect) 8: Turn off both HDMI and CVBS video output (Only available on ZT6 and A8 mini, restart gimbal to take effect)
ACK data format			
			No ack

Request Gimbal Attitude

CMD_ID:0x0D------Request Gimbal Attitude			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
	int16_t	yaw	Yaw axis degree
	int16_t	pitch	Pitch axis degree
	int16_t	roll	Roll axis degree
	int16_t	yaw_velocity	Yaw axis rotation speed
	int16_t	pitch_velocity	Pitch axis rotation speed
	int16_t	roll_velocity	Roll axis rotation speed

Mark:

1. The above data to be divided by 10 is the actual degree, accuracy in one decimal place.
2. It is suggested to use the command "0x25" to configure the sending frequency of gimbal attitude data in certain frequency continuously and actively.

Send Control Angle to Gimbal

CMD_ID:0x0E------Send Control Angle to Gimbal			
Send data format			
No.	Data Type	Data Name	Description

int16_t	yaw	Target yaw angle
int16_t	pitch	Target pitch angle
ACK data format		
int16_t	yaw	Current yaw angle
int16_t	pitch	Current pitch angle
int16_t	roll	Current roll angle

Control Angle Range

Yaw:

- ZR10 / A8 mini: -135.0 ~ 135.0 degrees
- ZT6 / ZR30: -270.0 ~ 270.0 degrees
- ZT30: Limitless

Pitch

- ZT30 / ZT6 / ZR30 / ZR10 / A8 mini / A2 mini: -90.0 ~ 25.0 degree

Mark:

1. The accuracy of the control angle is in one decimal place. Eg: Set yaw as 60.5 degrees, the command number should be set as 605.
2. The actual angle data returned to be divided by 10 is the actual degree, accuracy in one decimal place.

Single Axis Control (only available on A8 mini)

CMD_ID:0x41------ Single Axis Control			
Send data format			
No.	Data Type	Data Name	Description
	int16_t	angle	Target angle
	uint8_t	single_control_flag	Target axis: 0: Yaw 1: Pitch
ACK data format			
	int16_t	yaw	Current yaw angle
	int16_t	pitch	Current pitch angle
	int16_t	roll	Current roll angle

Control Angle Range

Yaw: -135.0 ~ 135.0 degrees

Pitch: -90.0 ~ 25.0 degree

Mark:

1. The accuracy of the control angle is in one decimal place. Eg: Set yaw as 60.5 degrees, the command number should be set as 605.
2. The actual angle data returned to be divided by 10 is the actual degree, accuracy in one decimal place.

Request Gimbal Camera Codec Specs

CMD_ID:0x20------Request Gimbal Camera Codec Specs			
Send data format			
No.	Data Type	Data Name	Description
	uint8_t	req_stream_type	0: Recording stream 1: Main stream 2: Sub stream (only available on ZT30 and ZT6)
ACK data format			
	uint8_t	stream_type	0: Recording stream 1: Main stream 2: Sub stream (only available on ZT30 and ZT6)
	uint8_t	VideoEncType	Codec Format 1: H264 2: H265
	uint16_t	Resolution_L	Resolution in length
	uint16_t	Resolution_H	Resolution in height
	uint16_t	VideoBitrate	Video Bitrate in Kbps
	uint8_t	VideoFrameRate	Video frame rate

Send Codec Specs to Gimbal Camera

CMD_ID:0x21------Send Codec Specs to Gimbal Camera			
Send data format			
No.	Data Type	Data Name	Description
	uint8_t	stream_type	0: Recording stream 1: Main stream 2: Sub stream (only available on ZT30 and ZT6)
	uint8_t	VideoEncType	Codec Format 1: H264 2: H265
	uint16_t	Resolution_L	Resolution in length: 1920, 1280
	uint16_t	Resolution_H	Resolution in height: 1080, 720
	uint16_t	VideoBitrate	Video Bitrate in Kbps
	uint8_t	reserve	Reserved
ACK data format			
	uint8_t	stream_type	0: Recording stream 1: Main stream 2: Sub stream (only available on ZT30 and ZT6)
	uint8_t	sta	1: Success 0: Failure

Request Gimbal Camera Image Mode

CMD_ID:0x10------Request Gimbal Camera Image Type
Send data format

No.	Data Type	Data Name	Description
ACK data format			
1	uint8_t	vdisp_mode	**Image Mode:** 0: Split Screen (Main: Zoom & Thermal. Sub: Wide Angle) 1: Split Screen (Main: Wide Angle & Thermal. Sub: Zoom) 2: Split Screen (Main: Zoom & Wide Angle. Sub: Thermal) 3: Single Image (Main: Zoom. Sub: Thermal) 4: Single Image (Main: Zoom. Sub: Wide Angle) 5: Single Image (Main: Wide Angle. Sub: Thermal) 6: Single Image (Main: Wide Angle. Sub: Zoom) 7: Single Image (Main: Thermal. Sub: Zoom) 8: Single Image (Main: Thermal. Sub: Wide Angle)

Mark:

This command is only available for ZT30 and ZT6 at this moment.

Send Image Mode to Gimbal Camera

CMD_ID:0x11------Send Image Type to Gimbal Camera			
Send data format			
No.	Data Type	Data Name	Description
1	uint8_t	vdisp_mode	**Image Mode:** 0: Split Screen (Main: Zoom & Thermal. Sub: Wide Angle) 1: Split Screen (Main: Wide Angle & Thermal. Sub: Zoom) 2: Split Screen (Main: Zoom & Wide Angle. Sub: Thermal) 3: Single Image (Main: Zoom. Sub: Thermal) 4: Single Image (Main: Zoom. Sub: Wide Angle) 5: Single Image (Main: Wide Angle. Sub: Thermal) 6: Single Image (Main: Wide Angle. Sub: Zoom) 7: Single Image (Main: Thermal. Sub: Zoom) 8: Single Image (Main: Thermal. Sub: Wide Angle)
ACK data format			
1	uint8_t	vdisp_mode	**Image Mode:** 0: Split Screen (Main: Zoom & Thermal. Sub: Wide Angle)

| 1: Split Screen (Main: Wide Angle & Thermal. Sub: Zoom) |
| 2: Split Screen (Main: Zoom & Wide Angle. Sub: Thermal) |
| 3: Single Image (Main: Zoom. Sub: Thermal) |
| 4: Single Image (Main: Zoom. Sub: Wide Angle) |
| 5: Single Image (Main: Wide Angle. Sub: Thermal) |
| 6: Single Image (Main: Wide Angle. Sub: Zoom) |
| 7: Single Image (Main: Thermal. Sub: Zoom) |
| 8: Single Image (Main: Thermal. Sub: Wide Angle) |

Mark:

This command is only available for ZT30 and ZT6 at this moment.

Request the Temperature of a Point

CMD_ID:0x12------Request the Temperature of a Point			
Send data format			
No.	Data Type	Data Name	Description
1	uint16_t	x	x coordinate of the point
2	uint16_t	y	y coordinate of the point
3	uint8_t	get_temp_flag	0: Turn off temperature measuring 1: Measure the temperature once 2: Continuous temperature measuring at 5 Hz
ACK data format			
1	uint16_t	temp	Temperature of the point / 100 (two decimal places)
2	uint16_t	x	X coordinate of the point
3	uint16_t	y	Y coordinate of the point

Mark:

This command is only available for ZT30 and ZT6 at this moment.

Request the Max / Min Temperature in a Selected Box

CMD_ID:0x13------Request the Max / Min Temperature in a Selected Box			
Send data format			
No.	Data Type	Data Name	Description
1	uint16_t	startx	X coordinate of the starting point of the box
2	uint16_t	starty	Y coordinate of the starting point of the box

3	uint16_t	endx	X coordinate of the ending point of the box
4	uint16_t	endy	Y coordinate of the ending point of the box
5	uint8_t	get_temp_flag	0: Turn off temperature measuring 1: Measure the temperature once 2: Continuous temperature measuring at 5 Hz
ACK data format			
1	uint16_t	startx	X coordinate of the starting point of the box
2	uint16_t	starty	Y coordinate of the starting point of the box
3	uint16_t	endx	X coordinate of the ending point of the box
4	uint16_t	endy	Y coordinate of the ending point of the box
5	uint16_t	temp_max	The maximum temperature in the box / 100 (two decimal places)
6	uint16_t	temp_min	The minimum temperature in the box / 100 (two decimal places)
7	uint16_t	temp_max_x	X coordinate of the max temperature in the box
8	uint16_t	temp_max_y	Y coordinate of the max temperature in the box
9	uint16_t	temp_min_x	X coordinate of the min temperature in the box
10	uint16_t	temp_min_x	Y coordinate of the min temperature in the box

Mark:

1. Thermal camera supports digital zoom, the temperature measuring box will zoom in and out according to the digital zoom multiples. Under digital zoom, the temperature measuring range should refer to the box responded by the camera.

2. This command is only available for ZT30 and ZT6 at this moment.

Request the Max / Min Temperature in the Full Image

CMD_ID:0x14------Request the Max / Min Temperature in the Full Image			
Send data format			
No.	Data Type	Data Name	Description
1	uint8_t	get_temp_flag	0: Turn off temperature measuring 1: Measure the temperature once 2: Continuous temperature measuring at 5 Hz
ACK data format			
1	uint16_t	temp_max	The maximum temperature in the full image / 100 (two decimal places)
2	uint16_t	temp_min	The minimum temperature in the full

			image / 100 (two decimal places)
3	uint16_t	temp_max_x	X coordinate of the max temperature in the full image
4	uint16_t	temp_max_y	Y coordinate of the max temperature in the full image
5	uint16_t	temp_min_x	X coordinate of the min temperature in the full image
6	uint16_t	temp_min_x	Y coordinate of the min temperature in the full image

Mark:

This command is only available for ZT30 and ZT6 at this moment.

Request the Thermal Color Palette

CMD_ID:0x1A------Request the Thermal Color Palette			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
	uint8_t	pseudo_color	11 thermal colors are available in total: 0: White_Hot 1: Reserved 2: Sepia 3: Ironbow 4: Rainbow 5: Night 6: Aurora 7: Red_Hot 8: Jungle 9: Medical 10: Black_Hot 11: Glory_Hot

Mark:

This command is only available for ZT30 and ZT6 at this moment.

Send a Thermal Color to Gimbal Camera

CMD_ID:0x1B------Send a Thermal Color to Gimbal Camera			
Send data format			
No.	Data Type	Data Name	Description
	uint8_t	pseudo_color	11 thermal colors are available in total: 0: White_Hot 1: Reserved 2: Sepia 3: Ironbow 4: Rainbow

			5: Night
			6: Aurora
			7: Red_Hot
			8: Jungle
			9: Medical
			10: Black_Hot
			11: Glory_Hot
ACK data format			
uint8_t	pseudo_color		11 thermal colors are available in total:
			0: White_Hot
			1: Reserved
			2: Sepia
			3: Ironbow
			4: Rainbow
			5: Night
			6: Aurora
			7: Red_Hot
			8: Jungle
			9: Medical
			10: Black_Hot
			11: Glory_Hot

Mark:

This command is only available for ZT30 and ZT6 at this moment.

Send Thermal RAW Data Command to Gimbal

CMD_ID:0x34------ Send Thermal RAW Data Command to Gimbal			
Send data format			
No.	Data Type	Data Name	Description
1	uint8_t	mode	0: 30 fps 1: 25 fps and output temperature frame
ACK data format			
1	uint8_t	mode	0: 30 fps 1: 25 fps and output temperature frame

Mark:

This command is only available for ZT30 and ZT6 at this moment.

Request Temperature from the Thermal Imaging Camera Once

CMD_ID:0x35------ Request Temperature from the Thermal Imaging Camera Once			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
1	uint8_t	ack	1: Success

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Request Thermal Gain

CMD_ID:0x37------ Request Thermal Gain			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
1	uint8_t	Ir_gain	0: Low gain 1: High gain

Send Thermal Gain to Gimbal

CMD_ID:0x38------ Send Thermal Gain to Gimbal			
Send data format			
No.	Data Type	Data Name	Description
1	uint8_t	Ir_gain	0: Low gain 1: High gain
ACK data format			
1	uint8_t	Ir_gain	0: Low gain 1: High gain

Request Thermal Calibration

CMD_ID:0x39------ Request Thermal Calibration			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
1	uint8_t	EnvCorrect	0: ON 1: OFF

Send Thermal Calibration to Gimbal

CMD_ID:0x3A------ Send Thermal Calibration to Gimbal
Send data format

No.	Data Type	Data Name	Description
1	uint8_t	EnvCorrect	0: ON 1: OFF
ACK data format			
1	uint8_t	EnvCorrect	0: ON 1: OFF

Mark:

This command is only available for ZT30 and ZT6 at this moment.

Request Thermal Calibration Parameters

CMD_ID:0x3B------ Request Thermal Calibration Parameters			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
1	uint16_t	Dist	Distance (m)
2	uint16_t	Ems	Target emission rate (%)
3	uint16_t	Hum	Humidity (%)
4	uint16_t	Ta	Atmospheric Temperature (°C)
5	uint16_t	Tu	Reflection Temperature (°C)

Mark:

1. All parameters of this protocol are divided by 100 and retained to two decimal places.
2. This command is only available for ZT30 and ZT6 at this moment.

Send Thermal Calibration Parameters to Gimbal

CMD_ID:0x3C------ Send Thermal Calibration Parameters to Gimbal			
Send data format			
No.	Data Type	Data Name	Description
1	uint16_t	Dist	Distance (m)
2	uint16_t	Ems	Target emission rate (%)
3	uint16_t	Hum	Humidity (%)
4	uint16_t	Ta	Atmospheric Temperature (°C)
5	uint16_t	Tu	Reflection Temperature (°C)
ACK data format			
1	uint8_t	ack	1: Success

Mark:

1. All parameters of this protocol are divided by 100 and retained to two decimal places.
2. This command is only available for ZT30 and ZT6 at this moment.

Request Range Value from the Laser Rangefinder

CMD_ID:0x15------Request Range Value from the Laser Rangefinder			
Send data format			
No.	Data Type	Data Name	Description

		ACK data format	
1	uint16_t	info_type	Range from Laser Rangefinder low byte in the front, high byte in the back Minimum value is 50 Data unit is dm

Mark:

This command is only available for ZT30 and at this moment.

Request the Latitude and Longitude of the Laser Rangefinder's Target

CMD_ID:0x17------ Request the Latitude and Longitude of the Laser Rangefinder's Target			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
1	int32_t	lon_degE7	[degE7] Longitude (WGS84, EGM96 spheroid)
2	int32_t	lat_degE7	[degE7] Latitude (WGS84, EGM96 spheroid)

Mark:

This command is only available for ZT30 at this moment.

Request Laser Rangefinder Status

CMD_ID:0x31------ Request Laser Rangefinder Status			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
1	uint8_t	laser_state	1: ON 0: OFF

Mark:

This command is only available for ZT30 at this moment.

Send Lase Rangefinder Status to Gimbal

CMD_ID:0x32------ Send Lase Rangefinder Status to Gimbal			
Send data format			
No.	Data Type	Data Name	Description
1	uint8_t	laser_state	1: ON 0: OFF
ACK data format			
1	uint8_t	sta	1: Success 0: Fail

Send Flight Controller Attitude Data to Gimbal UART Port

CMD_ID:0x22------ Send Flight Controller Attitude Data to Gimbal UART Port			
Send data format			
No.	Data Type	Data Name	Description
1	float	roll	[rad] Roll angle (-pi..+pi)
2	float	pitch	[rad] Pitch angle (-pi/2..+pi/2)
3	float	yaw	[rad] Yaw angle (-pi..+pi)
4	float	rollspeed	[rad/s] Roll angular speed
5	float	pitchspeed	[rad/s] Pitch angular speed
6	float	yawspeed	[rad/s] Yaw angular speed
ACK data format			

Request the Flight Controller to Send Data Stream to Gimbal

CMD_ID:0x24------ Request the Flight Controller to Send Data Stream to Gimbal			
Send data format			
No.	Data Type	Data Name	Description
1	uint8_t	data_type	1：Attitude data 2：RC channel data (not ready yet)
2	uint8_t	data_freq	Outputting Frequency 0：OFF 1：2 Hz 2：4 Hz 3：5 Hz 4：10 Hz 5：20 Hz 6：50 Hz 7：100 Hz
ACK data format			
1	uint8_t	data_type	1：Attitude data 2：RC channel data

Send Flight Controller GPS Data to Gimbal

CMD_ID:0x3E------ Send Flight Controller GPS Data to Gimbal			
Send data format			
No.	Data Type	Data Name	Description
1	uint32_t	time_boot_ms	[ms] time since boot
2	int32_t	lat	[degE7] Latitude
3	int32_t	lon	[degE7] Longitude
4	int32_t	alt	[cm] Altitude (MSL)
5	int32_t	alt_ellipsoid	[cm] Altitude (above WGS84, EGM96 ellipsoid). Positive for up.
6	float	vn	[m/s] X Speed

7	float	ve	[m/s] Y Speed
8	float	vd	[m/s] Z Speed
ACK data format			

Request the Gimbal to Send Data Stream

CMD_ID:0x25------ Request the Gimbal to Send Data Stream			
Send data format			
No.	Data Type	Data Name	Description
1	uint8_t	data_type	1：Attitude data 2：Laser rangefinder data (available in ZT30 only)
2	uint8_t	data_freq	Outputting Frequency 0：OFF 1：2 Hz 2：4 Hz 3：5 Hz 4：10 Hz 5：20 Hz 6：50 Hz 7：100 Hz
ACK data format			
1	uint8_t	data_type	1：Attitude data 2：Laser rangefinder data

Mark:

The frequency of sending laser rangefinder data cannot be configured at this moment. If the frequency is not 0, it sends data.

Set UTC Time

CMD_ID:0x30------ Set UTC Time			
Send data format			
No.	Data Type	Data Name	Description
1	uint64_t	Timestamp	UNIX epoch time(us)
ACK data format			
1	int8_t	ack	1: Success 0: Time format error

Format SD Card

CMD_ID:0x48------ Format SD Card			
Send data format			
No.	Data Type	Data Name	Description
ACK data format			
1	uint8_t	format_sta	0: Fail

			1: Success

Gimbal Camera Soft Restart

CMD_ID:0x80------ Gimbal Soft Restart			
Send data format			
No.	Data Type	Data Name	Description
1	uint8_t	Camera_reboot	0: No action 1: Camera restart
2	uint8_t	Gimbal_reset	0: No action 1: Gimbal restart
ACK data format			
1	uint8_t	Camera_reboot_sta	0: No action 1: Camera restart
2	uint8_t	Gimbal_reset_sta	0: No action 1: Gimbal restart

3.5.3 SIYI Gimbal Camera SDK Communication Interface

TTL Serial Port
- Baud rate: 115200
- Data position: 8 digits.   Stop position: 1 digit. No check.

UDP
- IP: 192.168.144.25
- Port Number: 37260

TCP
- IP: 192.168.144.25
- Port Number: 37260
- Heartbeat Package Data: 55 66 01 01 00 00 00 00 00 59 8B

3.5.4 SIYI Gimbal Camera SDK Communication Code Examples

Request the Gimbal Camera's Working Mode in Present
55 66 01 00 00 00 00 19 5D 57

zoom 1

55 66 01 01 00 00 00 05 01 8d 64

zoom -1

55 66 01 01 00 00 00 05 FF 5c 6a

Absolute Zoom (4.5X)

55 66 01 02 00 10 00 0f 04 05 6b 15

Request the Zoom Camera's Max Zoom Value in Present

55 66 01 00 00 00 00 16 B2 A6

Request the Zoom Camera's Zoom Value in Present

55 66 01 00 00 00 00 18 7C 47

Manual Zoom 1

55 66 01 01 00 00 00 06 01 de 31

Manual Zoom -1

55 66 01 01 00 00 00 06 ff 0f 3f

Take a Picture

55 66 01 01 00 00 00 0c 00 34 ce

Record Video

55 66 01 01 00 00 00 0c 02 76 ee

Gimbal Rotation 100 100

55 66 01 02 00 00 00 07 64 64 3d cf

Center

55 66 01 01 00 00 00 08 01 d1 12

Request Gimbal Camera's Status Information

55 66 01 00 00 00 00 0a 0f 75

Auto Focus

55 66 01 01 00 00 00 04 01 bc 57

Request the Gimbal Camera's Hardware ID

55 66 01 00 00 00 00 02 07 f4

Request the Gimbal Camera's Firmware Version

55 66 01 00 00 00 00 01 64 c4

Lock Mode

55 66 01 01 00 00 00 0c 03 57 fe

Follow Mode
55 66 01 01 00 00 00 0c 04 b0 8e

FPV Mode
55 66 01 01 00 00 00 0c 05 91 9e

Request the Gimbal Camera's Attitude Data
55 66 01 00 00 00 00 0d e8 05

Send Control Angle (-90, 0) (Upwards) to Gimbal Camera
55 66 01 04 00 00 00 0e 00 00 ff a6 3b 11

Send "Enable HDMI Output" Command to Gimbal Camera (Available for ZT6, ZR30, and A8 mini, restart after configuration)
55 66 01 01 00 00 00 0c 06 f2 ae

Send "Enable CVBS Output" Command to Gimbal Camera (Available for ZT6 and A8 mini, restart after configuration)
55 66 01 01 00 00 00 0c 07 d3 be

Send "Disable CVBS / HDMI Output" Command to Gimbal Camera (Available for ZT6, ZR30, and A8 mini, restart after configuration)
55 66 01 01 00 00 00 0c 08 3c 4f

Request Gimbal Camera Codec Specs
55 66 01 01 00 00 00 20 00 BF 8D

Configure Camera Codec Specs – Main Stream to HD Resolution
55 66 01 09 00 00 00 21 01 02 00 05 d0 02 dc 05 00 58 45

Configure Camera Codec Specs – Main Stream to Ultra HD Resolution
55 66 01 09 00 00 00 21 01 02 80 07 38 04 d0 07 00 5a 68

Configure Recording Video Stream Resolution as 2K and H265 Bitrate as 15 Mbps
55 66 01 09 00 00 00 21 00 02 00 0a a0 05 98 3a 00 15 f3

Configure Recording Video Stream Resolution as 4K and H265 Bitrate as 15 Mbps
55 66 01 09 00 00 00 21 00 02 00 0f 70 08 98 3a 00 70 be

Request Gimbal Camera's Image Mode in Present
55 66 01 00 00 00 00 10 74 c6

Send "Image Mode" Command to Gimbal Camera
55 66 01 01 00 00 00 11 01 3a ab

Request the Temperature of a Point in Thermal Image

55 66 01 05 00 00 00 12 00 00 00 00 00 01 a8 2f

Request the Thermal Color Palette

55 66 01 00 00 00 00 1A 3e 67

Send the "Thermal Color Palette" Command to the Thermal Camera

55 66 01 01 00 00 00 1B 03 b3 64

Request Range Value from the Rangefinder (Low byte in front, high byte in back, available for ZT30)

55 66 01 00 00 00 00 15 D1 96

3.5.5 SDK CRC16 Code

```
const uint16_t crc16_tab[256];
/*****************************************************
CRC16 Coding & Decoding G(X) = X^16+X^12+X^5+1
*****************************************************/
uint16_t CRC16_cal(uint8_t *ptr, uint32_t len, uint16_t crc_init)
{
    uint16_t crc,    oldcrc16;
    uint8_t   temp;
    crc = crc_init;
    while (len--!=0)
    {
        temp=(crc>>8)&0xff;
        oldcrc16=crc16_tab[*ptr^temp];
        crc=(crc<<8)^oldcrc16;
        ptr++;

    }
    //crc=~crc;           //??
    return(crc);
}

uint8_t crc_check_16bites(uint8_t* pbuf, uint32_t len,uint32_t* p_result)
{
    uint16_t crc_result = 0;
    crc_result= CRC16_cal(pbuf,len, 0);
    *p_result = crc_result;
```

```
    return 2;
}


const uint16_t crc16_tab[256]= {0x0,0x1021,0x2042,0x3063,0x4084,0x50a5,0x60c6,0x70e7,
                    0x8108,0x9129,0xa14a,0xb16b,0xc18c,0xd1ad,0xe1ce,0xf1ef,
                    0x1231,0x210,0x3273,0x2252,0x52b5,0x4294,0x72f7,0x62d6,
                    0x9339,0x8318,0xb37b,0xa35a,0xd3bd,0xc39c,0xf3ff,0xe3de,
                    0x2462,0x3443,0x420,0x1401,0x64e6,0x74c7,0x44a4,0x5485,
                    0xa56a,0xb54b,0x8528,0x9509,0xe5ee,0xf5cf,0xc5ac,0xd58d,
                    0x3653,0x2672,0x1611,0x630,0x76d7,0x66f6,0x5695,0x46b4,
                    0xb75b,0xa77a,0x9719,0x8738,0xf7df,0xe7fe,0xd79d,0xc7bc,
                    0x48c4,0x58e5,0x6886,0x78a7,0x840,0x1861,0x2802,0x3823,
                    0xc9cc,0xd9ed,0xe98e,0xf9af,0x8948,0x9969,0xa90a,0xb92b,
                    0x5af5,0x4ad4,0x7ab7,0x6a96,0x1a71,0xa50,0x3a33,0x2a12,
                    0xdbfd,0xcbdc,0xfbbf,0xeb9e,0x9b79,0x8b58,0xbb3b,0xab1a,
                    0x6ca6,0x7c87,0x4ce4,0x5cc5,0x2c22,0x3c03,0xc60,0x1c41,
                    0xedae,0xfd8f,0xcdec,0xddcd,0xad2a,0xbd0b,0x8d68,0x9d49,
                    0x7e97,0x6eb6,0x5ed5,0x4ef4,0x3e13,0x2e32,0x1e51,0xe70,
                    0xff9f,0xefbe,0xdfdd,0xcffc,0xbf1b,0xaf3a,0x9f59,0x8f78,
                    0x9188,0x81a9,0xb1ca,0xa1eb,0xd10c,0xc12d,0xf14e,0xe16f,
                    0x1080,0xa1,0x30c2,0x20e3,0x5004,0x4025,0x7046,0x6067,
                    0x83b9,0x9398,0xa3fb,0xb3da,0xc33d,0xd31c,0xe37f,0xf35e,
                    0x2b1,0x1290,0x22f3,0x32d2,0x4235,0x5214,0x6277,0x7256,
                    0xb5ea,0xa5cb,0x95a8,0x8589,0xf56e,0xe54f,0xd52c,0xc50d,
                    0x34e2,0x24c3,0x14a0,0x481,0x7466,0x6447,0x5424,0x4405,
                    0xa7db,0xb7fa,0x8799,0x97b8,0xe75f,0xf77e,0xc71d,0xd73c,
                    0x26d3,0x36f2,0x691,0x16b0,0x6657,0x7676,0x4615,0x5634,
                    0xd94c,0xc96d,0xf90e,0xe92f,0x99c8,0x89e9,0xb98a,0xa9ab,
                    0x5844,0x4865,0x7806,0x6827,0x18c0,0x8e1,0x3882,0x28a3,
                    0xcb7d,0xdb5c,0xeb3f,0xfb1e,0x8bf9,0x9bd8,0xabbb,0xbb9a,
                    0x4a75,0x5a54,0x6a37,0x7a16,0xaf1,0x1ad0,0x2ab3,0x3a92,
                    0xfd2e,0xed0f,0xdd6c,0xcd4d,0xbdaa,0xad8b,0x9de8,0x8dc9,
                    0x7c26,0x6c07,0x5c64,0x4c45,0x3ca2,0x2c83,0x1ce0,0xcc1,
                    0xef1f,0xff3e,0xcf5d,0xdf7c,0xaf9b,0xbfba,0x8fd9,0x9ff8,
                    0x6e17,0x7e36,0x4e55,0x5e74,0x2e93,0x3eb2,0xed1,0x1ef0

};
```

3.5.6 Advanced Guide for SIYI Gimbal SDK Integration

This special guide is to help developers (especially whose development is based on Linux platform) use SIYI gimbal SDK.

⭕ **Mark**

Before using the guide, please do read the chapter 3.3.1 to 3.3.5 of the user manual.

This guide is using UDP protocol:

1. Go to chapter 3.3.4 of this manual for SIYI Gimbal Camera SDK Communication Code Examples and fill your required examples to "send_buff" following the below format in hexadecimal.

```
int sockfd;
int ret, i, recv_len;
struct sockaddr_in send_addr, recv_addr;
unsigned char send_buf[] = {0x55,0x66,0x01,0x01,0x00,0x00,0x00,0x08,0x01,0xd1,0x12};//对应功能的帧协议,十六进制数据
unsigned char recv_buf[RECV_BUUF_SIZE] = {0};

/* 创建UDP套接字
```

2. Chang the gimbal camera's server port and IP addresses to what you need. The double quotation marks of the IP addresses should be kept.

```
#define SERVER_PORT    37260              //云台相机（服务端）端口号
#define SERVER_IP      "192.168.1.25"     //云台相机（服务端）IP
```

3. Create a socket keyword.

```
/* 创建UDP套接字
    AF_INET:      ipv4地址
    SOCK_DGRAM:  UDP 协议
    0:            自动选择类型对应的默认协议
*/
if ((sockfd = socket(AF_INET, SOCK_DGRAM, 0)) < 0) {
        perror("socket");
        exit(1);
}
```

4. Send data to the gimbal camera and do not revise.

```
/* 发送帧数据
    sockfd:                        socket套接字文件描述符
    send_buf:                      要发送的数据在内存中的首地址
    sizeof(send_buf):              要发送的数据的长度
    0:                             发送标志，一般为0
    (struct sockaddr *)&send_addr:  数据接收端的地址（包含IP地址和端口号）的结构体指针
    addr_len:                      数据接收端地址结构体的大小
*/
printf("Send HEX data\n");
socklen_t addr_len = sizeof(struct sockaddr_in);
if(sendto(sockfd, send_buf, sizeof(send_buf), 0, (struct sockaddr *)&send_addr, addr_len) < 0)
{
        perror("sendto");
        exit(1);
}
```

5. Receive data responded by the gimbal camera and do not revise.

```
/* 发送帧数据
    sockfd:                         socket套接字文件描述符
    send_buf:                       要发送的数据在内存中的首地址
    sizeof(send_buf):               要发送的数据的长度
    0:                              发送标志，一般为0
    (struct sockaddr *)&send_addr:  数据接收端的地址（包含IP地址和端口号）的结构体指针
    addr_len:                       数据接收端地址结构体的大小
*/
printf("Send HEX data\n");
socklen_t addr_len = sizeof(struct sockaddr_in);
if(sendto(sockfd, send_buf, sizeof(send_buf), 0, (struct sockaddr *)&send_addr, addr_len) < 0)
{
    perror("sendto");
    exit(1);
}
```

6. Print the received data in hexadecimal and do not revise.

```
// 十六进制形式打印接收到的数据
printf("Received HEX data: ");
for (int i = 0; i < recv_len; i++)
{
    printf("%02x ", recv_buf[i]);
}
printf("\n");
```

7. Following the above steps, compile and run the SDK and you will see the printed data below, which means data can be sent and received normally. At this moment, please observe if the gimbal camera executes the relevant actions.

```
yang@ubuntu:~/_star$ gcc siyi.c -o siyi
yang@ubuntu:~/_star$ ./siyi
Send HEX data
Received HEX data: 55 66 02 01 00 08 00 08 01 90 4f
yang@ubuntu:~/_star$
```

🔴 **Mark**

Before using the SDK to communicate with the gimbal camera in UDP protocol, please do make sure that the device and the gimbal camera are in the same gateway, which means that ubuntu can ping the gimbal camera's IP addresses successfully.

If they still didn't communicate, the possible reason is that the Windows firewall is interrupting the sending and receiving of data, then try to disable Windows firewall temporarily.

Relevant Code Examples

#include <stdio.h>

#include <stdlib.h>

#include <string.h>

#include <errno.h>

#include <sys/socket.h>

#include <netinet/in.h>

#include <arpa/inet.h>

#include <unistd.h>

#define RECV_BUUF_SIZE   64

#define SERVER_PORT   37260   // Gimbal Camera (Server) Port

#define SERVER_IP   "192.168.144.25"   // Gimbal Camera (Server) IP Addresses

```c
int main(int argc, char *argv[])
{
        int sockfd;
        int ret, i, recv_len;
        struct sockaddr_in send_addr, recv_addr;
        unsigned char send_buf[] = {0x55,0x66,0x01,0x01,0x00,0x00,0x00,0x08,0x01,0xd1,0x12}; // Frame protocol
  of the relevant functions in hexadecimal
        unsigned char recv_buf[RECV_BUUF_SIZE] = {0};

        /* Create UDP Socket
            AF_INET:      ipv4 addresses
            SOCK_DGRAM:   UDP protocol
            0:                automatically choose the default protocol of the relevant type
        */
        if ((sockfd = socket(AF_INET, SOCK_DGRAM, 0)) < 0) {
                perror("socket");
                exit(1);
        }

        /* Set IP addresses and port number of gimbal camera
            sin_family:              ipv4 addresses
            sin_addr.s_addr:     IP addresses of gimbal camera
            sin_port：               port of gimbal camera
        */
        memset(&send_addr, 0, sizeof(send_addr));
        send_addr.sin_family = AF_INET;
        send_addr.sin_addr.s_addr = inet_addr(SERVER_IP);
        send_addr.sin_port = htons(SERVER_PORT);

        /* Send frame data
            sockfd:                          descriptor of socket
            send_buf：                       head address in RAM of the sending data
            sizeof(send_buf)：               length of sending data
            0：                              sending mark, usually it is 0
            (struct sockaddr *)&send_addr:            structure pointer of the receiving data addresses (including IP
addresses and port)
            addr_len:                        structure size of the receiving data addresses
        */
        printf("Send HEX data\n");
        socklen_t addr_len = sizeof(struct sockaddr_in);
        if(sendto(sockfd, send_buf, sizeof(send_buf), 0, (struct sockaddr *)&send_addr, addr_len) < 0)
        {
            perror("sendto");
            exit(1);
```

```
        }

        /* Receive the responding data from gimbal camera
            sockfd:                          descriptor of "sockfd" socket
            recv_buf:                        head address in RAM of the responding data
            RECV_BUUF_SIZE:                  size of the buffer, which is the length of the max data to receive
            0:                               receiving mark, usually it is 0
            (struct sockaddr *)&recv_addr:   the target structure will be filled with addresses (including IP
addresses and port) from the data sender
                &addr_len:                   the target storage position, the structure size of "src_addr"
   and "addrlen" should be filled before calling, the actual size of the sender will be filled after calling

        */
        recv_len = recvfrom(sockfd, recv_buf, RECV_BUUF_SIZE, 0, (struct sockaddr *)&recv_addr, &addr_len);
        if (recv_len < 0) {
            perror("recvfrom");
            exit(1);
        }

        // print the received data in hexadecimal
        printf("Received HEX data: ");
        for (int i = 0; i < recv_len; i++)
        {
            printf("%02x ", recv_buf[i]);
        }
        printf("\n");

        // close socket
        close(sockfd);

        return 0;
    }
```

3.5.7 Interface Documentation for SIYI Gimbal Camera's Web Server

Videos and images stored in SIYI gimbal camera can be acquired directly from the web

server interface.

SIYI

Interface

baseUrl: http://192.168.144.25:82//cgi-bin/media.cgi

A Request File Directory

The below interface is to request the directory of the file format for an easy overview.
URL: /api/v1/getdirectories
Method: GET

Request Data

Data Name	Type	Description
media_type	int	0: Images 1: Videos

Response Data

The format of the response data is below:

```
{
    "code": 200, // Status code.
    "data": {}, // Content of the data.
    "success": true, // If the request is successful.
    "message": "" // Error message if the request is failed.
}
```

The definition of data is below:

Data Name	Type	Description
media_type	int	0: Images 1: Videos
directories	[{ "name": "aa", "path": "/yyy/aa" }, { "name": "bb", "path": "/yyy/bb" },]	File directory

Request Example

Request the number of all the images:

```
{
    "media_type": 0
}
```

Successful Response

Condition: Request data is legal.

Status Code: 200 OK

Response Example:

File directory after response:

```
{
    "code": 200,
    "data": {
      "media_type": 0,
      "directories": [
        {
            "name": "aa",
            "path": "photo/aa"
        },
        {
          "name": "bb",
            "path": "photo/bb"
        }
        ]
    }
    "success": true
}
```

Error Response

Condition: Request data is illegal. Eg: File type is illegal.

Status Code: 400 BAD REQUEST

Response Example:

```
{
    "code": 400,
    "message": "Invalid media type",
    "success": false
}
```

B Request the File Numbers under the File Directory

The below interface is for authorized users to request the file numbers under the target directory.
URL: /api/v1/getmediacount
Method: GET

Request Data

Data Name	Type	Description
media_type	int	0: Images 1: Videos
path	String	If the string is empty, return to request the total file number in present. If the string is not empty, return to the number of the target directory.

Response Data

The format of the response data is below:

```
{
    "code": 200, // Status code.
    "data": {}, // Content of the data.
    "success": true, // If the request is successful.
    "message": "" // Error message if the request is failed.
}
```

The definition of data is below:

Data Name	Type	Desciption
media_type	int	0: Images 1: Videos
count	int	File number
path	int	Path of file directory

Request Example

Request the number of all the images:

```
{
    "media_type": 0,
    "path": ""
}
```

Request the image numbers under the target path:

```
{
    "media_type": 0,
    "path": "/photo/aa"
}
```

Successful Response

Condition: Request data is legal and user identity verification passed.

Status Code: 200 OK

Response Example:

File numbers which return to 'photo/aa' after response:

```
{
    "code": 200,
    "data": {
        "media_type": 0,
        "count": 20,
        "path": "/photo/aa"
    },
    "success": true
}
```

Error Response

Condition: Request data is illegal. Eg: File type is illegal. File path does not exist.

Status Code: 400 BAD REQUEST

Response Example:

```
{
    "code": 400,
    "message": "Invalid media type",
    "success": false
}
```

C Request File List

The below interface is for authorized users to request the file list.

URL: /api/v1/getmedialist

Method: GET

Request Data

Data Name	Type	Description
media_type	int	0: Images 1: Videos
path	String	Empty String: File list is for all the files

		of the present type.
		Non-empty String: File list is for the
		files under the target path.
start	int	Start index of the file list
count	int	Number of the file list.
		If "start" plus "count" is more than the
		number of the file list, return to the end
		of the file list from "start".

Response Data

The format of the response data is below:

```
{
    "code": 200, // Status code.
    "data": {}, // Content of data.
    "success": true, // If the request is successful.
    "message": "" // Error message if the request is failed.
}
```

The definition of data is below:

Data Name	Type	Description
media_type	int	0: Images 1: Videos
path	String	The requested path.
list	[{ "name": "aa.jpg", "url": "http://xxx/yyy/aa.jpg" }, { "name": "bb.jpg", "url": "http://xxx/yyy/bb.jpg" },]	File list.

Request Example

Request the image list from "photo/20230630" directory:

```
{
    "media_type": 0,
    "path": "photo/20230630",
    "start": 0,
```

```
    "count": 10
}
```

Successful Response

Condition: Request data is legal and user identity verification passed.

Status Code: 200 OK

Response Example:

Return to the image list under "'photo/20230630" directory after response:

```
{
    "code": 200,
    "data": {
        "media_type": 0,
        "path": "photo/20230630",
      "list": [
        {
        "name": "aa.jpg",
        "url": "http://xxx/yy/aa.jpg"
        },
        {
        "name": "bb.jpg",
        "url": "http://xxx/yy/bb.jpg"
        },
            ...
        ],
    },
    "success": true
}
```

Error Response

Condition: Request data is illegal. Eg: File type is illegal. File path does not exist. Start index exceed the max value. Etc.

Status Code: 400 BAD REQUEST

Response Example:

```
{
    "code": 400,
    "message": "path not exist",
    "success": false
}
```

3.6 Control SIYI Gimbal Camera by the ArduPilot Driver through UART and Integrate Flight Controller Attitude Data

Gimbal camera's UART port connects to ArduPilot flight controller's UART port directly to communicate with the flight controller and to control gimbal rotation, gimbal functions, and camera functions.

Preparation

It is necessary to prepare the tools, firmware, and software below before controlling gimbal camera in this way.

● ArduPilot Flight Controller (v4.4.4 and above firmware)

● SIYI Optical Pod (Gimbal Camera)

🔴 **Mark**

Above products can be purchased from SIYI directly or from SIYI authorized dealers.

● SIYI Gimbal to PX4 / Ardupilot Flight Controller UART Cable

🔴 **Mark**

Above tools come with product package.

● Mission Planner (Windows) Software

Steps

1. Power SIYI gimbal camera and ArduPilot flight controller.

2. Connect gimbal camera's UART port to ArduPilot flight controller's UART port and make sure they are communicating with each other.

3. Run ground station and set the following parameters.

Gimbal Control

The params below assume the autopilot's telem2 port is used and the Camera1 control instance.

- SERIAL2_PROTOCOL to 8 ("SToRM32 Gimbal Serial")

- SERIAL2_BAUD to "115" for 115200 bps

- MNT1_TYPE to "8" ("SIYI") and reboot the ardupilot

- MNT1_PITCH_MIN to -90

- MNT1_PITCH_MAX to 25

- MNT1_YAW_MIN to -80

- MNT1_YAW_MAX to 80

- MNT1_RC_RATE to 90 (deg/s) to control speed of gimbal when using RC targetting

- CAM1_TYPE to 4 (Mount / SIYI) to allow control of the camera.

- RC6_OPTION = 213 ("Mount Pitch") to control the gimbal's pitch angle with RC channel 6

- RC7_OPTION = 214 ("Mount Yaw") to control the gimbal's yaw angle with RC channel 7

- RC8_OPTION = 163 ("Mount Lock") to switch between "lock" and "follow" mode with RC channel 8

  Optionally these auxiliary functions are also available.
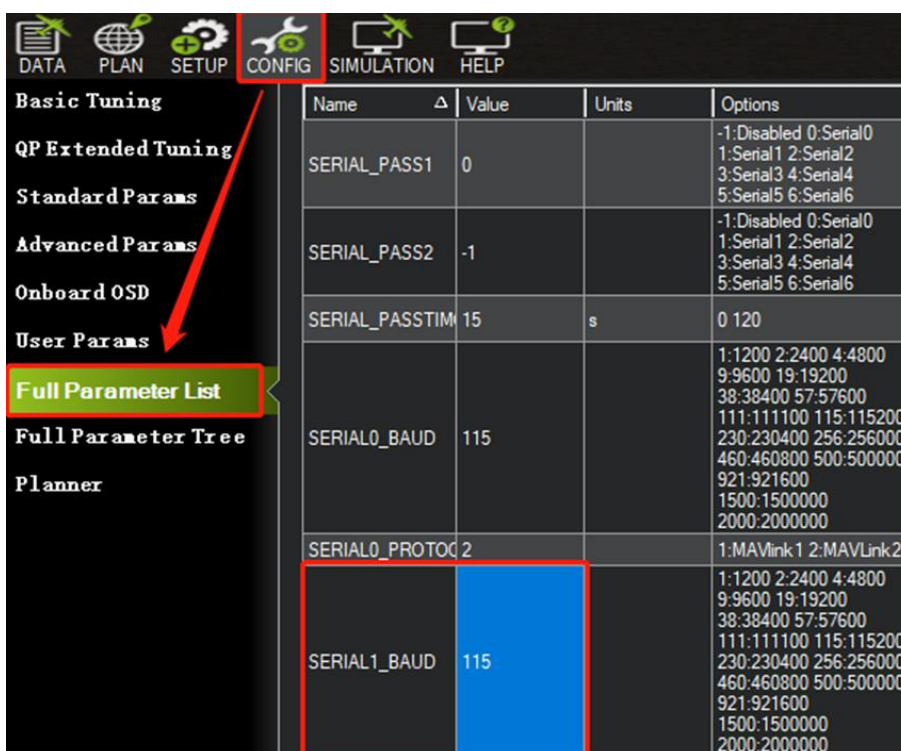
- RC9_OPTION = 166 ("Camera Record Video") to start/stop recording of video

- RC9_OPTION = 167 ("Camera Zoom") to zoom in and out

- RC9_OPTION = 168 ("Camera Manual Focus") to adjust focus in and out

- RC9_OPTION = 169 ("Camera Auto Focus") to trigger auto focus

Integrate Flight Controller Attitude Data

The params below assume the autopilot's telem2 port is used and the Camera1 control

instance.

- SERIAL2_BAUD to "115" for 115200 bps

- SR2_EXTRA1 to "50" to set flight controller attitude angle data sending

frequency.
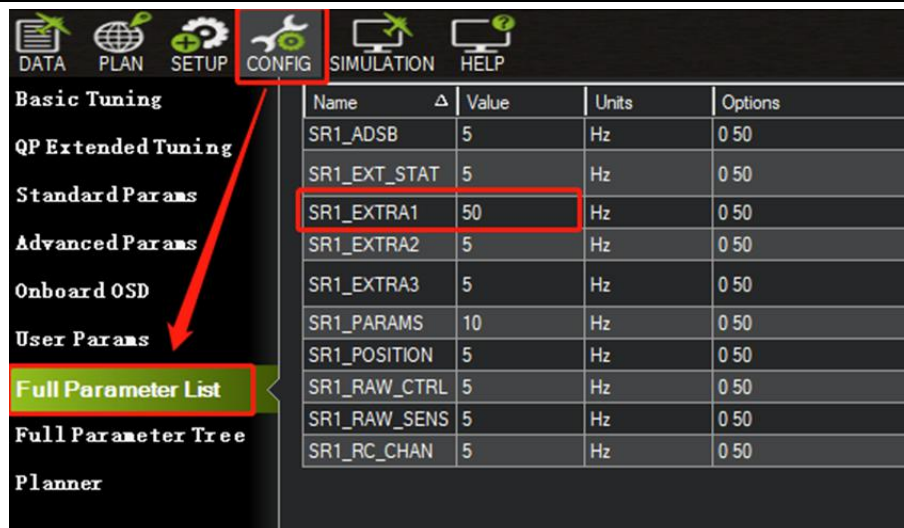
After configuration, it is necessary to "Write Parameters" and reboot the flight controller to take effect.

⬤ Mark

Integrate flight controller attitude data can effectively promote gimbal performance while drone attitude is changing fast.

Welcome to visit ArduPilot official documentation for SIYI gimbal as well.

https://ardupilot.org/copter/docs/common-siyi-zr10-gimbal.html

3.7 Control SIYI Gimbal Camera by Mavlink Gimbal Protocol through UART and Integrate Flight Controller Attitude Data

Gimbal camera's UART port connects to PX4 flight controller's UART port directly to communicate with the flight controller and to control gimbal rotation, gimbal functions, and camera functions.
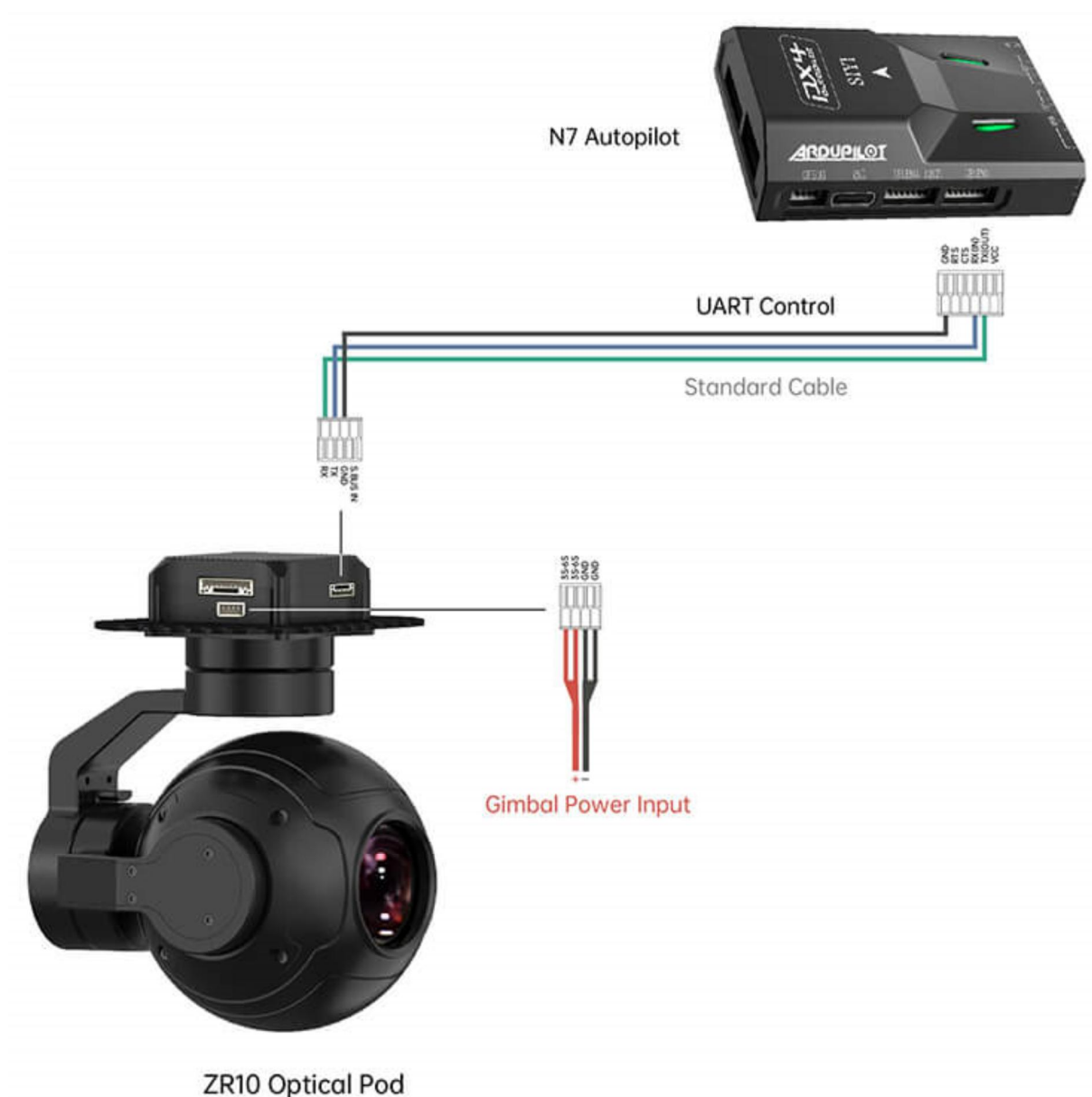
Preparation

It is necessary to prepare the tools, firmware, and software below before controlling gimbal camera in this way.

● PX4 Flight Controller

● SIYI Optical Pod (Gimbal Camera)

 Mark

Above products can be purchased from SIYI directly or from SIYI authorized dealers.

● SIYI Gimbal to PX4 / Ardupilot Flight Controller UART Cable

 Mark

Above tools come with product package.

● QGroundControl Windows GCS

3.8 Necessary Trouble Shooting Steps When Gimbal Attitude Control Is Abnormal

Let's take an example of the problem that gimbal roll axis tilts abnormally.

```
                    ┌─────────────────────┐
                    │ Gimbal Roll Axis Tilts │
                    └─────────────────────┘
                               │
                    ┌─────────────────────┐
          ┌─────────│   Check Firmware    │─────────┐
          │         │      Version        │         │
          │         └─────────────────────┘         │
          ▼                                          ▼
┌─────────────────────┐              ┌─────────────────────┐
│  Firmware Updated   │              │  Firmware Updated   │
│  PROBLEM SOLVED     │              │  PROBLEM STILL      │
└─────────────────────┘              └─────────────────────┘
                                               │
                              ┌─────────────────────┐
                    ┌─────────│   Calibrate Gimbal  │─────────┐
                    │         │      1.  IMU        │         │
                    │         │   2.  Temperature   │         │
                    │         │   3.  Accelerator   │         │
                    ▼         └─────────────────────┘         ▼
        ┌─────────────────────┐              ┌─────────────────────┐
        │    Calibrated       │              │    Calibrated       │
        │  PROBLEM SOLVED     │              │  PROBLEM STILL      │
        └─────────────────────┘              └─────────────────────┘
                                                       │
              ┌──────────────────────────────────────────────┐
      ┌───────│            Optimize Installation             │───────┐
      │       │          1.  Gimbal Mounting                 │       │
      │       │   2.  Gimbal connection cables to power,     │       │
      │       │    Ethernet, and control should be soft.     │       │
      │       │          3.  Are dampers original?           │       │
      │       │  4.  Check drone vibration and propeller     │       │
      │       │             dynamic balance.                 │       │
      ▼       └──────────────────────────────────────────────┘       ▼
┌─────────────────────┐                          ┌─────────────────────┐
│  PROBLEM SOLVED     │                          │  PROBLEM STILL      │
└─────────────────────┘                          └─────────────────────┘
                                                           │
                                                           ▼
```

```
                          ┌─────────────────────┐
                          │ Check Flight Attitude│
                          └─────────────────────┘
              ┌─────────────────┐        ┌─────────────────┐
              │   NO / SLOW     │        │      FAST       │
              │ ATTITUDE CHANGE │        │ ATTITUDE CHANGE │
              └─────────────────┘        └─────────────────┘

                                    ┌──────────────────┐
                                    │    Integrate     │
                                    │ Flight Controller│
                                    │  Altitude Data   │
                                    └──────────────────┘

                          ┌─────────────────┐   ┌─────────────────┐
                          │ PROBLEM SOLVED  │   │  PROBLEM STILL  │
                          └─────────────────┘   └─────────────────┘
```

Final Trouble Shooting Before Contacting SIYI

1. **If the gimbal was modified or disassembled?**
2. **If the gimbal was damaged by external force?**

Contact SIYI Support

4 VIDEO OUTPUT

ZR10 optical pod outputs video in multiple ways through the Ethernet port.

4.1 Output Video to Windows Device Directly through Ethernet

Gimbal camera connects to Windows device directly, then video will be displayed in SIYI QGC Windows software.

Preparation

It is necessary to prepare the tools, firmware, and software below before outputting video stream in this way.

● SIYI Optical Pod (Gimbal Camera)

🔴 **Mark**

Above products can be purchased from SIYI directly or from SIYI authorized dealers.

● SIYI Gimbal Ethernet to RJ45 Cable

🔴 **Mark**

Above tools come with product package.

● SIYI QGC Windows Software

🔴 **Mark**

Above software can be downloaded from relevant product page on SIYI official website.

Steps

1. Power gimbal camera.

2. Use SIYI Gimbal Ethernet to RJ45 Cable to connect the gimbal quick release board's Ethernet port to Windows device's RJ45 port. If your computer does not come with RJ45 port, it is suggested to use an RJ45 to USB converter.

3. Modify the computer's Ethernet settings to have the same gateway with SIYI link and avoid IP addresses conflict.

   For example, let's assign "192.168.144.30" for the computer IP addresses.

4. Run SIYI QGC Windows software, go to "Comm Links – Video Settings", and select "RTSP Video Stream" for "Source", then enter the default RTSP addresses of SIYI

gimbal camera, video stream will display. Gimbal motion and camera functions can be controlled by mouse in QGroundControl.

4.2 Output Video to Third-Party Link through Ethernet

SIYI gimbal camera can output video to any third-party link which provides Ethernet port and is compatible with RTSP video stream.

In this way, it is necessary to prepare a customized video cable for connection between SIYI gimbal camera and the third-party link.

⚠ CAUTION

SIYI gimbal camera Ethernet port's "RX-" pinout should connect to the third-party link Ethernet port's "RX-" pinout, and "RX+" pinout to "RX+" pinout. Do not cross the pinouts, otherwise it will cause damage to the device.

Steps

1. Power the air unit of the third-party link and bind it with the ground unit.

2. Use the video cable to connect SIYI gimbal camera's Ethernet port and the third-party link's Ethernet port.

3. Open RTSP video player and input SIYI gimbal camera's default RTSP addresses, if connection is successful, video will display normally.

⬤ **Mark**

SIYI QGC Android app and Windows software support video display from third-party links as well.

4.3 Output Video through Ethernet-HDMI Converter

ZR10 optical pod can output video to HDMI devices through Ethernet to HDMI converter.

SIYI
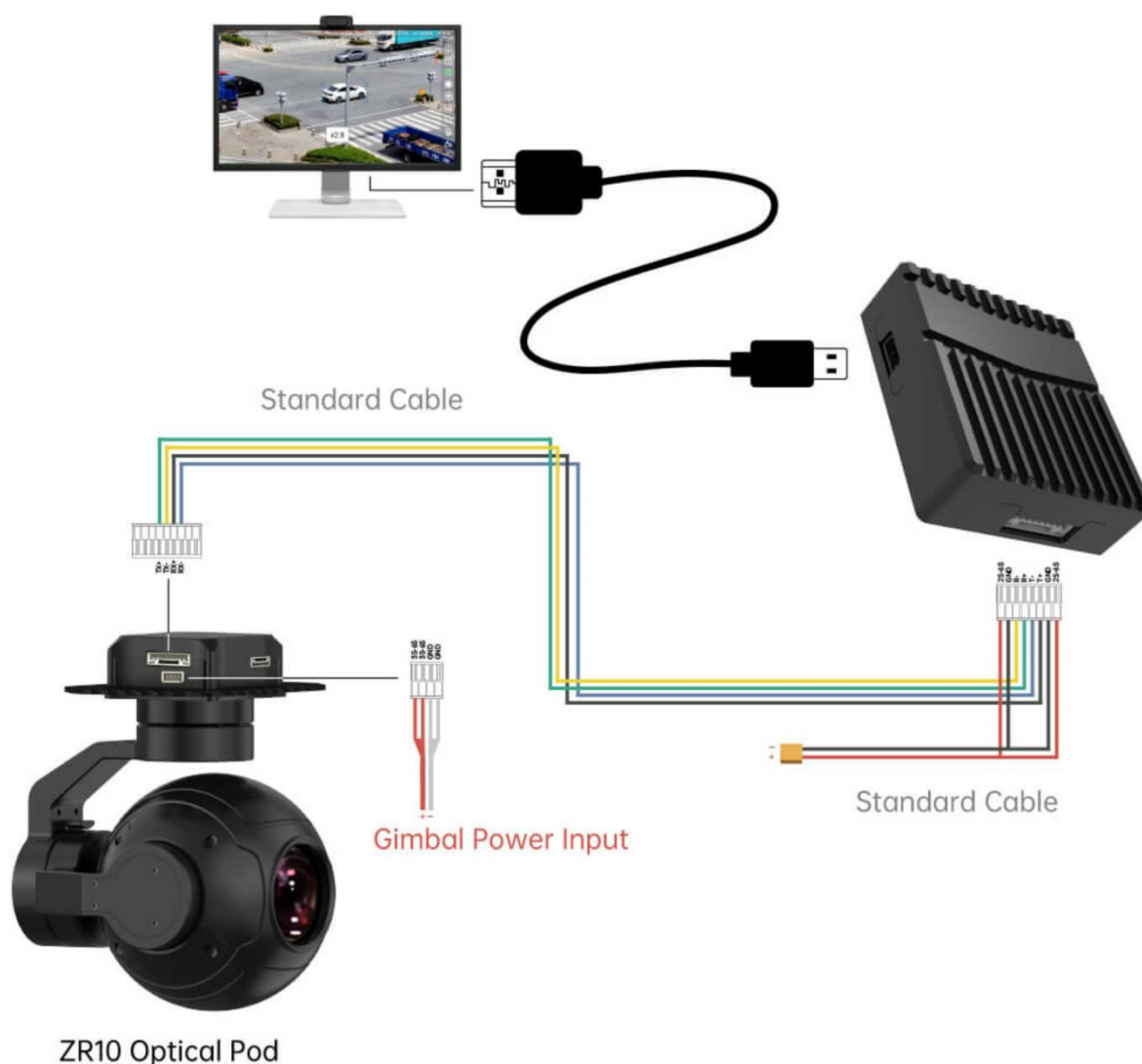
Steps

1. Power ZR10 and the Ethernet-HDMI converter separately. Then refer to the above picture to make the diagram among gimbal camera, HDMI converter, and HDMI device.

2. If video shows up, the connection is successful.

4.4 Solutions to No Image through Ethernet

If gimbal camera failed to output video or the video cannot be displayed properly, please follow the steps below for trouble shooting.

1. Confirm if the link's ground unit is communicating with the air unit and if the camera is connected to the air unit.

2. Check Camera IP addresses and RTSP addresses.

3. If you are using SIYI FPV app, check the connection status, app version, video stream settings.

4. If you are using SIYI handheld ground stations, check the Ethernet switch in Android system.

5. Please double check if the gimbal camera's IP addresses was modified accidentally.

If video still does not show up, please follow the steps below and make a deep investigation according to the video output mode, the video display device, and the application / software you are using.

4.4.1 Video Output to Android Device

1. Input SIYI gimbal's default IP addresses "192.168.144.25" in the "Ping Tools" app and check if the network communication is successful. If the tool responds, then check if the RTSP address in the application / software is correct.

Successful Network Communication
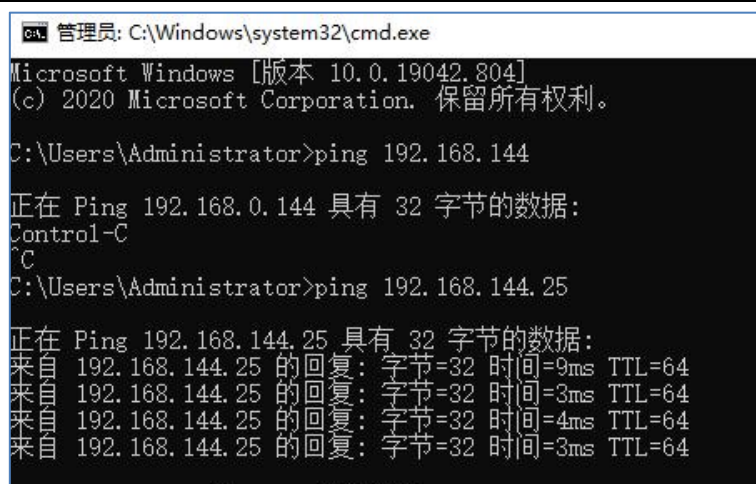
Network Communication Failed

2. If the network communication is failed, then check the communication between the link's ground unit and the air unit. If the communication is good, then check if the video cable between the camera and the link's air unit is good, and if the voltage input is in normal range.

4.4.2 Video Output to Windows Device

1. Use the "Win + R" key combo to wake up the "Run" program and input the command "cmd".

Successful Network Communication

Network Communication Failed

2. Input SIYI gimbal camera's default IP addresses "192.168.144.25" and press the "Enter" key to check if the communication is successful. If it is, please check the RTSP addresses in the software or try to switch to another software.

3. If the network didn't connect, then check the communication between the link's ground unit and the air unit. If the communication is successful, then check if the video cable between the camera and the link's air unit is good, and if the voltage input is in normal range.

Mark

If you have done all trouble shooting by following the steps above and still didn't solve the

problem, then please contact your dealer, or contact SIYI Support directly.

4.5 Common IP Addresses

SIYI Air Unit IP Address: 192.168.144.11

SIYI Ground Unit IP Address: 192.168.144.12

SIYI Handheld Ground Station Android System IP Address: 192.168.144.20

SIYI Ethernet to HDMI Output Converter IP Add: 192.168.144.50

SIYI AI Camera IP Address: 192.168.144.60

SIYI Optical Pod / Gimbal Camera's Default IP Addresses: 192.168.144.25

(NEW) SIYI Optical Pod / Gimbal Camera's Default RTSP Addresses:

- SIYI AI Camera: rtsp://192.168.144.25:8554/video0

- Main Stream: rtsp://192.168.144.25:8554/video1

- Sub Stream: rtsp://192.168.144.25:8554/video2

(NEW) SIYI FPV App's Private Video Stream Protocol's Addresses:

- SIYI Camera 1 Main Stream: 192.168.144.25: 37256

- SIYI Camera 1 Sub Stream: 192.168.144.25: 37255

- SIYI Camera 2 Main Stream: 192.168.144.26: 37256

- SIYI Camera 2 Sub Stream: 192.168.144.26: 37255

SIYI IP67 Camera A's IP Address: 192.168.144.25

SIYI IP67 Camera B's IP Address: 192.168.144.26

SIYI Air Unit HDMI Input Converter's IP Address: 192.168.144.25

SIYI IP67 Camera A's RTSP Address: rtsp://192.168.144.25:8554/main.264

SIYI IP67 Camera B's RTSP Address: rtsp://192.168.144.26:8554/main.264

SIYI Air Unit HDMI Input Converter's RTSP Address:

rtsp://192.168.144.25:8554/main.264

Common Video Player: SIYI FPV, QGroundControl, EasyPlayer

Network Diagnosis Tool: Ping Tools

🔴 **Mark**

SIYI cameras released after ZT30 (including ZT30 and ZT6) start to use the new addresses.

SIYI cameras released before ZT30 (including ZR30, A2 mini, A8 mini, ZR10, and R1M) are stilling using the old addresses.

5 SIYI FPV ANDROID APP

SIYI FPV is an Android application developed by SIYI to configure many SIYI products for video display, camera stream settings, and communication link status monitoring.

 Mark

This chapter is edited based on SIYI FPV App v2.5.15.691.

SIYI FPV App can be downloaded from SIYI official website:

https://siyi.biz/en/index.php?id=downloads&asd=27

SIYI FPV App compatible SIYI devices
- ZT6 Mini Dual-Sensor Optical Pod
- SIYI AI Tracking Module
- ZT30 Four-Sensor Optical Pod
- ZR30 4K AI 180X Hybrid Zoom Optical Pod
- A2 mini Ultra-Wide-Angle FPV Gimbal
- MK32 / MK32E Enterprise Handheld Ground Station
- A8 mini AI Zoom Gimbal Camera
- ZR10 2K 30X Hybrid Zoom Optical Pod
- R1M HD Recording FPV Camera
- Air Unit HDMI Input Converter
- HM30 Full HD Image Transmission System
- MK15 / MK15E Mini Handheld Ground Station

SIYI FPV App OSD Information Definition
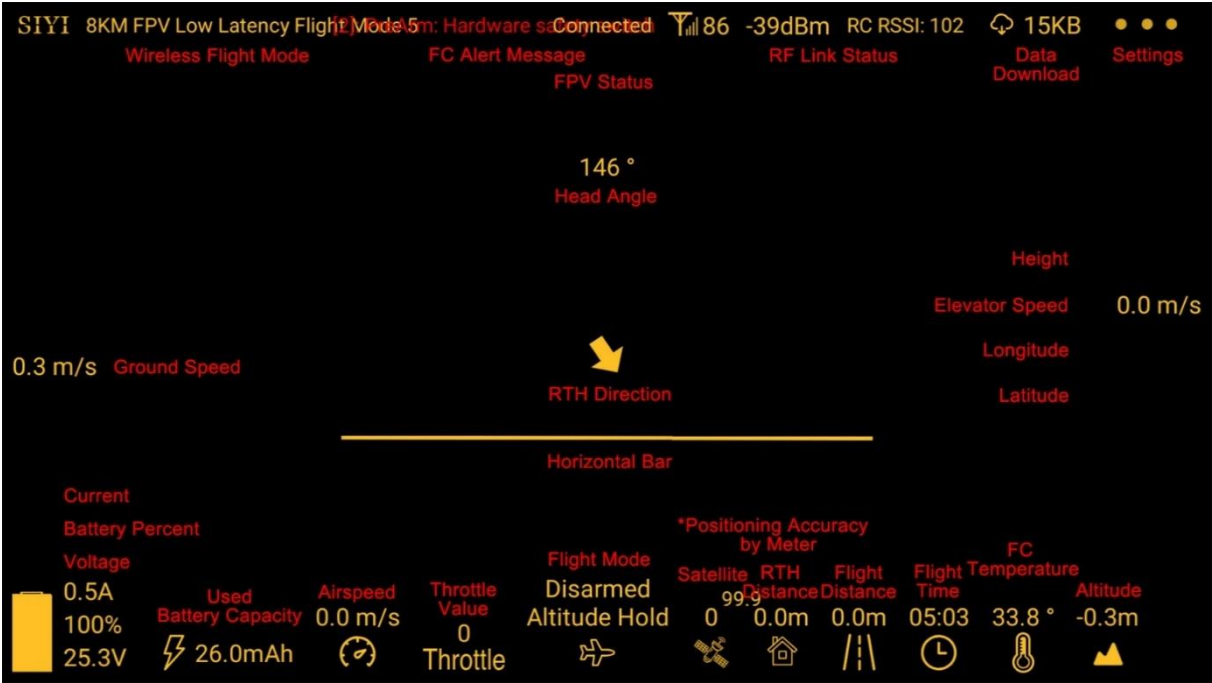
SIYI FPV Camera Function Icon Definition

5.1 Settings

In "Settings" page, you can select camera type with stream type, select or input video stream IP addresses, custom app interface, and switch map type.
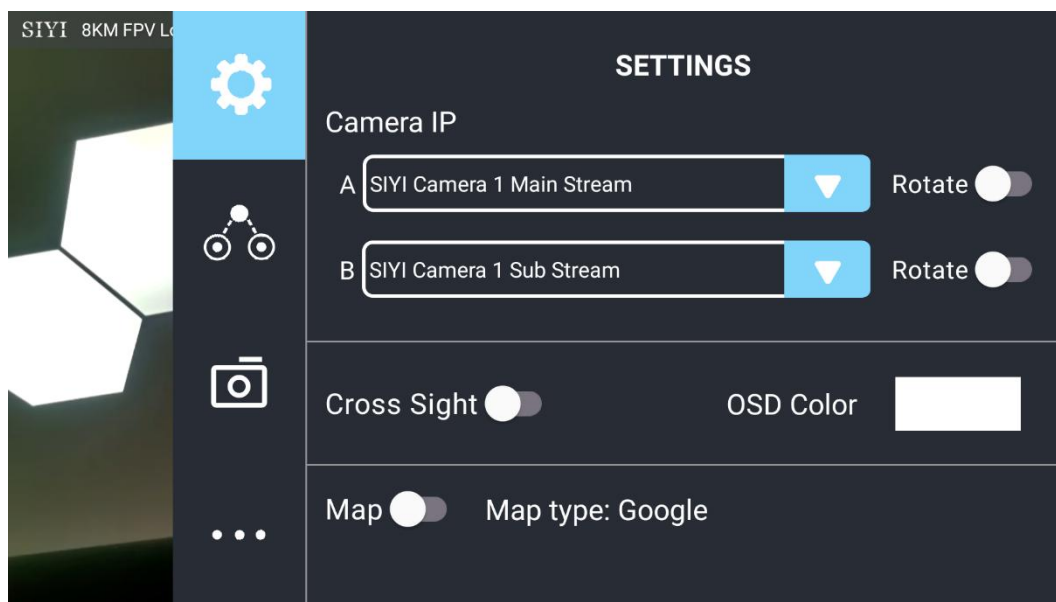
About Settings

Camera IP: Select among SIYI AI Camera, SIYI Camera 1 and SIYI Camera 2, between main stream and sub stream, select or input video stream RTSP addresses, disable image, or rotate the relevant image in 180 degrees.

Cross Sight: Enable / disable a cross sight in the center of the image.

OSD Color: Custom the color of all OSD information.

Map: Enable / disable the map box over the left-bottom corner of the image.

Map Type: Switch map type (currently between Baidu and Google).

5.2 Link Status

Display the link status directly over the FPV image.
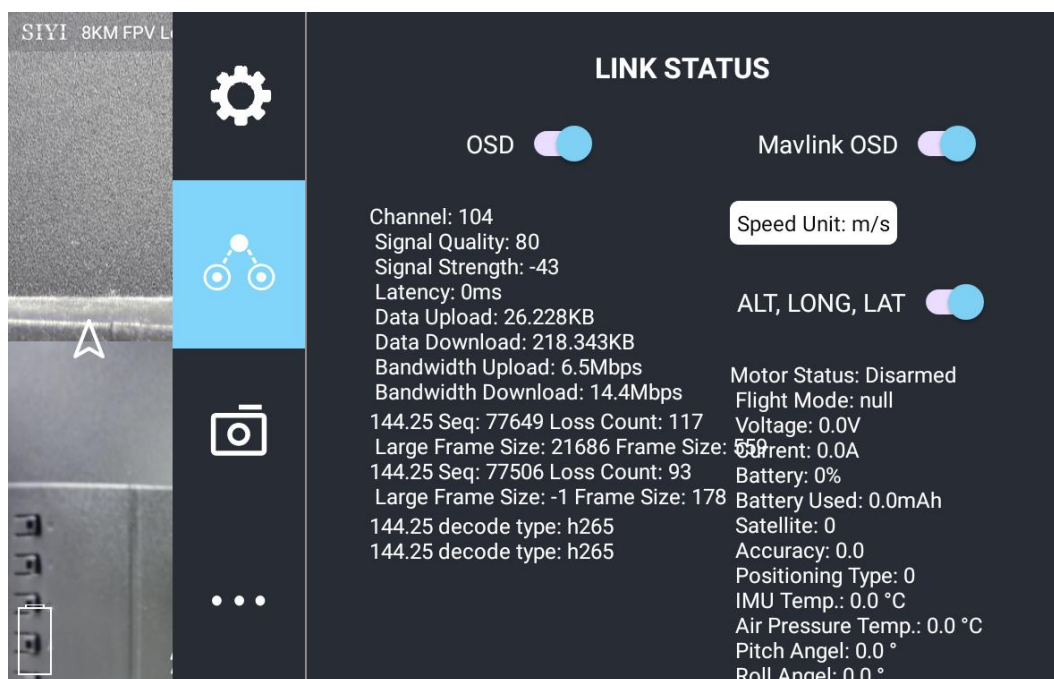
About Link Status

OSD: Enable / disable standard OSD information.

Mavlink OSD: Enable / disable Mavlink OSD information.

Speed Unit: Switch speed unit between meter per seconds and kilometer per hour.

Longitude and Latitude: Enable / disable information.

5.3 Gimbal Camera

Configure the basic functions for SIYI gimbal cameras and cameras.
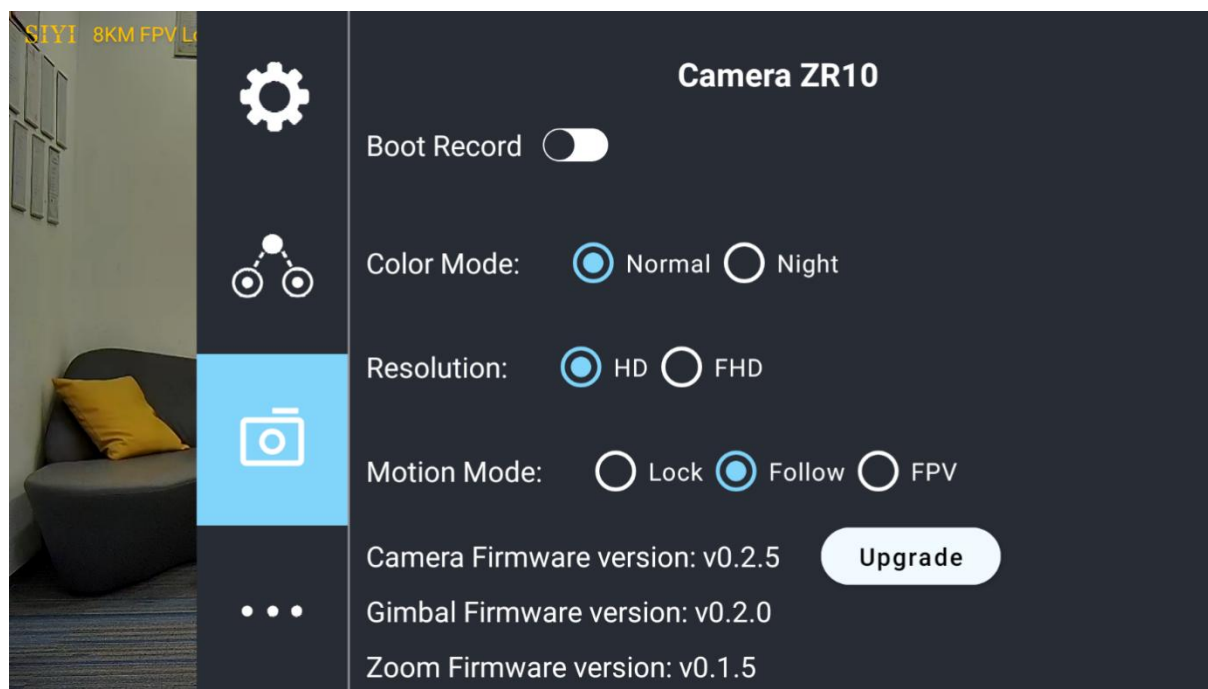
About Gimbal Camera

Boot Record: Enable / disable automatic video recording by SD card as soon as the camera is powered.

File Manager: Preview stored images in TF card. Format the TF card.

Main / Sub Stream: Configure the main stream and the sub stream separately for their camera source and parameters.

Image Mode: Select the video stream's image type and camera source. Single image or split image. Zoom camera, wide angle camera, or thermal imaging camera.

Stream Resolution: Decide to switch the output resolution of the current video stream or not according to camera source. Max output resolution is Ultra HD (1080p).

Record Resolution: Decide to switch the recording resolution or not according to camera source. Max record resolution is 4K.

Video Output Port: Switch the video outputting ports.

- HDMI: Through the gimbal camera's Micro-HDMI port.

- CVBS: Through the CVBS pin in the gimbal camera's Ethernet port to output videos in analog signal (Only available for ZT6 and A8 mini).

- OFF: Through the gimbal camera's Ethernet only.

Gimbal Working Mode: Switch gimbal working mode among Lock Mode, Follow Mode, and FPV Mode.

- Lock Mode: Horizontally, gimbal does not follow when aircraft rotates.

- Follow Mode: Horizontally, gimbal follows when aircraft rotates.

- FPV Mode: Gimbal rotates simultaneously as aircraft rolls to get FPV view, and output images with enhanced stability.

- AI Tracking: When the gimbal is connected to the AI tracking module and the AI tracking function is activated. It will be AI tracking mode only.

Camera Firmware Version: Display current camera firmware version.

Gimbal Firmware Version: Display current gimbal firmware version.

Zoom Firmware Version: Display current gimbal firmware version. (Only available for optical zoom cameras)

5.4 About SIYI FPV

Displays the software version of SIYI FPV and common contact information of SIYI

Technology.

5.5 SIYI FPV App Update Log

Date	2024-04-23
Version	2.5.15.708
Updates	1. New: Support the functions of SIYI AI Tracking Module Gen 2 (car plate recognition, insulator recognition, any object recognition) 2. Improve: UI for AI functions. 3. New: Support a new 4K camera. 4. Fix: AI tracking status icon does not show correctly if restarting the app under AI tracking function. 5. New: Adjust shutter speed manually. 6. New: AI recognition and tracking under thermal images.

Date	2024-01-26
Version	2.5.15.695
Updates	1. New: Support AI follow function.

Date	2023-12-18
Version	2.5.15.691
Updates	1. Fix: Temperature data still shows on image after switching to optical cameras from thermal camera. 2. New (A8 mini): Enable OSD watermark on recording images. 3. New: Both video streams can turn on / off recording. 4. New (SIYI AI Tracking Module): A switch for flight tracking. 5. New (Thermal): A switch for thermal gain. 6. New (Thermal): A switch for thermal calibration. 7. New (Thermal): A switch for thermal RAW. 8. Fix: Camera control interface bug when two different cameras are plugged.

Date	2023-10-20
Version	2.5.15.679
Updates	1. New: AI recognition and tracking function control interface. 2. New (ZT30): Zoom & thermal camera simultaneous recording function control interface. 3. New: Add the AI tracking module to IP addresses settings. 4. Improve: Occasionally video stream does not recover when the link is disconnected under SIYI camera protocol.

Date	2023-08-24
Version	2.5.15.660
Updates	1. New (ZT30): Laser calibration. Display laser ranging target's coordinates. 2. New: Support TF format.

	3. New (ZT30): Thermal color palette.
	4. New: File manager to preview stored pictures in TF card.
	5. Improve: New icon indication for missing TF card.

Date	2023-07-31
Version	2.5.14.644
Updates	1. New: Status indication for successfully integrated flight controller attitude data.
	2. New: Google map is supported.
	3. Fix: Flight controller location was no accurate. New icons for flight controller location and device location.
	4. New: Status indication for missing TF card.

5.6 SIYI FPV SDK Guide

SIYI provides the SIYI FPV SDK to help professional Android application developers to

integrate the unique features in SIYI FPV app to their own GCS.

5.6.1 Access Method

a) Add "fpvlib" into Your Project

Copy the "fpvlib.aar" file to the "libs" folder in your "module" like below:
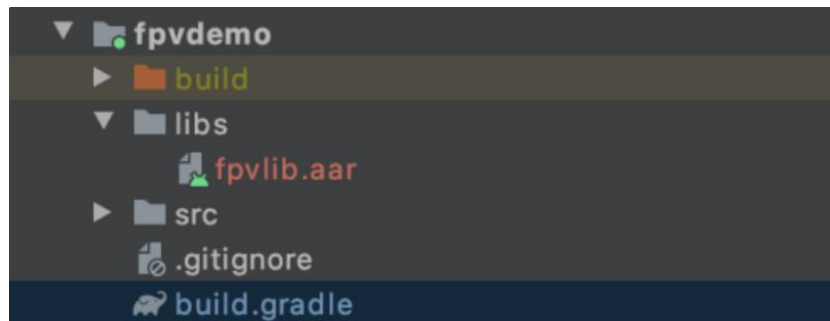
Revise the "build.gradle" file:
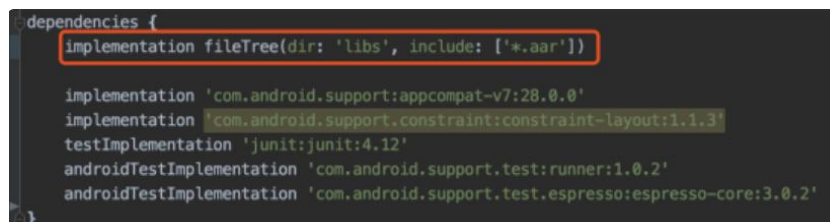
b) Configure "AndroidManifest" File

Add USB reading authorization to the "AndroidManifest" file in your "module" and configure the
"intent-filter" file.

c) Add FPV Display Function into Code

Add JNI Library

Like the example below, add JNI library file into the "main" directory, then the "so" library file can be copied from "demo" to your project directory.
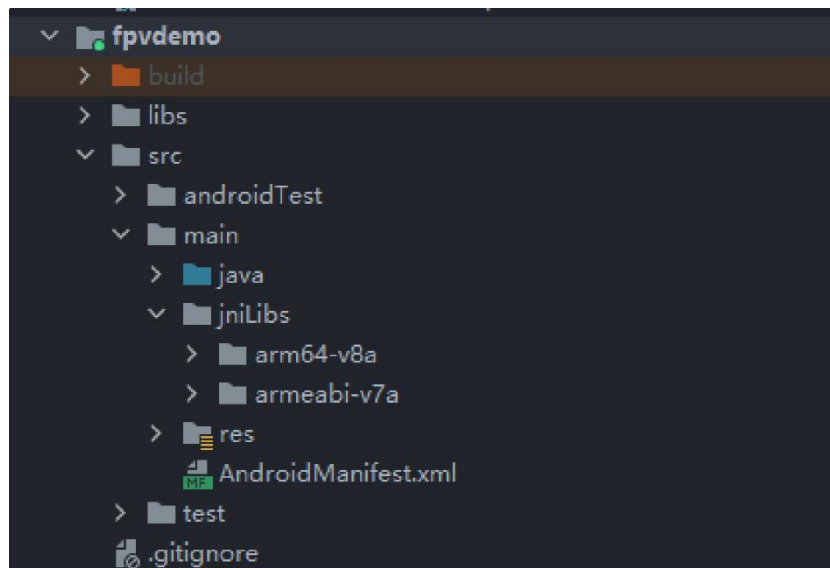
Add FPV Video Display to Code

Please pay attention to the below points for your code:

- Firstly, use the static method "getInstances()" of "ConnectionManager" to get the "ConnectionManager" object. Then call the "ConnectionManager.checkConnectWithIntent()" method in the lifecycle method "onCreate()" and "onNewIntent()".
- Video stream should be displayed through "SurfaceView". So, we create an "SurfaceView" object and need to call "ConntionManager.notifySurfaceCreate()" and "notifySurfaceDestroy" method from "surfaceCreated()" and "surfaceDestroy()".

```
mSurfaceView.getHolder().addCallback(new SurfaceHolder.Callback() {
 @Override
 public void surfaceCreated(SurfaceHolder holder) {
 Logcat.d(TAG, "onSurfaceCreated...");
 mConnectionManager.notifySurfaceCreate(holder.getSurface());
 }
 @Override
 public void surfaceChanged(SurfaceHolder holder, int format, int width
, int height) {
 }
 @Override
 public void surfaceDestroyed(SurfaceHolder holder) {
 mConnectionManager.notifySurfaceDestroy(holder.getSurface());
 }
});
```

- Dual-Channel FPV Display:

Dual-channel FPV display supports Ethernet connection only. It does not support AOA or USB connection. For dual-channel FPV display, we should configure the IP addresses first, then create two "SurfaceView" for image display. Whether the second video stream is required or not can be judged by the connection type through connection status. You can refer to "demo" for detail.

- When you quit the application, please do not forget to call the "UsbConnectionManager.release()" method.

For more detail, please refer to the codes in "demo".

5.6.2 Interface Instructions

ConnectionManager

Name	Description
getInstance(Context context)	Single case method for "ConnectionManager"
setWirelessUrl(String url1, String url2)	Set the addresses for video stream.
checkConnectWithIntent(Intent intent)	Initial the connection.
notifySurfaceCreate(Surface surface)	Notify that the first "Surface" is created, the "Surface" is for video display.
notifySurfaceDestroy(Surface surface)	Notify that the first "Surface" is destroyed.
notifySecondSurfaceCreate(Surface surface)	Notify that the second "Surface" is created, the "Surface" is for video

	display.
notifySecondSurfaceDestroy(Surface surface)	Notify that the second "Surface" is destroyed.
setConnectionListener(ConnectionListener listener)	Set callback for the connection status.
setFrameListeners(FrameListener frameListener, FrameListener secondFrameListener)	Set callback for video stream.
getSDKVersion()	Request SDK version.
release()	Release SDK.

SettingsConfig

Name	Description
SettingsConfig.getInstance().initConfig(context)	**Initialize the settigns. This method must be called.**
setLogEnable(boolean)	Set if print the log in the sdk. It is suggested to disable print in the "release" version.
setDecodeType(Context context, @IDecodeListener.DecodeType int decodeType)	Set decoding type. In default it is hardware decoding.
setSupportWirelessConnection(Context context, boolean supportWireless)	Set if to support Ethernet connection method.
setRectify(Context context, boolean rectify)	Set if to activate the video stream distortion correction function. The function is disabled in default and is only for A2 mini FPV gimbal at this moment. It works only when the video stream addresses is "RtspConstants.DEFAULT_TCP_VIDEO_URL" "SUB_TCP_VIDEO_URL". Attention：If distortion correction is activated, when you switch from SIYI camera addresses "RtspConstants.DEFAULT_TCP_VIDEO_URL" "SUB_TCP_VIDEO_URL" to RTSP addresses, new surface objects should be imported. One way to do this is to remove "SurfaceView" and add a

	new "SurfaceView" through "addView", then import the "Surface" object again in "SurfaceHolder.Callback".
getCameraManager()	Request camera control objects. SYSDKCameraManager

SYSDKCameraManager

Name	Description

/**
* Set Camera Resolution
* @param streamType：
* [CameraInfo.STREAM_MAIN], [CameraInfo.STREAM_SUB].
* @param resolution：
[CAMERA_RESOLUTION_SD] 480p,
[CAMERA_RESOLUTION_HD] 720p,
[CAMERA_RESOLUTION_FHD] 1080p.
* [CAMERA_RESOLUTION_2K] 2K,
[CAMERA_RESOLUTION_4K] 4K,
*/
fun setResolution(cameraIndex: Int,
  @CameraInfo.StreamType streamType: Int,
  @CameraResolution resolution: Int)
	Set camera resolution.

5.7 SIYI FPV SDK Update Log

Version	2.5.15
Updates	1. Fix the issue that RTSP stream may blurr. 2. Add camera control interface. 3. Fix some other known issues. Mark: It is necessary to update the "so" and "aar" file, which can be updated frm the "aar_so" folder.

Version	2.5.14
Updates	1. Fix some issues which causes anormal in JNI library (need to update "so" library). 2. Fix some other known issues. Mark: It is necessary to update the "so" and "aar" file, which can be updated frm the "aar_so" folder.

Version	2.5.13
Updates	1. Fix the issue that the video stream of some IP65 cameras may blurr. 2. Add to support ZT30 camera video stream. Mark: It is necessary to update the "so" and "aar" file, which can be updated frm the "aar_so" folder.

SIYI

6 SIYI FPV WINDOWS APP

SIYI FPV Windows is a Windows OS based application developed by SIYI to support many SIYI link products, optical pods (gimbal cameras), and autopilot (flight controller) for their abundant function, configuration, and device status monitoring.

Mark

This chapter is edited based on SIYI FPV Windows app v0.0.6.

SIYI FPV Windows app can be downloaded from SIYI official website:

https://siyi.biz/en/index.php?id=downloads&asd=602

SIYI FPV App compatible SIYI devices
- ZT6 Mini Dual-Sensor Optical Pod
- ZT30 Four-Sensor Optical Pod
- ZR30 4K 180X Hybrid Zoom Optical Pod
- MK32 Enterprise Handheld Ground Station
- A8 mini Zoom Gimbal Camera
- ZR10 2K 30X Hybrid Zoom Optical Pod
- HM30 Full HD Image Transmission System
- MK15 Mini Handheld Ground Station

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SIYI FPV Windows App Function Definition
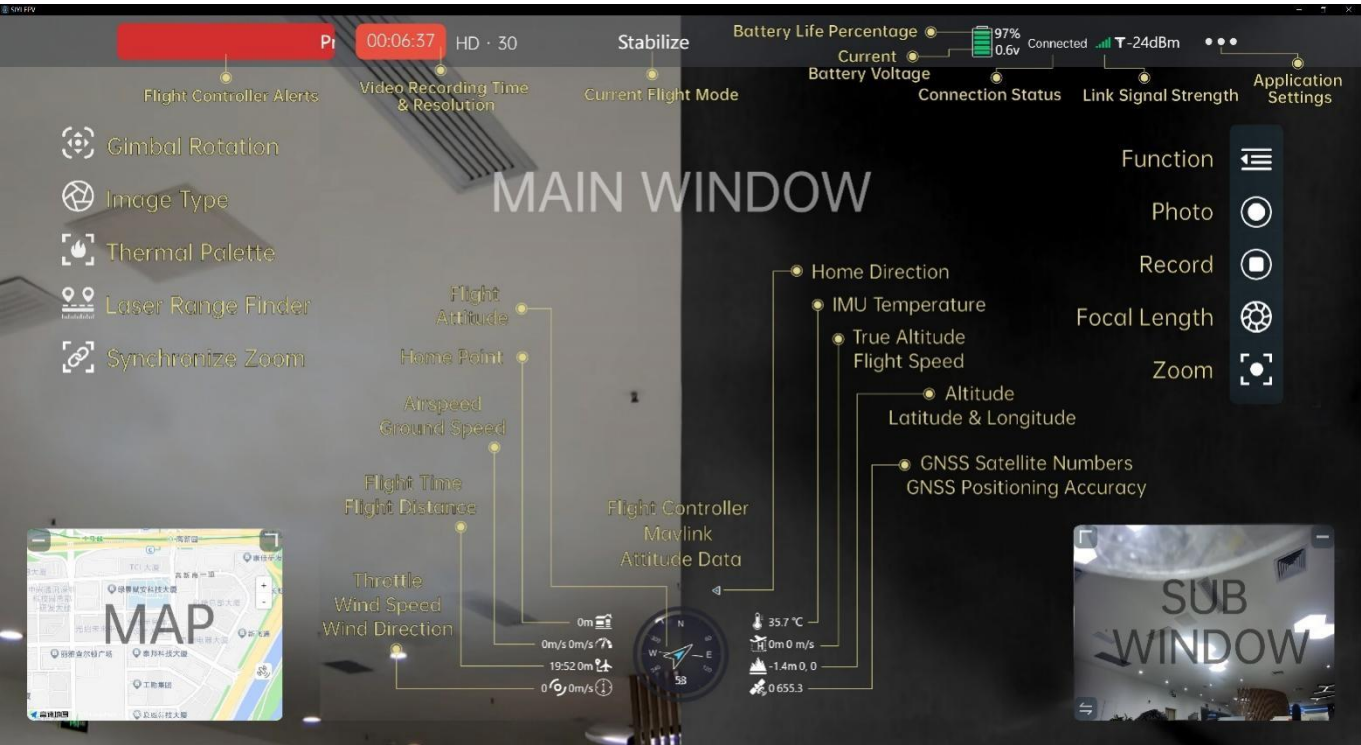
6.1 UI Function & Definition

6.1.1 Top Status Bar

Top status bar is to display the system's working status.

About Top Status Bar

Flight Controller Alerts: Alert messages from flight controller.

Flight Mode: Currently activated flight mode.

Current Voltage: Current voltage from aircraft power battery.

Battery Life Percentage: Current battery level from aircraft power battery in percentage.

Connection Status: Connection status of video stream.

Link Signal Strength: Signal strength of the communication link in dBm.

Application Settings: Some basic application settings.

6.1.2 Left Tools Bar

Left tools bar is to control the basic function of optical pod (gimbal camera).

SIYI

Gimbal Rotation

Provide some quick actions to control gimbal attitude.
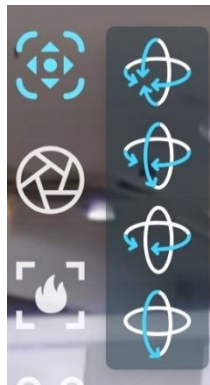
About Gimbal Rotation

Center: Gimbal camera centers in both yaw axis and pitch axis.

Yaw Center & Pitch Down: Gimbal camera centers in yaw axis and points down in pitch axis.

Yaw Center: Gimbal camera centers in yaw axis.

Pitch Down: Gimbal camera points down in pitch axis.

Image Type

Switch image type for multi-sensor optical pods.
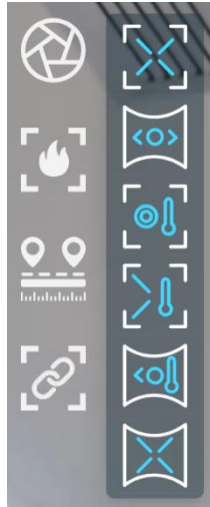
About Image Type

Singe Image (Zoom Camera): Main windows displays image from zoom camera only.

Singe Image (Wide Angle Camera): Main windows displays image from wide angle camera only.

Singe Image (Thermal Camera): Main windows displays image from thermal camera only.

Split Image (Zoom & Thermal): Main windows displays image from zoom camera in left and thermal camera in right.

Split Image (Wide Angle & Thermal): Main windows displays image from wide angle camera in left and thermal camera in right.

Split Image (Zoom & Wide Angle): Main windows displays image from zoom camera in left and wide-angle camera in right.

Thermal Palette

Switch thermal image type in multiple-sensor optical pods.
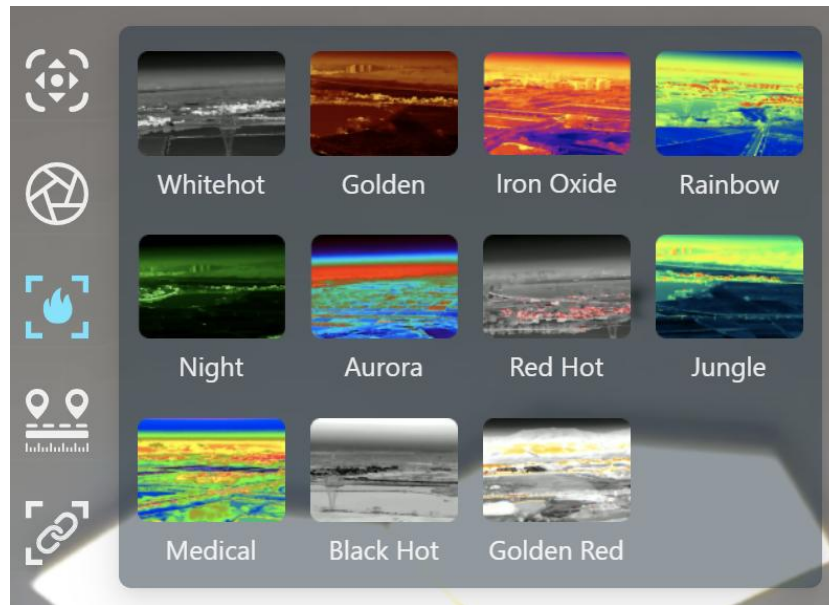
Laser Range Finder

Turn on / off the laser range finder in multiple-sensor optical pods.

Synchronize Zoom

Turn on / off synchronize zoom of zoom camera and thermal camera from 1X to 2X under split image in in multiple-sensor optical pods.

6.1.3 Right Tools Bar

Right tools bar is to control the basic function of camera.
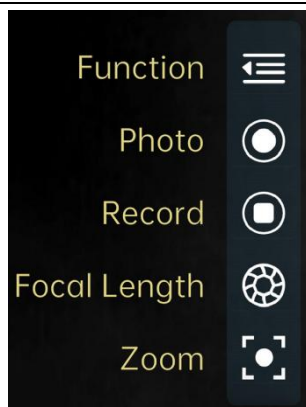
Function

Basic settings for optical cameras.

About Optical Camera Basic Settings

Boot Record: Enable / disable automatic video recording by SD card as soon as the camera

is powered.

Record Sub Stream: Turn on video recording for the sub stream.

Stream Resolution: Decide to switch the output resolution of the current video stream or

not according to camera source. Max output resolution is Ultra HD (1080p).

Record Resolution: Decide to switch the recording resolution or not according to camera

source. Max record resolution is 4K.

Basic settings for thermal camera.
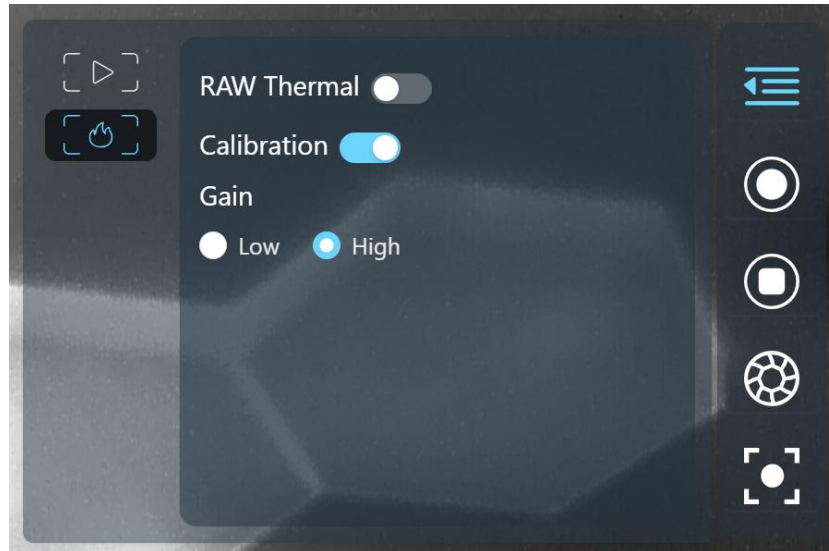
About Thermal Camera Basic Settings

Thermal RAW: Choose to include the RAW data in thermal images or not.

Thermal Calibration: To calibrate the thermal camera by changing environment elements.

Thermal Gain: Switch between low gain and high gain for the thermal imaging camera.

6.1.4 Flight Controller Mavlink Attitude Data

Displays Mavlink flight attitude data telemetry from flight controller in real-time.
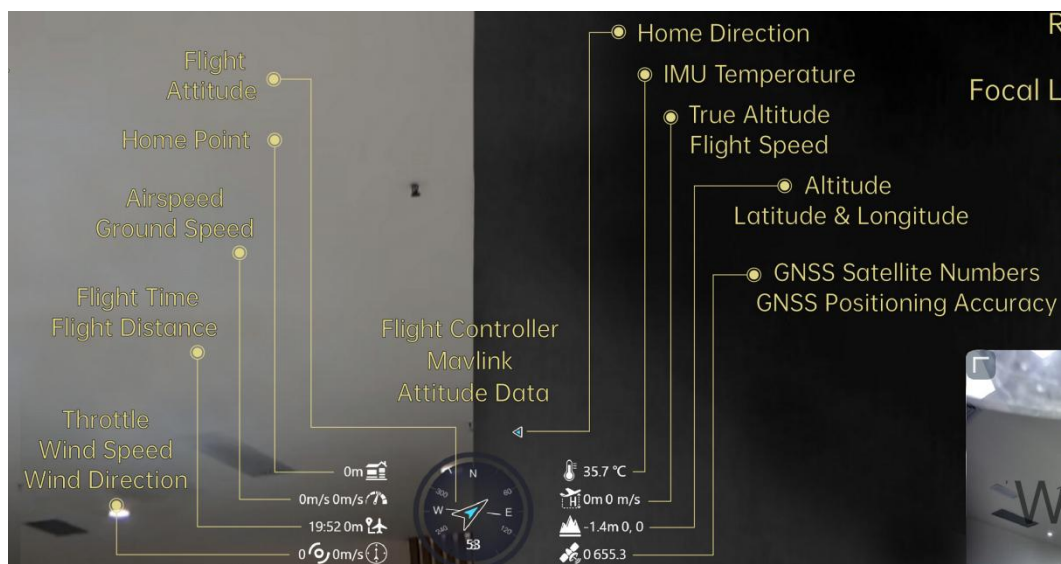
About Flight Controller Mavlink Attitude Data

Flight Attitude: Aircraft flight direction and yaw angle.

Home Point: Direct distance between the projection of the current position of the aircraft on the ground and the home point.

Airspeed: The speed of the aircraft relative to the surrounding air during flight (Unit: m/s or km/h).

Ground Speed: The speed of the aircraft relative to ground during flight (Unit: m/s or km/h).

Flight Time: Accumulated flight time of aircraft.

Flight Distance: Accumulated flight distance of aircraft relative to ground.

Throttle: Current throttle output (0 ~ 100).

Wind Speed: The velocity of air flow around the aircraft (Unit: m/s or km/h).

Wind Direction: The direction of air flow around the aircraft.

IMU Temperature: Flight controller IMU temperature.

True Altitude: The current flight altitude of the aircraft relative to the home point.

Flight Speed: The absolute flight speed of the aircraft in real time.

Altitude: The absolute altitude of the aircraft in real time.

Latitude & Longitude: Latitude and longitude of the aircraft's current location.

GNSS Satellite Number: The current number of satellites captured by the global positioning and navigation system.

GNSS Positioning Accuracy: The current positioning accuracy of the global positioning and navigation system.

● **Mark**

Ground speed depends on the airspeed of the aircraft, the wind speed around the aircraft, and the direction of the wind. If the aircraft flies downwind, the ground speed will be higher than the air speed; If the aircraft flies against the wind, the ground speed will be lower than the airspeed. Ground speed is usually provided by the aircraft navigation system or flight controller.

6.1.5 Map

Map box locates in the left-down corner of the main window which can be displayed / hided, and the size can be adjusted.

6.1.6 Sub Window

Sub window locates in the right-down corner of the main window which displays video stream from sub stream. Sub window can be displayed or hided, and the size can be adjusted. Sub window and main window can be switched for image display.

6.2 System Settings

6.2.1 Camera Settings

Check current camera model, camera network addresses, and camera firmware version.

About Camera Settings

Camera Addresses: Select camera model, default camera network addresses, or input

RTSP addresses for main stream and sub stream, or disable image.

Camera Firmware Version: Display current camera firmware version.

6.2.2 Gimbal Settings

Set gimbal motion mode, check gimbal firmware version, and zoom firmware version.

Motion Mode
○ Lock ● Follow ○ FPV

⚙ Gimbal Firmware: v0.2.1

⚙ Zoom Firmware: v0.1.6

About Gimbal Settings

Gimbal Motion Mode: Switch gimbal working mode among Lock Mode, Follow Mode, and FPV Mode.

● Lock Mode: Horizontally, gimbal does not follow when aircraft rotates.
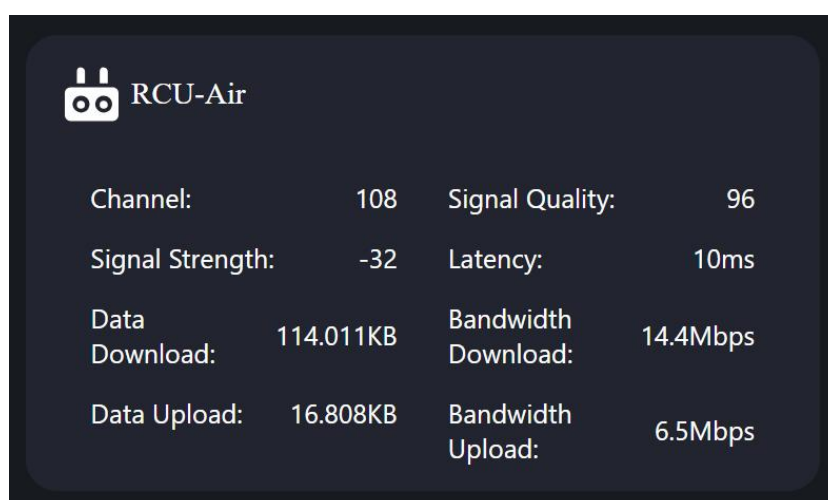
● Follow Mode: Horizontally, gimbal follows when aircraft rotates.

● FPV Mode: Gimbal rotates simultaneously as aircraft rolls to get FPV view, and output images with enhanced stability.

Gimbal Firmware Version: Display current gimbal firmware version.

Zoom Firmware Version: Display current gimbal firmware version (Only available for optical zoom cameras).

6.2.3 Link Status

Monitor SIYI image transmission link's status.

About Link Status

Channel: Current frequency channel of the transmission link under current working frequency.

Signal Quality: Current signal quality of the link in percentage (0 ~ 100).

Signal Strength: Current signal strength of the link in dBm.

Latency: Current signal transmission latency of the link (Unit: ms).

Data Download: Downloading data of the transmission link from air unit per second (Unit: KB).

Bandwidth Download: Downloading bandwidth of the transmission link from air unit (Unit: Mbps).

Data Upload: Uploading data of the transmission link to air unit per second (Unit: KB).

Bandwidth Upload: Uploading bandwidth of the transmission link to air unit (Unit: Mbps).

6.2.4 Others

Switch map type, check application version and SIYI contact information.

Map Type

Map   Google ⌄

About

App Version   0.0.6

Email   support@siyi.biz

Phone   400 838 2918

Website   www.siyi.biz

Fackbook Group

6.3 SIYI FPV App Update Log

Date	2024-04-25
Version	0.0.11
Updates	1. New: Support browser and download files from SD card. 2. New: Support format SD card. 3. New: Function description for laser rangefinder and synchronized zoom. 4. Improve: Update some icons. 5. New: Function description for gimbal rotation and camera switching. 6. New: E.S.C configuration. 7. Fix: A8 mini images do not show up occasionally. 8. Fix: A8 mini error messages.

7 SIYI Assistant

SIYI PC Assistant is a Windows software developed by SIYI to configure many SIYI products for configuration, firmware update, and calibration.

🔴 **Mark**

The manual is edited based on SIYI PC Assistant v1.3.9.

SIYI PC Assistant and the relevant firmware pack can be downloaded from SIYI official website:

https://siyi.biz/en/index.php?id=downloads&asd=27

7.1 Gimbal / Zoom Firmware Update

SIYI gimbal camera connects to SIYI PC Assistant for gimbal firmware and zoom firmware update.

⬤ **Mark**

Zoom firmware update is only available for optical zoom gimbal cameras.

Before upgrading, it is necessary to prepare the tools, software, and firmware below.

- SIYI PC Assistant (v1.3.9 or latest version)

- Gimbal Firmware

- Zoom Firmware

⬤ **Mark**

Above software and firmware can be downloaded from relevant product page on SIYI official website.

- Cable (USB-C to USB-A)

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Customers should prepare the above tools.

Firmware Upgrade Steps

1. Install "SIYI PC Assistant" on your Windows device.

2. Use the USB-C to USB-A cable to connect Windows device's USB-A port to gimbal camera's USB-C port.

3. Run "SIYI PC Assistant" and switch to "Upload" page to check gimbal camera's current firmware version.

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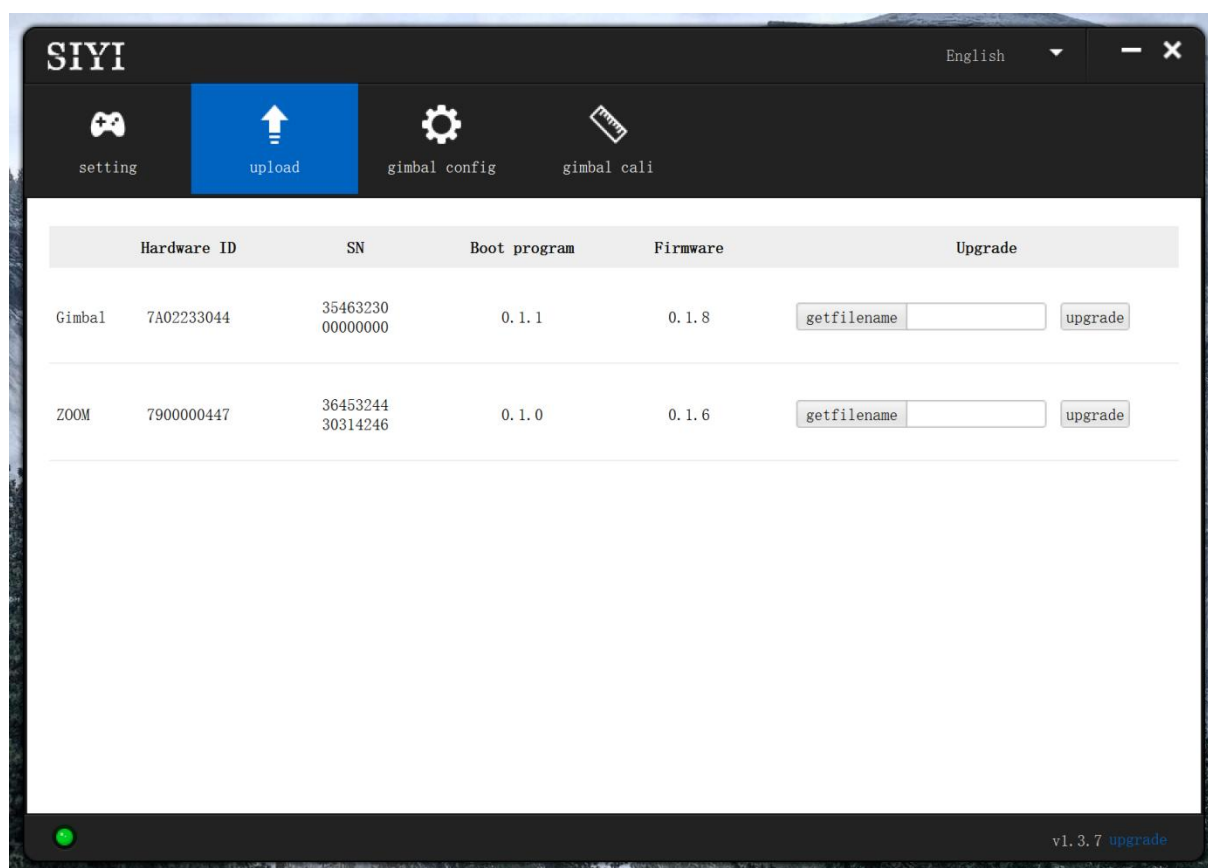
4. If the firmware is not latest, then click the "Select File" button in the "Gimbal" to import the latest firmware. And click "Upgrade" and wait till it is "100%" finished.

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Before updating any firmware, gimbal camera should be powered.

It is the same process for both gimbal firmware and zoom firmware.

7.2 Camera Firmware Update

The camera firmware of SIYI gimbal camera should be upgraded by SD card.

Before upgrading, it is necessary to prepare the tools, software, and firmware below.

● Micro-SD Card

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Customers should prepare the above tools.

SIYI

Please make sure that the TF card has been formatted to FAT32 before camera firmware upgrade.

- Camera Firmware

🔴 **Mark**

Above software and firmware can be downloaded from relevant product page on SIYI official website.

Firmware Upgrade Steps

1. Save camera firmware's ".bin" file to the SD card's root directory and do not change the file name.

名称 ^	修改日期	类型	大小
📄 ZR10_UpgradeSD.bin	2023/10/16 16:29	BIN 文件	13,605 KB

2. Restart gimbal camera and wait for 3 to 5 minutes. Camera firmware will be flashed automatically.

3. Run SIYI FPV app or SIYI PC Assistant software to check if camera firmware is updated successfully.

7.3 Gimbal Camera Configuration

SIYI gimbal camera can be connected to SIYI PC Assistant for channel settings and camera settings.
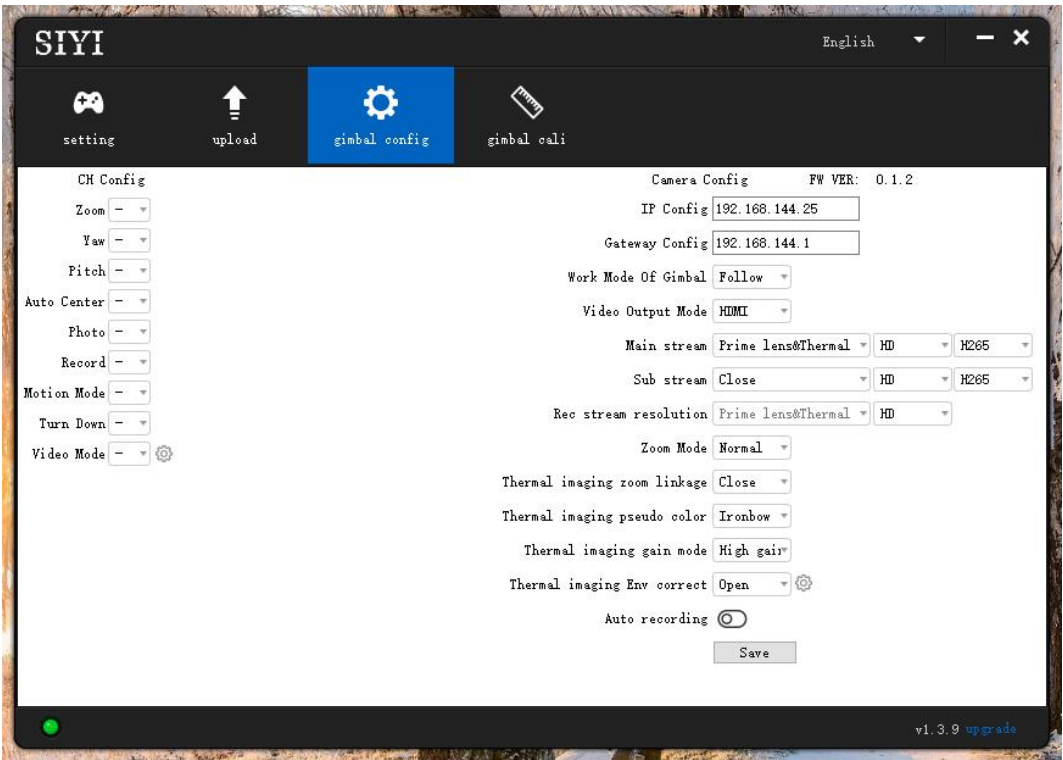
7.3.1 Channel Configuration

The "Channel Config" menu under "Gimbal Config" menu can assign the below gimbal camera functions to up to 16 channels and an idle channel (disabled).

Gimbal Functions and Description

- Auto Focus: Control zoom camera for automatic focus.

- Zoom: Control camera for optical zoom and digital zoom.

- Manual Focus: Adjust zoom camera focal length for manual focus.

- Yaw: Control gimbal rotation on yaw axis.

- Pitch: Control gimbal rotation on pitch axis.

- Auto Center: Control gimbal to reset to initial position. Coordinates (0, 0).

- Photo: Control camera to take a picture.

- Record: Enable / disable video recording.

- Motion Mode: Switch gimbal working mode (follow mode, lock mode, FPV mode).

- Auto Down: Control gimbal pitch axis to point downward vertically. Coordinates (0, -90).

- Image Mode: Select the video stream's image type and camera source. Single image or split image. Zoom camera, wide angle camera, or thermal imaging camera. Max three switches to be assigned for different image mode.
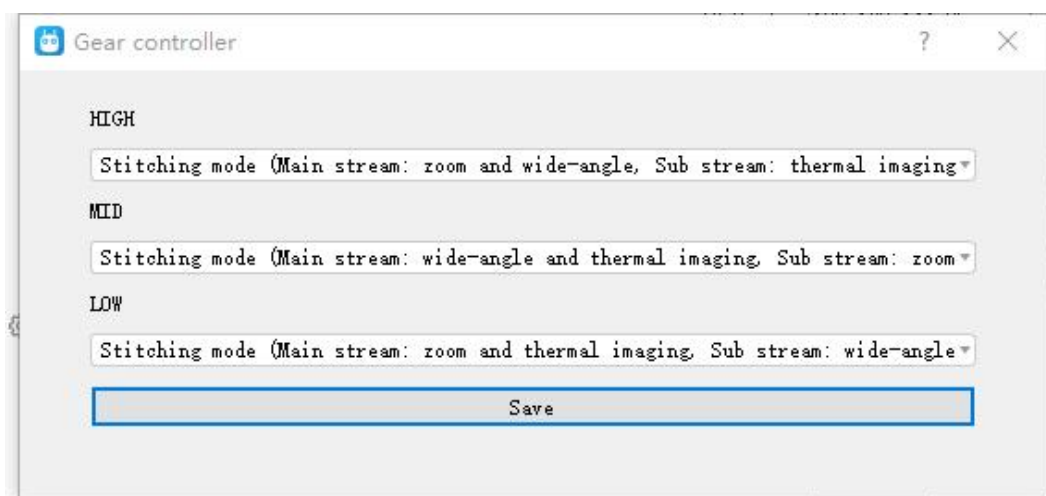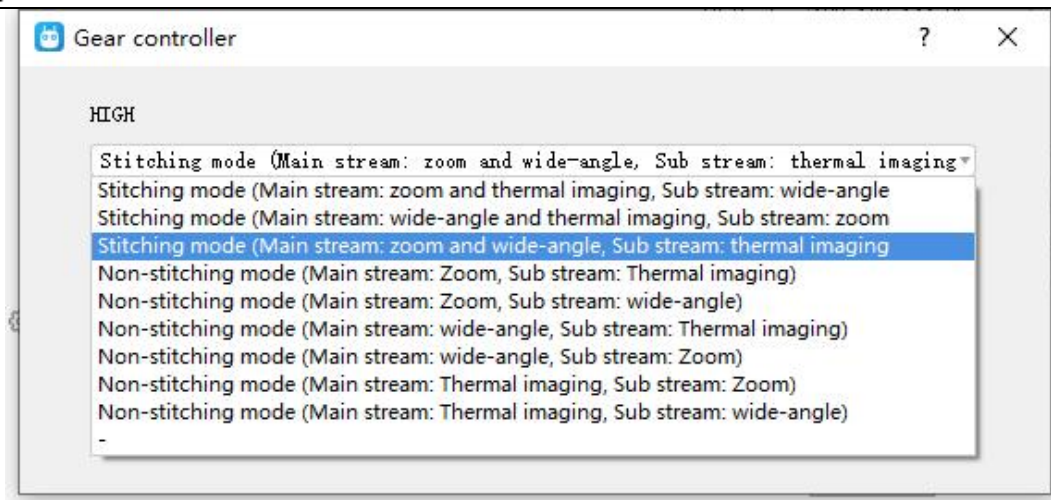
7.3.2 Camera Configuration

The "Gimbal Config" menu also supports abundant and core features of SIYI gimbal camera, such as, checking camera firmware version, modifying camera IP addresses, selecting camera source for main / sub stream and video recording, switching camera resolution or zoom mode, enabling / disabling thermal camera's synchronized zoom, enabling / disabling boot recording.

About Camera Configuration

- IP Config: Modify camera IP addresses.

- Gateway Config: Modify camera gateway.

- Gimbal Working Mode: Switch gimbal working mode (Follow Mode / Lock Mode / FPV Mode)

- Main Stream: Select camera source and switch output resolution for the main stream.

- Sub Stream: Select camera source and switch output resolution for the sub stream.

- Record Resolution: Select camera source and switch video resolution for recording.

- Zoom Mode: Switch zoom camera's zoom mode (Normal / Absolute Zoom).

- Boot Record: Enable / disable automatic video recording by TF card as soon as gimbal camera is powered.

⬤ **Mark**

The camera image source of the record stream is the same with the main stream.

7.4 Gimbal Calibration

The "Gimbal Calibration" can help users do IMU calibration, IMU Constant temperature calibration, and accelerator hexahedral calibration.

7.4.1 IMU Calibration

IMU calibration can keep the inertial measuring unit's accuracy and reliability.

Steps

1. Click "Check", gimbal camera will power off automatically. Meanwhile, please follow the message box and place the gimbal camera on a flat surface and make sure that the IMU is static. Do not touch or vibrate the gimbal camera. Then go for "Start Checking".
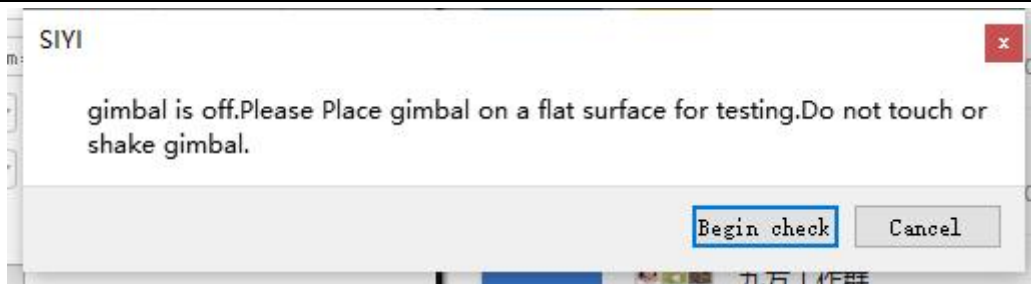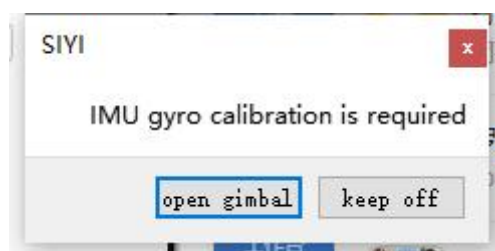
2. The PC assistant start to check IMU status automatically to determine if the gimbal should be calibrated.
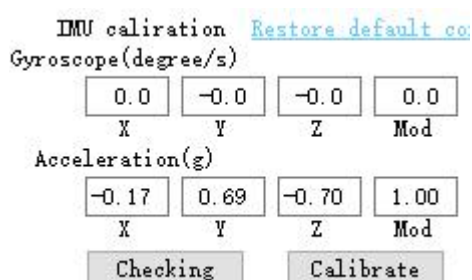

3. If IMU is working normally, there will be a message box to indicate "not necessary to calibrate".

4. If IMU is not working normally, there will be a message box to indicate "calibration is necessary".

5. Click "Start Gimbal" and "Calibrate".

6. The message box will say again "please follow the message box and place the gimbal camera on a flat surface and make sure that the IMU is static. Do not touch or vibrate the gimbal camera".
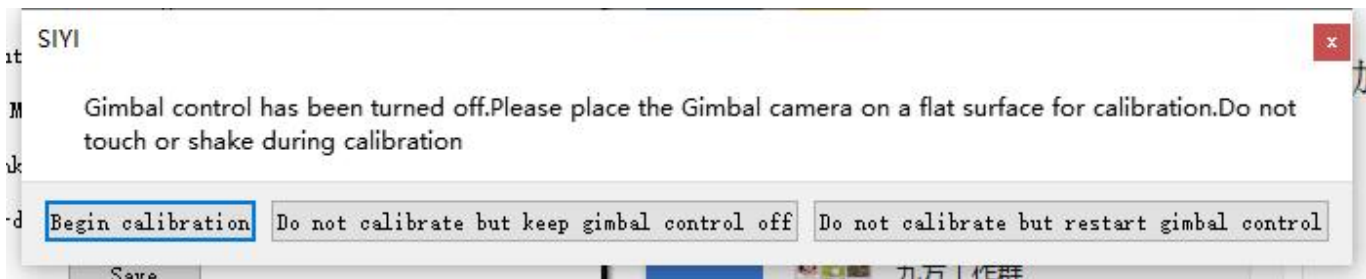
7. IMU calibration menu will display "calibrating".
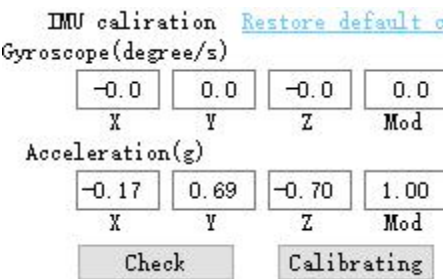
8. After a few seconds, IMU calibration will be finished.

7.4.2 IMU Constant Temperature Calibration

Specially designed for using gimbals in scenarios with big difference in temperature to avoid the situation that gimbal behaves abnormally because IMU cannot reach constant temperature normally and fast when the environment temperature is far from IMU constant temperature.

Before calibration, please input the environment temperature of your operating field, the software will start to calculate the target IMU constant temperature so that IMU can reach the temperature fast after powering on gimbal camera. The software is showing IMU temperature in real-time.

7.4.3 Accelerator Hexahedral Calibration

Accelerator hexahedral calibration can calibrate the accelerator's sensitivity, zero bias, and inter axis error, etc. During calibration, the gimbal should be placed in all hexahedrons to record accelerator's output value on each orientation and build the error model. Hexahedral calibration can keep the accelerator's accuracy and reliability.

7.5 Main Firmware Update Log

Date	2024-04-16
Camera Firmware	0.3.5
Gimbal Firmware	0.4.0
SIYI FPV Android	2.5.15.705
SIYI FPV Windows	0.0.10
SIYI PC Assistant	1.4.2
Updates	1. Improve: Yaw axis following speed is slow. 2. Improve: EXIF information update.

Date	2024-03-04
Camera Firmware	0.3.4
Gimbal Firmware	0.3.9
SIYI FPV Android	2.5.15.696
SIYI FPV Windows	0.0.6
SIYI PC Assistant	1.4.0
Updates	1. New: AI following function (only for SIYI AI tracking module and multi-rotor drones) 2. New: Support SIYI FPV (Windows) version 3. New: Adapt to Mavlink protocol control and support the integration of PX4 flight controller attitude data 4. New: SIYI gimbal SDK supports obtaining attitude data from external devices for flight controller integration 5. New: SIYI Gimbal SDK supports formatting SD card 6. New: SIYI gimbal SDK supports obtaining GPS information and adding it to photo EXIF format 7. New: Support DCIM standard file system and EXIF information format 8. Fix: Gimbal working mode does not save after restarting

Date	2023-10-20
Camera Firmware	0.3.1
Gimbal Firmware	0.3.6
Zoom Firmware	0.2.3
SIYI FPV	2.5.15.679
SIYI PC Assistant	1.3.8
Updates	1. New: Support SIYI AI tracking module. 2. New: SIYI gimbal SDK supports configuring camera specs (bit rate, codec format, etc.). 3. Improve: SIYI gimbal SDK supports requesting zoom multiples. 4. Fix: S.Bus control may lost if Mavlink is connected simultaneously.

Date	2023-09-14
Camera Firmware	0.3.0
Gimbal Firmware	0.3.5
SIYI FPV	2.5.15.669
Updates	1. Fix: Occasionally that gimbal attitude behaves abnormally in natural status.

Date	2023-07-28
Camera Firmware	0.2.9 svn947 svn945
Gimbal Firmware	0.3.0 svn6895
Zoom Firmware	0.2.2 svn6826
SIYI FPV	2.5.14.644
Updates	1. New: Gimbal SDK supports all TCP and UDP commands. 2. Improve: Absolute zoom error. 3. New: Now customers can preview stored camera pictures and videos through SIYI FPV app. 4. Improve: Now ZR10 records videos in MP4 format. 5. Improve: RTSP streaming supports up to 4 streams from the same IP addresses. 6. Fix: Date information in picture file was wrong. 7. Improve: Videos recorded and pictures taken by ZR10 are organized by date and time in folders.

Date	2023-05-06

Camera Firmware	0.2.8 svn636 svn544
Gimbal Firmware	0.2.7 svn6662
Zoom Firmware	0.2.1 svn6675
SIYI PC Assistant	1.3.4 svn6679
Updates	1. New: Accelerator hexahedral calibration. 2. Fix: Abnormal temperature indicators. 3. New: Now camera pictures come with time and location information. 4. Improve: Gimbal will not center when it hits roll limit. 5. Improve: Gimbal and motor control algorithm. 6. Improve: Auto focus.

Date	2022-11-30
Camera Firmware	0.2.6 svn452 svn451
Gimbal Firmware	0.2.2 svn6290
Updates	1. New: SDK command for gimbal rotation control by angle. 2. New: User IMU calibration.

Date	2022-11-16
Camera Firmware	0.2.5 svn329 svn307
Gimbal Firmware	0.1.9 svn6097
Updates	1. New: Upside down mode. 2. New: FPV mode. 3. Improve: Lock mode, follow mode. 4. Improve: Gimbal and motor control algorithm.

Date	2022-08-02
Camera Firmware	0.2.4 svn306
Gimbal Firmware	0.1.8 svn6012
Zoom Firmware	0.1.5 svn6007
Updates	1. Improve: Auto focus from 10X to 30X zoom. 2. New: SDK commands for acquiring firmware version, device ID, gimbal attitude

data, working mode.
3. Improve: Over exposure.
4. New: Codec switch in SIYI PC Assistant.
5. Improve: Reduce gimbal rotation control speed under high zoom to improve stability.
6. Improve: Auto detection of yaw axis limit on start. Support 320-degree yaw along with the new manufacturing lot.
7. Improve: Zoom control.

7.6 SIYI PC Assistant Update Log

Date	2024-04-16
Version	1.4.2
Updates	1. New: ZT30 / ZR30 / ZR10 can adjust gimbal following speed now.

Date	2024-01-06
Version	1.4.0
Updates	2. New: Support AI follow function and adjusting follow speed.

Date	2023-12-18
Version	1.3.9
Updates	3. New (ZT30, ZT6): An activation process for thermal imaging function.

Date	2023-11-02
Version	1.3.8 svn6958
Updates	4. New: Compatibility to ZT6 Mini Dual-Sensor Optical Pod. 5. New: A switch to enable zoom camera and thermal camera recording simultaneously (only in non-split-image mode and main / sub stream should be zoom / thermal camera). 6. Fix: ZT30 does not record video after setting recording resolution. 7. Fix: ZT30 does not set main stream resolution.

Date	2023-08-24
Version	v1.3.7 svn6958
Updates	8. New: Compatibility to a new model. 9. New: Support ZT30 to switch between H265 and H264 codec. 10. Improve: Gimbal calibration function has its own page now. 11. New: Gimbal configuration (thermal synchronize zoom, thermal color palette)

8 After-sale Service

Please visit the SIYI Technology support page at [Service and Support - SIYI Technology | Empowering and Building an Intelligent Robot Ecology](#) for the latest after-sales and warranty information.