K40T Four-Sensor External Protocol - Single-channel Streaming Protocol

1. Electrical Interface

1. Four-Sensor Payload External Electrical Interface Protocol

Pin	Function	Name	Remarks
To be determined	Power interface	To be determined	
To be determined	Network interface	LAN_TX_P	
		LAN_TX_N	
		LAN_RX_N	
		LAN_RX_P	
To be determined	Communication interface	USART_RX	
		USART_TX	
To be determined	Clock synchronization pin	RTC_IO	

2. Protocol Definition

2.1 Protocol Frame Format

V1 Frame 12-255bytes									
STX	LEN	DT_SYS ID	DA_COMP ID	SEQ	SA_SYS ID	SA_COMP ID	MESSAGE_ID	PAYLOAD DATA	CHECKSUM
1 bytes	1 bytes	1 bytes	1 bytes	1 bytes	1 bytes	1 bytes	3 bytes	0-243 bytes	2 bytes

Byte number	Type	Content	Value	Explanation
0	Uint8_t	Packet start flag	0xFD	Protocol-specific Start of Text (stx) marker, used to indicate the start of a new packet. Any system that does not recognize the protocol version will skip the packet.
1	Uint8_t	payload length	0-255	Displays the length of the payload portion. This may be affected by the message data.
2	Uint8_t	System ID (receiver)	0-255	Refers to the Receiver System ID, used to distinguish systems from different products.
3	Uint8_t	Component ID (receiver)	0-255	Refers to the Receiver System ID, used to distinguish components from different products.

4	Uint8_t	Packet sequence number	0-255	Used to detect packet loss, the component increments for each message sent.
5	Uint8_t	System ID (sender)	1-255	Refers to the sender system ID, used to distinguish systems on the network.
6	Uint8_t	Component ID (sender)	1-255	Refers to the sender component ID, used to distinguish components in the system.
7-9	Uint32_t	Message ID (low, mid, high bytes)	0-16777215	The id of the message type in the load, used to decode the data back into the message object.
10-n+10	Uint8_t [243]	Effective payload		Message data. Depends on the message type (i.e. message ID) and content.
N+11 -N+12	Uint16_t	Checksum		X.16 CRC

APP address：System ID：0x01 ； Component ID：0x01
Flight control：System ID：0x02 ； Component ID：0x01
Four-Sensor Payload：System ID：0x04 ； Component ID：0x01
Set the high byte of the message ID of the message to 0x00
Set the high byte of the message ID of the ACK message reply to 0x01
Set the high byte of the message ID of the status frame message of the message reply to 0x02
For example: After specifying the hybrid zoom （0x000304）setting，the message ID of the ACK is 0x010304，and the message ID of the status frame is 0x020304.
The multi-byte parameters of the message payload (except ACK) are all in the order of low byte first and high byte last.
Note:
Setting message: The message sent by the APP or Assistant software to the gimbal
ACK: Feedback on whether the gimbal receives and executes the setting information normally
Status frame: Status feedback during the gimbal execution process

crc code：

```
static void crc_accumulate(uint8_t data, uint16_t *crcAccum)
{
    uint8_t tmp;
    tmp = data ^  (uint8_t)(*crcAccum &0xff);
    tmp ^=  (tmp<<4);
    *crcAccum =  (*crcAccum>>8)^(tmp<<8)^(tmp<<3)^(tmp>>4);
}
```

```
8
9   #define X25_INIT_CRC 0xffff
10  static void crc_init(uint16_t* crcAccum)
11  {
12      *crcAccum = X25_INIT_CRC;
13  }
14
15  uint16_t crc_calculate(const uint8_t* pBuffer, uint16_t length)
16  {
17      uint16_t crcTmp;
18      crc_init(&crcTmp);
19      while (length--)
20      {
21          crc_accumulate(*pBuffer++, &crcTmp);
22      }
23      return (crcTmp);
24  }
```

2.2 Serial Port Description

2.2.1 Serial port definition

The serial port is 3.3VTTL serial port.

2.2.2 Serial port description and configuration

The basic configuration of the serial port is:

Serial port baud rate	115200
Serial port level standard	TTL 3.3V level
Serial port data bit	8 Bit
Serial port stop bit	1 Bit
Parity bit	None
Serial port flow control	None

2.3 Network Port Description

2.3.1 Camera network port default IP address

The camera default IP address is: 192.168.144.64

2.3.2 RTSP streaming address

Default streaming address： rtsp://IP:558/live/single

For example： rtsp://192.168.144.64:558/live/single

2.3.3 UDP streaming address

Default streaming address:

3. Payload System

3.1 Gimbal payload protocol（Sysid:0x03）

3.1.1 Periodic reporting message（0x000001-0x00000F）

3.1.1.1 gimbal status message（500ms）（msgid：0x000001）

Description: This message is the report of the gimbal status information. Reporting cycle：2HZ

payload:

Byte1	Byte2	Byte3	Byte4	Byte5	Byte6-7
Gimbal status	Upgrade status	Self-test results	Image stabilization status	Reserved	Reserved

The specific description is as follows:

Gimbal status message	Byte1	Gimbal status, uint8_t data Low 4 bits: 0: Gimbal connection is normal; 1: Gimbal connection is abnormal High 4 bits: 0: Camera connection is normal; 1: Camera connection is abnormal
	Byte2	Upgrade status: uint8_t type data 0x00: Upgrade is normal 0x01: Kernel upgrade is not completed 0x02: Firmware upgrade is not completed
	Byte3	Self-test results Bit0： Infrared sensor: 1-Normal; 0-Abnormal Bit1： Telephoto visible light sensor: 1-Normal; 0-Abnormal

		Bit2： Wide-angle visible light movement: 1-normal; 0-abnormal Bit3 ： Laser: 1-normal; 0-abnormal Bit5-7 ： Reserved
	Byte4	Stabilization status: 0: Stabilization is not enabled, 1: Stabilization is in progress, 2: Stabilization failed, 3: Stabilization feature lost
	Byte5	Reserved
	Byte6-7	Reserved

3.1.1.2 Gimbal attitude information（100ms）(msgid：0x000002)

This message is for reporting the gimbal attitude angle information. Reporting cycle： 10HZ

payload：

Byte1-2	Byte3-4	Byte5-6	Byte7-8	Byte9-10	Byte11-12
Gimbal yaw angle (joint angle)	Gimbal roll angle (joint angle)	Gimbal pitch angle (joint angle)	Gimbal yaw angle (attitude angle)	Gimbal roll angle (attitude angle)	Gimbal pitch angle (attitude angle)

Byte13-14	Byte15-16	Byte17-18	Byte19-20	
Gimbal yaw angular velocity	Gimbal pitch angular velocity	Gimbal roll angular velocity	Reserved	

The specific instructions are as follows：

Gimbal information	Byte1-2	Gimbal yaw angle (joint angle), integer; unit: degree * 100
	Byte3-4	Gimbal roll angle (joint angle), integer; unit: degree * 100
	Byte5-6	Gimbal pitch angle (joint angle), integer; unit: degree * 100
	Byte7-8	Gimbal yaw angle (attitude angle), integer; unit: degree * 100
	Byte9-10	Gimbal roll angle (attitude angle), integer; unit: degree * 100
	Byte11-12	Gimbal pitch angle (attitude angle), low byte first; unit: degree * 100

	Byte13-14	Gimbal yaw angular velocity int16, x100 times, precision 0.01°/s
	Byte15-16	Gimbal pitch angular velocity int16, x100 times, precision 0.01°/s
	Byte17-18	Gimbal roll angular velocity int16, x100 times, precision 0.01°/s
	Byte19-20	Reserved

3.1.2 Request message（0x000010-0x0000FF）

3.1.2.1 Gimbal control commands(msgid：0x000010)

Description: This message is used to control the gimbal action.

payload:

Byte1	Byte2	Byte3	Byte4
Working mode and quick function	yaw control	Pitch control	Reserved

The specific instructions are as follows:

Remote gimbal information	Byte1	Upper 4 bits: gimbal working mode 00(0000): No operation, default 01(0001): Indicates that the gimbal is back to center 02(0010): Indicates that the gimbal is looking down 90° Lower 4 bits: Reserved
	Byte2	Set the direction of the yaw movement (0: move left, 1: move right, 2: stop moving)
	Byte3	Set the direction of the pitch movement (0: move up, 1: move down, 2: stop moving)
	Byte4	Reserved

Ack

Byte1-2
Response code

3.1.2.2 Specify the gimbal angle control command(msgid： 0x000012)

Description: This message specifies that the gimbal moves to the corresponding angle position

payload：

Byte1-3	Byte4-6	Byte7
Specify the gimbal pitch angle	Specify the gimbal yaw angle	Reserved

The specific instructions are as follows：

Specify the gimbal angle command	Byte1-3	Byte1 specifies the gimbal movement direction 0: Upward specified angle 1: Downward specified angle 2: No movement Byte2-3 specifies the gimbal movement angle (up 30 degrees, down 90 degrees)
	Byte4-6	Byte4 specifies the gimbal yaw movement direction 0: left specified angle 1: right specified angle 2: no movement Byte5-6 specifies the gimbal yaw movement angle (180 degrees left, 180 degrees right)
	Byte7	Reserved

Ack

Byte1-2
Response code

3.1.2.3 Gimbal One-key drift calibration command(0x000013)

Description: The APP sends a one-key drift calibration command to control the gimbal to perform drift calibration.

Request frame： payload：

Byte 1	Byte 2
Drift calibration status	Reserved

The specific instructions are as follows：

One-key drift calibration gimbal	Byte1	0x01:Start drift calibrating
	Byte2	Reserved

Ack

Byte1-2
Response code

3.1.2.4 Gimbal dial speed setting command(msgid： 0x000017)

Description：APP sets the maximum gimbal dial speed command.

Request frame： payload：

Byte 1	Byte 2	Byte 3
Gimbal pitch dial speed	Gimbal yaw dial speed	Reserved

The specific instructions are as follows：

Gimbal maximum dial speed setting command	Byte1	Gimbal pitch dial speed： Byte1 gimbal pitch dial speed , uint8_t type, range 5-150, corresponding to a movement speed of 1-30 degrees/second
	Byte2	Gimbal yaw dial speed： Byte1 gimbal yaw dial speed , uint8_t type, range 5-150, corresponding to a movement speed of 1-30 degrees/second
	Byte 3	Reserved

Ack

Byte1-2
Response code

3. 1.2.5 Get the gimbal version number(msgid： 0x000018)

Description：Get the gimbal version number

payload：

Byte 1	Byte 2
Get the gimbal version number	Reserved

The specific instructions are as follows:

Get the gimbal version number	Byte1	Byte1 0x01: Get the gimbal version number
	Byte2	Reserved

Ack:

Byte1-2	Byte3-5	Byte6-8	Byte9
Response code	Gimbal hardware version number	Gimbal software version number	Reserved

The specific instructions are as follows:

Get the gimbal version number	Byte1-2	Response code
	Byte3	Gimbal hardware version number (major version number)
	Byte4	Gimbal hardware version number (sub Version number)
	Byte5	Gimbal hardware version number(patch Version number)
	Byte6	Gimbal software version number(major version number)
	Byte7	Gimbal software version number(sub Version number)
	Byte8	Gimbal software version number(patch Version number)
	Byte9	Reserved

3.1.2.6 Gimbal pointing alignment command（0x00002C）

Description: Gimbal pointing alignment control command

payload:

Byte1	Byte 2-3	Byte4-5	Byte6-7

Zoom lens selection	Hybrid zoom ratio	Point to X coordinate point	Point to Y coordinate point

The specific instructions are as follows:

Gimbal pointing alignment command	Byte1	Zoom lens selection 0x00： telephoto lens 0x01： wide-angle lens 0x02： infrared lens
	Byte2-3	Hybrid zoom ratio, Uint16_t Telephoto lens unit 0.1x range (3.5-11.0 is optical zoom, 11.0-160 is electronic zoom) wide-angle lens unit 0.1x (supports 1-8 integer multiple electronic zoom) Infrared lens unit 0.1x (supports 1-8 integer multiple electronic zoom)
	Byte4-5	Point to X coordinate point, uint16 type, range 1-1920 intermediate value 960
	Byte6-7	Point to Y coordinate point, uint16 type, range 1-1080 intermediate value 540

Ack:

Byte1-2
Response code

3.1.2.7 Turn off the gimbal servo command（0x00002D）

Description: APP requests the gimbal to turn off the servo.

Request frame： payload：

Byte 1	Byte 2
turn off the servo（0x00）	Reserved

Ack

Byte1-2

Response code

3.1.2.8 Gimbal linear calibration command（0x00002E）

Description: APP requests gimbal linear calibration.

Request frame： payload：

Byte 1	Byte 2
linear calibration（0x01）	Reserved

Ack：

Byte1-2
Response code

3.1.2.9 Gimbal soft restart command（0x00002F）

Description: APP requests gimbal soft restart.

Request frame： payload：

Byte 1	Byte 2
soft restart（0x01）	Reserved

Ack：

Byte1-2
Response code

3.1.2.10 Gimbal uses flight control fake attitude command（0x000030）

Description: APP requests the gimbal to use flight control fake attitude.

Request frame： payload：

Byte 1	Byte 2
use flight control fake attitude（0x01）	Reserved

Ack:

Byte1-2
Response code

3.1.2.11 Gimbal calibration motion acceleration offset command（0x000031）

Description: APP requests the gimbal to calibrate motion acceleration offset.

Request frame： payload：

Byte 1	Byte 2
Calibrate motion acceleration（0x01）	Reserved

Ack:

Byte1-2
Response code

3.1.2. 12 Gimbal image stabilization command（0x000033）

Description: APP requests gimbal image stabilization settings.

Request frame： payload：

Byte 1	Byte 2
Image stabilization (0x01: image stabilization on; 0x00: image stabilization off)	Reserved

Ack:

Byte1-2
Response code

3.2 Camera Payload Protocol（Sysid:0x04）

3.2.1 Periodic reporting message (status reporting)（0x000001-0x00000F）

3.2.1.1 Camera system status feedback（1s）（msgid：0x000003）

This message is for uploading camera system status information. Reporting cycle：1HZ

payload：

Byte 1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
Photo/video mode	Preview Stream resolution	Preview Stream encoding format	Streaming mode	Preview Stream bitrate	Set photo mode	Time-lapse photo duration
Byte8	Byte9	Byte10-11	Byte12-13	Byte14-15	Byte16	
Number of continuous shots	SD status	Total SD card capacity	Remaining SD card capacity	Used SD card capacity	Reserved	

The specific instructions are as follows：

Camera status feedback	Byte 1	Photo/video mode 0： Photo mode 1： video mode
	Byte 2	Preview Stream encoding format 0： 1080P30fps 1： 720P30fps
	Byte3	Preview Stream encoding format 0： H264 1： H265
	Byte4	Streaming mode： 00： Infrared streaming 0x05/0x06:Visible light streaming 0x07:Split screen streaming
	Byte5	Preview Stream bitrate 1:1M 2:1.5M 3:2M 4：4M 5： 8M 6: 12M
	Byte6	photo mode 0: Single shot 1: Burst Shot 3/5 pictures 2: Time-lapse shooting
	Byte7	Time-lapse photo duration 5/7/30/60
	Byte8	Number of Burst Shot 3/5
	Byte9	SD card status 0: Normal card 1: Abnormal card 2: The current card has slow read and write speed 3: No SD card is inserted 4: SD card is full 5: SD card format error
	Byte10-11	Total SD card capacity unit： MB*10
	Byte12-13	Remaining SD card capacit unit： MB*10
	Byte14-15	Used SD card capacity unit： MB*10
	Byte16	Reserved

3.2.1.2 Infrared camera status feedback（200ms）(msgid： 0x000004)

Description: This message is the infrared status information reported to the flight control and APP;

Reporting cycle:5HZ

payload:

Byte 1-2	Byte3-4	Byte5-6	Byte7-8	Byte9-10	Byte11-14	Byte15-18	Byte19-22
The highest temperature value of the region	The lowest temperature value of the region	The central temperature value of the region	The point temperature value	The average temperature value of the region	The coordinates of the highest temperature of the region	The coordinates of the lowest temperature of the region	The coordinates of the central temperature of the region
Byte23-26	Byte27	Byte28	Byte29	Byte30	Byte31-34		
Point temperature measurement coordinates	High temperature warning sign	Low temperature warning sign	Temperature difference warning sign	Threshold temperature warning sign	Reserved		

The specific instructions are as follows:

Infrared camera status feedback	Byte1-2	Maximum temperature value of the region，int16_t type， unit0.1℃
	Byte3-4	Minimum temperature value of the region， int16_t type， unit0.1℃
	Byte5-6	Central temperature value of the region， int16_t type， unit0.1℃
	Byte7-8	Point temperature measurement value， int16_t type， unit0.1℃
	Byte9-10	Average temperature value of the region， int16_t type， unit0.1℃
	Byte11-14	Maximum temperature coordinate of the region Byte11-12: Maximum temperature coordinate of the region X， uint16_t type Byte13-14: Maximum temperature coordinate of the region Y， uint16_t type
	Byte15-18	Minimum temperature coordinate of the region Byte15-16: Minimum temperature coordinate of the region X， uint16_t type Byte17-18: Minimum temperature coordinate of the region Y， uint16_t type
	Byte19-22	Central temperature coordinate of the region

		Byte19-20: Central temperature coordinate of the region X, uint16_t type Byte21-22: Central temperature coordinate of the region Y, uint16_t type
	Byte23-26	Point temperature measurement coordinates Byte23-24: Point temperature measurement coordinates X, unit16_t type Byte25-26: Point temperature measurement coordinates Y, unit16_t type
	Byte27	High temperature warning sign: 0: No warning 1: Start warning
	Byte28	Low temperature warning sign: 0: No warning 1: Start warning
	Byte29	Temperature difference warning sign: 0: No warning 1: Start warning
	Byte30	Threshold temperature warning sign: 0: No warning 1: Start warning
	Byte31-34	Reserved

Note: Regional temperature measurement reports the highest temperature, lowest temperature, average temperature, center temperature and the coordinates of the highest temperature, lowest temperature and center temperature. Point temperature measurement reports the point temperature value and its coordinates.

3.2.1.3 Visible light camera status feedback (200ms) (msgid: 0x000005)

Description: This message is for reporting the visible light camera parameter status information

Reporting cycle:5HZ

payload:

Byte1	Byte2-3	Byte4-5	Byte 6	Byte7-8	Byte9-10	Byte11	Byte12	Byte13-14	Byte15
Zoom status	Focal length	Hybrid zoom ratio	EV value reporting	ISO value reporting	Electronic shutter reporting	AE_LOCK status	Focus status	Accurate shoot focal length	Reserved

The specific instructions are as follows:

Visible light camera parameter status information	Byte1	Zoom status 0x00: Zoom completed 0x01: Zoom in progress
	Byte2-3	Focal length， unit:0.01mm
	Byte4-5	Hybrid zoom ratio： The telephoto Hybrid zoom ratio includes optical zoom and electronic zoom. Zooms above 11X are electronic zooms. Unit: 0.1X
	Byte6	EV value reporting 0x00:Auto 0x0A:+2 0x10:+1 0x16:0 0x1C:-1 0x23:-2
	Byte 7-8	ISO value reporting unit:0.1db
	Byte9-10	Electronic shutter reporting unit：Microseconds
	Byte11	AE_LOCK status 0x01 On， 0x02 Off
	Byte12	Focus status 0x00： Focus completed 0x01： Focusing
	Byte13-14	Accurate shoot focal length
	Byte15	Reserved

3.2.1.4 Camera upgrade and repair status feedback（ 1s） （ msgid： 0x000008）

Description: Camera upgrade or repair progress report

Byte 1	Byte2	Byte3
Status	Progress	Reserved

The specific instructions are as follows:

Camera upgrade and repair status feedback	Byte 1	0： Upgrade or repair succeeded 1： Upgrade or repair failed 2： Upgrading 3： Repairing
	Byte 2	Current upgrade or repair progress（0~100） 0： Start 100： Completed
	Byte 3	Reserved

3.2.2 Infrared Camera Setup Message（0x000100-0x0001FF）

3.2.2.1 Infrared camera all setting parameters read command（0x000100）

Description: Read all parameters of infrared camera

payload:

Byte1	Byte2
Read all camera settings	Reserved

The specific instructions are as follows:

APP reads all camera parameter commands	Byte1	0x01 ： Read all infrared camera setting commands
	Byte2	Reserved

Ack

Byte1-2	Byte3-23
Response code	All camera settings parameters feedback

The specific instructions are as follows:

ACK	Byte1-2	Feedback， ACK：0 indicates successful feedback
All infrared camera parameters	Byte3	Infrared camera image settings Thermal color palette settings： 1-20
	Byte4	Temperature measurement and electronic magnification configuration Byte4（bit7-bit0）： bit0 Temperature measurement switch （0 On， 1 Off) Bit1 Temperature measurement type （0 point temperature measurement, 1 area temperature measurement) Bit2 Infrared movement type (0 sighting version, 1 temperature measurement version) Bit3-7 Electronic magnification
	Byte5	Infrared sharpening parameters Range See support instructions

	Byte6	IR gain mode (0: High gain mode 1: Low gain mode 2: Auto)
	Byte7	IR brightness setting Range See support instructions
	Byte8	IR contrast setting Range See support instructions
	Byte9	Denoising setting Byte3（bit7） Denoising switch 0： Off； 1： On Byte3（bit6-bit0） Denoising level
	Byte10	Enhanced settings Byte10（bit0）Enhanced switch： 0： Off； 1： On Byte10（bit6-0）Enhanced parameters
	Byte11-12	High temperature warning temperature setting: Open and set temperature range： -1000-5000 Close high temperature warning： -2732 unit： 0.1℃ Data type： int
	Byte13-14	Low temperature warning temperature setting: Open and set temperature range： -1000-5000 Close low temperature warning： -2732 unit ： 0.1℃ Data type： int
	Byte15-16	Temperature difference warning setting: Open and set the temperature difference range： 1-6000 Close the temperature difference warning： -2732 unit ： 0.1℃ Data type： int
	Byte17	Threshold temperature warning switch: Set the threshold temperature difference alarm function switch： 0： Off； 1： On
	Byte18-19	Temperature difference reference value setting（-30℃ to 50℃）： Set temperature difference reference value： -300-500 unit ： 0.1℃ Data type： int
	Byte20-21	Temperature floating value setting: Set temperature floating value： 0-800

		unit： 0.1℃ Data type： int
	Byte22-23	Reserved

3.2.2.2 Infrared electronic amplification setting command(0x000105)

Description: Set the infrared electronic amplification command

Request frame： payload：

Byte 1	Byte 2
Infrared electronic magnification settings	Reserved

The specific instructions are as follows：

Infrared electronic magnification settings	Byte1	Byte1 ： 0x01 ： No amplification 0x02-0x08 ： 2-8X electronic amplification
	Byte2	Reserved

Ack：

Byte1-2
Response code

3.2.2.3 Infrared Thermal color palette setting command （0x000106）

Description: Set the infrared Thermal color palette setting request command.

Request frame： payload：

Byte 1	Byte 2
Infrared Thermal color palette settings	Reserved

The specific instructions are as follows：

Infrared Thermal color palette settings	Byte1	1-20 represent White hot，black hot, rainbow, high contrast red, iron red, magma, sky, medium gray, gray red, purple orange, special 1, warning red,

		Ice Fire, Yellow Red, Special 2, Gradient Red, Gradient Green, Gradient Yellow, Warning Green, Warning Blue
	Byte2	Reserved

Ack:

Byte1-2
Response code

3.2.2.4 Infrared temperature measurement switch command（0x000108）

Description: Set the infrared temperature measurement switch request command

Request frame： payload：

Byte 1	Byte 2
Infrared temperature switch	Reserved

The specific instructions are as follows:

Infrared temperature switch	Byte1	Byte1 0x00： Temperature measurement switch on 0x01： Temperature measurement switch off；on by default (when on, the camera periodically sends temperature information)
	Byte2	Reserved

Ack:

Byte1-2
Response code

3.2.2.5 Infrared sharpening setting command（0x00010A）

Description: Set the infrared sharpening setting request command

Request frame： payload：

Byte 1	Byte 2
sharpening setting	Reserved

The specific instructions are as follows:

sharpening setting	Byte1	Byte1 sharpening setting: 0-100
	Byte2	Reserved

Ack:

Byte1-2
Response code

3.2.2.6 Infrared brightness setting command (0x00010B)

Description: Set infrared brightness request command

Request frame: payload:

Byte 1	Byte 2
Infrared brightness setting	Reserved

The specific instructions are as follows:

Infrared brightness setting	Byte1	Byte1 Brightness parameters 0-100
	Byte2	Reserved

Ack:

Byte1-2
Response code

3.2.2.7 Infrared contrast setting command (0x00010C)

Description: Set infrared contrast request command

Request frame： payload：

Byte 1	Byte 2
Infrared contrast setting	Reserved

The specific instructions are as follows：

Infrared contrast setting	Byte1	Byte1 Contrast parameter 0-100
	Byte2	Reserved

Ack：

Byte1-2
Response code

3.2.2.8 Infrared denoising setting command（0x00010D）

Description: Set infrared denoising request command

Request frame： payload：

Byte 1-2	Byte 3
Infrared denoising setting	Reserved

The specific instructions are as follows：

Infrared de-noising setting	Byte1-2	Byte1 ： Denoising switch 0： Off 1： On Byte2： Denoising level： 0-100
	Byte3	Reserved

Ack：

Byte1-2
Response code

3.2.2.9 Infrared image enhancement setting command（0x00010E）

Description: Infrared enhancement setting command

Request frame： payload：

Byte1	Byte2
Infrared enhancement setting	Reserved

The specific instructions are as follows：

Infrared enhancement setting	Byte1	Infrared image enhancement setting：0 :Off； 1-10 : Set level.
	Byte2	Reserved

Ack：

Byte1-2
Response code

3.2.2.10 Infrared point temperature measurement setting command（0x00010F）

Description: Set the infrared point temperature measurement command

Request frame： payload：

Byte1-2	Byte3-4	Byte5
X-axis cursor point	Y-axis cursor point	Reserved

The specific instructions are as follows：

	Byte1-2	Byte1-Byte2 X-axis cursor point Range： 0-1920 (including black border, actual area：320-1079)

	Byte3-4	Byte3-Byte4 Y-axis cursor point Range: 0-1088 (including black border, actual area: 32-1023)
	Byte5	Reserved

Ack:

Byte1-2
Response code

3.2.2. 11 Infrared area temperature measurement setting command (0x000110)

Description: APP sets the infrared rectangular frame temperature measurement instruction

Request frame: payload:

Byte 1-2	Byte 3-4	Byte 5-6	Byte 7-8	Byte 9
Infrared rectangular frame width	Infrared rectangular frame height	Infrared rectangular frame center coordinate X1	Infrared rectangular frame center coordinate Y1	Reserved

The specific instructions are as follows:

Infrared rectangle frame settings	Byte1-2	Byte1-Byte2 Area frame width
	Byte3-4	Byte3-Byte4 Area frame height
	Byte5-6	Byte5-Byte6 Area frame center X coordinate
	Byte7-8	Byte7-Byte8 Area frame center Y coordinate
	Byte9	Reserved

Ack:

Byte1-2
Response code

Note: Actual temperature measurement area: half of the width of the rectangular frame plus the x-coordinate range is between 320-1279; half of the height of the rectangular frame plus the y-coordinate range is between 32-1023.

3.2.2. 12 Infrared camera gain mode setting command（0x000123）

Description: APP sets the infrared camera gain mode command

Request frame： payload：

Byte1	Byte2
Infrared camera gain mode setting	Reserved

The specific instructions are as follows：

Infrared camera gain mode setting	Byte1	0x00： High gain mode 0x01： Low gain mode 0x02： Automatic mode
	Byte2	Reserved

Ack：

Byte1-2
Response code

3.2.2.13 Infrared camera temperature warning setting command（0x000124）

Description: The APP sets infrared high temperature warning, low temperature warning, and temperature difference warning setting functions.

Request frame： payload：

Byte1-2	Byte3-4	Byte5-6	Byte7
High temperature warning temperature setting	Low temperature warning temperature setting	Temperature difference warning setting	Reserved

The specific instructions are as follows：

Infrared camera temperature warning setting	Byte1-2	High temperature warning temperature setting： Open and set the temperature range： -1000-5000 Turn off high temperature warning： -2732 unit： 0.1℃ Data type： int

	Byte3-4	Low temperature warning temperature setting: Open and set the temperature range : -1000-5000 Turn off the low temperature warning : -2732 unit : 0.1℃ Data type: int
	Byte5-6	Temperature difference warning setting: Open and set the temperature difference range: 1-6000 Turn off the temperature difference warning : -2732 unit : 0.1℃ Data type: int
	Byte7-8	Reserved

Ack:

Byte1-2
Response code

Note: If other values are set, the command reporting setting fails

3.2.2.14 Infrared camera temperature measurement information overlay switch setting command (0x000125)

Message ID: 0x0125

Description: The APP sets the temperature information command of infrared image overlay temperature measurement. The area temperature measurement displays the highest and lowest temperatures, and the point temperature measurement displays the temperature of the cursor point.

Request frame: payload:

Byte1	Byte2
Temperature superposition switch	Reserved

The specific instructions are as follows:

Infrared camera gain mode setting	Byte1	0x00 : Turn off temperature information overlay 0x01 : Turn on temperature information overlay
	Byte2	Reserved

Ack:

Byte1-2
Response code

3.2.2.15 Infrared camera threshold temperature difference setting command (0x0126)

Description: The APP sets the infrared threshold temperature difference warning setting function.

Request frame: payload:

Byte1	Byte2-3	Byte4-5	Byte6
Switch setting	Temperature difference reference value	Temperature floating value	Reserved

The specific instructions are as follows:

Infrared threshold temperature difference warning setting	Byte1	Switch setting: Set the threshold temperature difference alarm function switch : 0 : Off; 1 : On
	Byte2-3	Temperature difference reference value setting (-30 ℃ to 50℃): Set temperature difference reference value: -300-500 unit : 0.1℃ Data type: int
	Byte4-5	Temperature floating value setting: Set the temperature floating value : 0-800 unit : 0.1℃ Data type: int
	Byte6	Reserved

Ack:

Byte1-2
Response code

3.2.3 Visible Light Camera(0x000200-0x0002FF)

3.2.3.1 Read all setting parameters of visible light camera (0x000200)

Description: Read all parameter commands of visible light camera

Request frame: payload:

Byte1	Byte2
Read all setting commands of visible light camera	Reserved

The specific instructions are as follows:

APP reads all camera parameter commands	Byte1	0x01: Read all setting commands of visible light camera
	Byte2	Reserved

Ack

Byte1-2	Byte3-17
Response code	All camera settings parameters feedback

ACK		
	Byte1-2	Feedback, ACK: 0 Indicates successful feedback
All camera settings parameters feedback	Byte3	Visible light camera resolution 0x14: 8000*6000 0x15: 4000*3000 0x16: 5160*3870
	Byte4	Visible light video resolution Telephoto 0x08: 1080p:1920*1080 0x26: 4K:3840*2160 0x36: 1200W:4000*3000
	Byte5	Visible light video bitrate H264 encoding format 0x00:6M; 0x01:8M; 0x02:10M; 0x03:12M(1080P video resolution)

	0x00:30M; 0x01:40M; 0x02:50M; 0x03:60M(4Kvideo resolution) 0x00:40M; 0x01:55M; 0x02:70M; 0x03:80M(4000*3000 video resolution) H265 encoding format (default H265) 0x00:3M; 0x01:4M; 0x02:5M; 0x03:6M(1080P video resolution) 0x00:15M; 0x01:20M; 0x02:25M; 0x03:30M(4K video resolution) 0x00:20M; 0x01:25M; 0x02:35M; 0x03:40M (4000*3000 video resolution)
Byte6	bit3-0 White balance setting: 0001: Auto 0010: Incandescent light 0011: fluorescent light 0100 : Warm daylight 0101: Daylight 0110 : Cloudy day 0111 : Dusk 1000 :Dark bit7-4 : Reserved
Byte7-8	Reserved
Byte9	EV value 0x00:Auto 0x0A:+2 0x10:+1 0x16:0 0x1C:-1 0x23:-2
Byte10	ISO Settings 0x00: AUTO 0x01: ISO100 0x02: ISO200 0x03: ISO400 0x04: ISO800 0x05: ISO1600 0x06: ISO3200 0x07: ISO6400
Byte11	Electronic shutter Photo mode: Auto: 0x00: Auto Manual : 0x01: 1/4 0x02: 1/8 0x03: 1/ 15 0x04: 1/30 0x05: 1/60 0x06: 1/ 125 0x07: 1/250 0x08: 1/500 0x09: 1/ 1000 0x0A: 1/2000 0x0B: 1/4000 0x0C: 1/5000 0x0C: 1/6000 0x0E: 1/8000 Video mode: Auto : 0x00: Auto Manual : 0x01: 1/4 0x02: 1/8 0x03: 1/ 15 0x04: 1/30 0x05: 1/60 0x06: 1/ 125 0x07: 1/250 0x08: 1/500 0x09: 1/ 1000 0x0A: 1/2000 0x0B: 1/4000 0x0C: 1/5000 0x0C: 1/6000 0x0E: 1/8000

Byte12	Zoom fine-tuning value 0-100
Byte13	Backlight compensation Bit7： Backlight compensation switch 0x01:On 0x02:Off Bit6-Bit0： Backlight compensation value:： 0-100
Byte14	Strong light suppression Bit7： Strong light suppression switch 0x01:On 0x02:Off Bit6-Bit0： Strong light suppression value： 0-100
Byte15	AE LOCK feedback: 0x1： On 0x2： Off
Byte16	Visible light OSD watermark switch and anti-flicker status Bit3-bit0: Watermark switch bit7-bit4： Anti-flicker status 0x01： Anti-flicker off 0x02： 50HZ Anti-flicker 0x03： 60HZ Anti-flicker 0x04: Auto
Byte17	Visible light metering mode setting feedback 0x01: Center weighted metering 0x02: Area metering 0x03: Average metering

3.2.3.2 Visible light video recording resolution setting command（0x000201）

Description: Request command to set the visible light video recording resolution.

Request frame: payload:

Byte 1	Byte 2
Start setting	Visible light video resolution setting

The specific instructions are as follows:

Visible light video resolution setting	Byte1	0x00： Start setting
	Byte2	0x08:1920*1080 0x26:3840*2160 0x36:4000*3000

Ack：

Byte1-2
Response code

3.2.3.3 Visible light camera resolution setting command（0x000202）

Description: Set visible light camera resolution request command

Request frame： payload：

Byte 1	Byte 2
Start setting	Visible light photo resolution setting

The specific instructions are as follows：

Visible light photo resolution setting	Byte1	0x00 : Start setting
	Byte2	0x14:8000*6000 0x15:4000*3000

Ack：

Byte1-2
Response code

3.2.3.4 Visible light ISO setting command（0x000203）

Description: Set the ISO parameter command of the visible light camera.

Request frame： payload：

Byte1	Byte 2
Start setting	Visible Light ISO Settings

The specific instructions are as follows:

Visible Light ISO Settings	Byte1	0x00: Start setting
	Byte2	0x00：AUTO；0x01： ISO100 0x02： ISO200 0x03： ISO400；0x04： ISO800 0x05： ISO1600；0x06： ISO3200；0x07： ISO6400 One-key to restore to factory defaults ： 0x00：AUTO

Ack:

Byte1-2
Response code

3.2.3.5 Visible photoelectric shutter setting command（0x000204）

Description: Set the visible photoelectric shutter command.

Request frame： payload:

Byte1	Byte 2
Start setting	Visible photoelectric shutter setting

The specific instructions are as follows:

Visible photoelectric shutter setting	Byte1	0x00:Start setting
	Byte2	Auto ： 0x00： Auto Manual ： 0x01： 1/4 0x02： 1/8 0x03： 1/ 15 0x04： 1/30 0x05： 1/60 0x06： 1/125 0x07： 1/250 0x08： 1/500 0x09： 1/1000 0x0A： 1/2000 0x0B: 1/4000 0x0C: 1/5000 0x0C: 1/6000 0x0E: 1/8000

Ack：

Byte1-2
Response code

3.2.3.6 Visible light EV setting command（0x000205）

Description: Set the visible light camera EV parameter command.

Request frame： payload：

Byte1	Byte 2
Start setting	Visible light EV setting

The specific instructions are as follows：

Visible light EV setting	Byte1	0x00:Start setting
	Byte2	0x00： Auto: 0x0A: +2 0x10: +1.0 0x16: +0 0x1C: -1 0x23: -2

Ack：

Byte1-2
Response code

3.2.3.7 Visible light white balance setting command（0x000206）

Description: Setting visible light white balance parameter command.

Request frame： payload：

Byte1	Byte 2-4
Start setting	Visible light white balance setting

The specific instructions are as follows：

Visible light white balance setting	Byte1	0x00:Start setting
	Byte2	bit3-0 White balance setting: 0001: Auto: 0010: Incandescent light 0011: fluorescent light 0100 : Warm daylight 0101: Daylight 0110 : Cloudy day 0111 : Dusk 1000 : Dark bit7-4 : Reserved
	Byte3-4	Reserved

Ack:

Byte1-2
Response code

3.2.3.8 Visible light anti-flicker setting command (0x000207)

Description: Set the visible light anti-flicker command.

Request frame: payload:

Byte1	Byte 2
Start setting	Visible light anti-flicker setting

The specific instructions are as follows:

Visible light anti-flicker setting	Byte1	0x00:Start setting
	Byte2	0x01 : anti-flicker Off 0x02 : 50HZ anti-flicker 0x03 : 60HZ anti-flicker 0x04: Auto

Ack:

Byte1-2
Response code

3.2.3.9 Visible light strong light suppression setting command（0x000208）

Description: Set the visible light anti-flicker command.

Request frame： payload：

Byte1	Byte 2
Start setting	Strong light suppression setting

The specific instructions are as follows：

Visible light anti-flicker setting	Byte1	0x00: Start setting	
	Byte2-3	Byte2 0x01： On 0x02： Off Byte3 Setting value： 0-100	

Ack：

Byte1-2
Response code

Note: High light suppression and backlight compensation cannot be set at the same time

3.2.3.10 Visible light backlight compensation setting command（0x000209）

Description: Set the visible light backlight compensation command.

Request frame： payload：

Byte1	Byte 2
Start setting	Backlight compensation setting

The specific instructions are as follows：

	Byte1	0x00:Start setting

Visible light anti-flicker setting	Byte2-3	Byte2 0x01 ： On 0x02 : Off Byte3 Setting value ： 0-100

Ack:

Byte1-2
Response code

Note: High light suppression and backlight compensation cannot be set at the same time

3.2.3.11 Visible light AE LOCK setting command（0x00020A）

Description: Set the AE LOCK command

Request frame： payload:

Byte1	Byte2
Start setting	AE LOCK setting

The specific instructions are as follows:

AE LOCK	Byte1	0x00:Start setting
	Byte2	0x01:On 0x02:Off

Ack:

Byte1-2
Response code

3.2.3.12 Visible light camera metering mode command（0x00020B）

Description: Set metering mode command

Request frame： payload:

Byte1	Byte2
Start setting	Metering mode setting

The specific instructions are as follows:

	Byte1	0x00:Start setting
	Byte2	1: Center-weighted metering 2: Zone metering (default zone) 3 : Average metering

Ack:

Byte1-2
Response code

3.2.4 Common Part(0x000300-0x0003FF)

3.2.4.1 Photo and video mode setting command (0x000300)

Description: Set the visible light photo and video mode request command

Request frame: payload:

Byte 1	Byte 2
Photo/Video Mode Settings	Reserved

The specific instructions are as follows:

Visible light photo/video mode settings	Byte1	Byte1 Mode switch : 0 : Photo mode; 1 : Video mode
	Byte2	Reserved

Note: In the photo mode, it does not respond to the video recording command; in the video recording mode, it does not respond to the photo command

3.2.4.2 Photographing parameter setting command (0x000301)

Description: Set the photographing parameter setting request command

Request frame： payload：

Byte 1	Byte2	Byte3	Byte 4
Photo function settings	Time-lapse interval	Burst shot number	Reserved

The specific instructions are as follows：

Visible light photography parameter settings	Byte1	0x00： Normal single shot 0x01： Burst shot: 3/5 shots 0x02： Delayed shooting
	Byte2	Byte2 Delay interval: 5/7/30/60
	Byte3	Byte3 Burst shot number： 3/5
	Byte4	Reserved

Ack：

Byte1-2
Response code

3.2.4.3 Photo command（0x000302）

Description: Camera photo command

Request frame： payload：

Byte 1	Byte 2	Byte3-22	Byte23-54
Photo mode	Camera photo command	Folder name	Image name

The specific instructions are as follows：

Camera photo command	Byte1	Photo mode 0x00： Default photo taking (infrared + visible light) 0x01： Infrared photo taking (resolution: 640*512)

		0x02： Visible light photography (resolution: 4000*3000) 0x03： Infrared + visible light photography
	Byte2	Camera shooting command 0x00： Single shot/start shooting 0x01： Stop shooting (only valid in continuous shooting mode)
	Byte3-22	Folder name, not including’\0’, a total of 20 bytes, This byte array forms a string (string A). When the string is NULL or "", this field is not used and the folder is placed in the root directory where the image is saved. When the string is not empty, this field is used. If the root directory where the image is saved has this folder, there is no need to create it. If there is no such folder, it needs to be created.
	Byte23-byte54	Image name, does not contain '\0', a total of 32 bytes, This byte array, forms a string, when the string is NULL or "", the default naming rule is used to name, and the string is not empty, use the string as the image name

Ack

Byte1-2
Response code

Status frame (no status frame for single shot)

Byte 1	Byte2	Byte3-4	Byte5-7
Photo mode status	Current photo feedback	Number of Burst shot	Reserved

Photo status feedback	Byte1	0-Default photo shooting 1-Infrared photo shooting 2-Visible light photo shooting 3-Infrared + visible light photo shooting
	Byte2	Current photo feedback

		0-Photo taken 1-Single shot in progress 2-Continuous shot in progress 3-Time-lapse shot in progress 4-Stop shooting 5-Single shot in progress 6-Photo taken failed 7-SD card not inserted 8-SD card full 9-Abnormal card 10-Slow card 11-SD card format error
	Byte3-4	Burst shot number
	Byte5-7	Reserved

Note: Before taking a photo, a GPS request command will be sent to the flight controller to obtain GPS information.

3.2.4.4 Video recording command (0x000303)

Description: Camera video recording command

Request frame: payload:

Byte 1	Byte 2	Byte3-22	Byte23-54
Video recording mode	Camera video recording command	Folder name	Image name

The specific instructions are as follows:

Camera video recording command	Byte1	Recording mode 0x00: Default recording (infrared + visible light recording) 0x01: Infrared recording (resolution: 640*512) 0x02: Visible light recording (resolution: 4000*3000) 0x03: Infrared + visible light recording 0x04: Video stream recording (resolution: 1920*1080)
	Byte2	

		0x01: Start recording (sending again will not stop recording, to stop, you need to send the stop recording command) 0x02: Stop recording
	Byte3-22	Folder name, does not contain '\0', a total of 20 bytes, This byte array forms a string (string A). When the string is NULL or "", this field is not used and is placed in the root directory where the image is saved; when the string is not empty, this field is used. If the root directory where the image is saved has this folder, it does not need to be created. If there is no such folder, it needs to be created.
	Byte23-byte54	Video name, does not contain '\0', a total of 32 bytes, This byte array, forms a string, when the string is NULL or "", the default naming rule is used to name, the string is not empty, use the string as the video name

Ack

Byte1-2
Response code

Status Frame （1HZ)

Byte 1	Byte 2	Byte3-4	Byte5-7
Current recording mode feedback	Current recording feedback	Recording time	Reserved

Video status feedback	Byte1	Feedback on current recording mode 0-Default recording 1-Infrared recording 2-Visible light recording 3-Infrared + visible light recording 4-Video stream recording
	Byte2	Current video feedback 0-stop recording; 1-recording; 2-waiting for time-lapse recording;

		3-Time-lapse recording 4-SD card not inserted 5-SD card full 6-Abnormal card 7-Slow card 8-SD card format error
	Byte3-4	Recording time
	Byte5-7	Reserved

3.2.4.5 Specify Hybrid zoom command（0x000304）

Description: Specify Hybrid zoom ratio command

Request frame： payload：

Byte 1	Byte2-3
Start setting	Hybrid zoom ratio

The specific instructions are as follows：

Visible light precise zoom ratio	Byte1	0： Start setting
	Byte2-3	Specify the hybrid zoom ratio* 10 (the ratio is the actual ratio supported by the camera, accurate to one decimal place) (1-160x hybrid zoom)

Ack：

Byte1-2
Response code

Status Frame

Byte 1	Byte 2
Zoom status	Reserved

Visible light specified zoom ratio status frame	Byte1	Byte1 Zoom status 0x01: Zoom in progress 0x00: Zoom completed
	Byte2	Reserved

3.2.4.6 Continuous hybrid zoom command（0x000306）

Description: Execute continuous zoom command

Request frame： payload：

Byte1	Byte2
Camera zoom control	Reserved

The specific instructions are as follows：

Camera zoom control	Byte1	0x00: Continuous zoom in 0x01: Continuous zoom out 0x02: Stop zooming 0x03: Zoom in 0x04: Zoom out
	Byte2	Reserved

Ack：

Byte1-2
Response code

3.2.4.7 Specify the camera's accurate shoot command（0x000307）

Description: Specify the camera's accurate shoot command

Request frame： payload：

Byte 1	Byte 2	Byte 3-4	Byte 5-6

Photo mode	Visible light photo resolution	Visible light magnification	Visible light precise re-photography focal length
Byte7-26	Byte27-58		
Folder Name	Photo Name		

The specific instructions are as follows:

camera's precise re-shooting	Byte1	0x00: Default photo taking (all storage) 0x01: Infrared photo taking 0x02: Visible light photo taking 0x03: Infrared + visible light photo taking
	Byte2	0x14:8000*6000 0x15:4000*3000 0x16:5160*3890 0x17:5664*4248
	Byte3-4	Visible light magnification, unit 0.1X
	Byte5-6	Visible light accurate shoot focal length
	Byte7-26	Folder name, does not contain '\0', a total of 20 bytes, This byte array forms a string (string A). When the string is NULL or "", this field is not used and is placed in the root directory where the image file is saved; when the string is not empty, this field is used. If the root directory where the image is saved has this folder, it does not need to be created. If there is no such folder, it needs to be created.
	Byte27-58	Image name, does not contain '\0', a total of 32 bytes, This byte array, forms a string, when the string is NULL or "", the default naming rule is used to name, and the string is not empty, use the string as the image name

Ack:

Byte1-2
Response code

Status Frame

Byte 1	Byte2	Byte3-7
Photo mode	Current photo feedback	Reserved

Photo status feedback	Byte1	0-Default photo shooting 1-Infrared photo shooting 2-Visible light photo shooting 3-Infrared + visible light photo shooting
	Byte2	Current photo feedback 0-Photography completed 1-Continuous shooting 2-Continuous shooting 3-Time-lapse shooting 4-Stop shooting 5-Single shooting 6-Photography failed 7-SD card not inserted 8-SD card full 9-Abnormal card 10-Slow card 11-SD card format error 12-Precise re-shooting
	Byte3-7	Reserved

3.2.4.8 Video output code stream setting command (0x000308)

Description: Set the camera video output code stream command.

Request frame: payload:

Byte1	Byte2
Camera output stream settings	Reserved

The specific instructions are as follows:

Camera output stream settings	Byte1	1:1M 2:1.5M 3:2M 4：4M 5：8M 6: 12M
	Byte2	Reserved

Ack:

Byte1-2
Response code

3.2.4.9 Video output resolution setting command（0x00030A）

Description: Set the camera video output format command.

Request frame： payload:

Byte1	Byte2
Video output resolution	Reserved

The specific instructions are as follows:

Camera output code stream settings	Byte1	1： 1080P30fps 2： 720P30fps（not supported）
	Byte2	Reserved

Ack:

Byte1-2
Response code

3.2.4.10 Video encoding format setting command（0x00030B）

Description: Set the video output encoding format setting command.

Request frame： payload:

Byte1	Byte2
Video output encoding format	Reserved

The specific instructions are as follows:

	Byte1	0： H264 1： H265
	Byte2	Byte2： Reserved

Ack:

Byte1-2
Response code

3.2.4.11 TF card upgrade command（0x00030C）

Description: Set the visible light camera TF card upgrade command

Request frame： payload:

Byte1	Byte2
Visible light camera TF card upgrade	Reserved

The specific instructions are as follows:

Visible light camera TF card upgrade	Byte1	Byte1 1: Start TF card upgrade; 0: Invalid
	Byte2	Reserved

Ack:

Byte1-2
Response code

Status Frame

Byte 1	Byte2
TF card upgrade status	Reserved

TF card upgrade status	Byte1	TF card upgrade status: 0x01: Upgrading 0x02: Upgrading failed 0x00: Upgrading successfully
	Byte2	Reserved

3.2.4.12 TF card formatting command（0x00030D）

Description: TF card formatting command

Request frame： payload：

Byte 1	Byte2
TF card formatting command	Reserved

The specific instructions are as follows：

TF card formatting command	Byte1	Byte1 0x01:formatting sd card
	Byte2	Reserved

Ack

Byte1-2
Response code

Status Frame （5HZ）

Byte1	Byte2-3

Current status feedback	Reserved

	Byte1	0x00: Formatting completed 0x01: Formatting in progress 0x02: Formatting failed 0x03: SD card unavailable
	Byte2-3	Reserved

Note: Feedback failed during video recording and photo taking

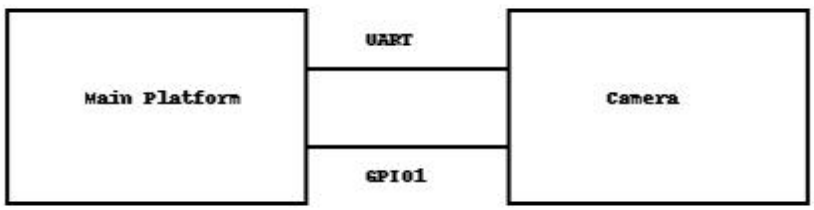
3.2.4.13 Gimbal camera timing command（0x00030E）

Description: Gimbal camera timing command.。

Request frame： payload：

Byte 1-8	Byte9-12	Byte13-16
Timestamp (the number of milliseconds since 1970-01-01 00:00:00)	Time zone tz_minuteswest /* minutes west of Greenwich */	Time zone tz_dsttime /* type of dst correction */

1. System Connection Diagram



2. Synchronization Method

• The main platform sends a high-level pulse to the **GPIO** port, then immediately sends a synchronization command via the serial port. The camera receives the signal from the **GPIO** port and records the rising edge time.

• After recording the rising edge time, the synchronization command from the serial port is used to correct the time. The corrected time corresponds to the rising edge time of the **GPIO** signal.

• The synchronization command format is: **time = rising edge time**. The **rising edge time** is received by the camera as a timestamp and corrected accordingly.

• This process should be repeated every 10 seconds to maintain synchronization

Ack

Byte1-2
Response code

3.2.4.14 Restore factory settings command（0x00030F）

Description: Restore factory settings command

Request frame： payload：

Byte 1	Byte2
Restore factory settings command	Reserved

The specific instructions are as follows：

Restore factory settings command	Byte1	Byte1 0x01:Restore factory settings command
	Byte2	Reserved

Ack

Byte1-2
Response code

Note: Restart after one second

3.2.4.15 The camera requests GPS information from the flight controller（0x000310）

Description: The camera sends a command to the flight controller to request GPS information at a specified time.

Request frame： payload：

Byte 1-6
GPS time information

The specific instructions are as follows:

time information	Byte1	Lens enable , 0: disabled 1: enabled
	Byte2	Hours : 0-23
	Byte3	Minutes: 0-59
	Byte4	Seconds : 0-59
	Byte5-6	Milliseconds : 0-999

Ack: (Flight control sends to gimbal)

Byte1-2	Byte3-19	Byte20-25
Response code	GPS information	Aircraft attitude information

The specific instructions are as follows:

GPS information	Byte1-2	Response code
	Byte3	Hours : 0-23(Keep consistent with the request content)
	Byte4	Minutes : 0-59(Keep consistent with the request content)
	Byte5	Seconds : 0-59(Keep consistent with the request content)
	Byte6-7	Milliseconds: 0-999(Keep consistent with the request content)
	Byte8-11	Longitude angle (unit:°) * 10^7, signed integer
	Byte12-15	Latitude angle (unit:°) * 10^7, signed integer
	Byte16-17	Relative height (unit:m) *10, signed integer
	Byte18-19	Altitude (unit:m) * 10, signed integer
	Byte20-21	2-byte signed integer, aircraft yaw angle * 100
	Byte22-23	2-byte signed integer, aircraft roll angle * 100
	Byte24-25	2-byte signed integer, aircraft pitch angle * 100

Note: The GPS information in the photo attributes needs this command to obtain

3.2.4. 16 Camera IP address setting command（0x000311）

Description: Set the camera IP address command

Request frame： payload：

Byte1	Byte2-5	Byte6-9	Byte10-13
IP Type	IP Address	Subnet Mask	Default Gateway

The specific instructions are as follows：

Example	Byte1	0： Static setting 1： Dynamic acquisition	
	Byte2	145（example）	
	Byte3	192	
	Byte4	1	
	Byte5	20	
	Byte6	255	0x00： NULL
	Byte7	255	
	Byte8	255	
	Byte9	0	
	Byte10	145	0x00： NULL
	Byte11	192	
	Byte12	1	
	Byte13	1	

Ack：

Byte1-2
Response code

3.2.4. 17 Camera IP address acquisition command（0x000312）

Description: Query the camera IP address command.

Request frame： payload：

Byte1	Byte2
Query IP address	Reserved

The specific instructions are as follows：

example	Byte1	1： Query IP address
	Byte2	Reserved

Ack：

Byte1-2	Byte3-6	Byte7-10	Byte11-14
Response code	IP address	Subnet Mask	Default Gateway

The specific instructions are as follows：

Byte1-2	Response code
Byte3	145（example）
Byte4	192
Byte5	1
Byte6	20
Byte7	255
Byte8	255
Byte9	255

Byte10	0
Byte11	145
Byte12	192
Byte13	1
Byte14	1

3.2.4.18 Focus command (0x000313)

Description: Set the camera focus request command

Request frame: payload:

Byte 1-9	Byte 10
Focus settings	Reserved

The specific instructions are as follows:

	Byte1	0x00: Auto focus 0x01: Manual fine-tuning focus + 0x02: Manual fine-tuning focus - 0x03: Stop manual fine-tuning focus 0x04: Area auto focus 0x05: One-touch focus 0x06: Turn on auto focus after zooming 0x07: Turn off auto focus after zooming
	Byte2-3	Byte2 Upper left X coordinate of the area auto focus frame
	Byte4-5	Byte3 Upper left Y coordinate of the area auto focus frame
	Byte6-7	Byte4 Lower right X coordinate of the area auto focus frame
	Byte8-9	Byte5 Lower right Y coordinate of the area auto focus frame
	Byte10	Reserved

Ack:

Byte1-2
Response code

Note: After zooming and one-button focusing, the camera will switch back to center focus mode. The gimbal will automatically set one-button focus every 5 seconds.

3.2.4.19 Camera OSD watermark switch（0x000314）

Description: Set the camera OSD watermark switch.

Request frame： payload：

Byte1	Byte2	Byte3
watermark switch	Reserved	Reserved

The specific instructions are as follows：

	Byte1	watermark switch： 0： Off 1： On
	Byte2	Reserved
	Byte3	Reserved

Ack：

Byte1-2
Response code

3.2.4.20 Camera shutdown command（0x000316）

Description: Camera shutdown command

Request frame： payload：

Byte1	Byte2
Camera shutdown command	Reserved

The specific instructions are as follows:

Camera shutdown command	Byte1	Byte1 0x01:About to shut down
	Byte2	Reserved

Ack:

Byte1-2
Response code

3.2.4.21 Get the camera version number (0x000317)

Description: Get the camera version number

Request frame: payload:

Byte 1	Byte 2
Get the camera version number	Reserved

The specific instructions are as follows:

Get the camera version number	Byte1	0x01: Get the camera version number
	Byte2	Reserved

Ack:

Byte1-2	Byte3	Byte4	Byte5
Response code	Major Version	Sub Version	Patch Version

3.2.4.22 Image mode setting command（0x000318）

Description: Set the camera image mode command

Request frame： payload：

Byte 1	Byte 2
Image Mode	Reserved

The specific instructions are as follows：

Image Mode Settings	Byte1	0x00: Infrared image 0x05/0x06: Visible light 0x07: Split screen
	Byte2	Reserved

Ack：

Byte1-2
Response code

3.2.4.23 Intelligent recognition command（0x000319）

Description: AI intelligent recognition command

Request frame： payload：

Byte 1	Byte 2	Byte 3-12
Identification switch	Specify the model type to load	Identify the target category

The specific instructions are as follows:

AI smart switch settings	Byte1	Identification switch 0x01: On 0x02: Off
	Byte2	Specify the model type to be loaded. The supported model is the yolov series model. The default value of this byte is 0x00
	Byte 3-12	Target categories to be identified simultaneously. Up to 10 categories can be identified simultaneously

Ack:

Byte1-2
Response code

Note: The target category ID range is determined by the label file recognized by the model. After turning on AI intelligent recognition, the camera will automatically select and recognize the object.

3.2.4.24 Flight control request target GPS information command (0x000320)

Description: The flight control requests the GPS information of the current laser aiming target from the camera.

Request frame: payload:

Byte1-42
Request Information

The specific instructions are as follows:

Camera off command	Byte1	Request mount Bit0：1：Request mount1，0：Mount 1 not requested Bit1：1：Request mount2，0：Mount 2 not requested Bit2：1：Request mount3，0：Mount 3 not requested Bit3：1：Request mount4，0：Mount 4 not requested Bit4：1：Request mount5，0：Mount 5 not requested Bit5：1：Request mount6，0：Mount 6 not requested Bit6：1：Request mount7，0：Mount 7 not requested Bit7：1：Request mount8，0：Mount 8 not requested Default request mount 1
	Byte2	GPS status 0: GPS not connected 1: GPS connected, no positioning information 2: 2D positioning 3: 3D positioning 4: 3D positioning supported by DGPS/SBAS 5: Floating RTK, 3D positioning 6: Fixed RTK, 3D positioning 7: Static fixed state, used for base station 8: PPP, 3D positioning Note: 3 and above are considered to have usable positioning accuracy
	Byte3-10	UTC timestamp, unit: milliseconds, low byte first
	Byte11-14	Longitude angle (unit:°) * 10^7, signed integer, low byte first
	Byte15-18	Latitude angle (unit:°) * 10^7, signed integer, low byte first
	Byte19-22	Relative height (unit:m) * 1000, signed integer, low byte first
	Byte23-26	Altitude (unit:m) * 1000, signed integer, low byte first
	Byte27-28	Aircraft yaw angle * 100 signed integer, low byte first
	Byte29-30	Aircraft roll angle * 100 signed integer, low byte first

	Byte31-32	Aircraft pitch angle * 100, signed integer, low byte first
	Byte33-34	Airspeed * 100 (current airspeed) unit: m/s low byte first
	Byte35-36	Ground speed * 100 (current airspeed) unit: m/s low byte first
	Byte37-38	Yaw * 100 (current yaw in compass unit (0-360, 0: north)) unit: deg low byte first
	Byte39-40	Oil valve * 100 (current oil valve setting: 0-100) unit: % low byte first
	Byte41-42	Climb rate * 100 (current climb rate) unit: m/s low byte first

Ack：

Byte1-2	Byte3	Byte4-11	Byte12-27
Response code	Mount enable	Time information	GPS information

Response code	Byte1-2	ACK Response code
Mount enable	Byte3	Get the target GPS request mount fixed to: 0x1f
Time information	Byte4-11	UTC timestamp, unit: milliseconds, low byte first
GPS information	Byte12-15	Longitude angle (unit:°) * 10^7, signed integer, low byte first
	Byte16-19	Latitude angle (unit:°) *10^7, signed integer, low byte first
	Byte20-23	Relative height (unit:m) * 1000, signed integer, low byte first
	Byte24-27	Altitude (unit:m) * 1000, signed integer, low byte first

Note: The target category ID range is determined by the label file recognized by the model. After turning on AI intelligent recognition, the camera will automatically select the recognized object.

3.2.4.25 Frame target tracking command（0x000324）

Description: Set the camera box selection target tracking command

Request frame： payload：

Byte1-2	Byte2-3	Byte4-5	Byte6-7	Byte8-9	Byte10
frame selection settings	x coordinate of the upper left point of the target frame	y coordinate of the upper left point of the target frame	target frame width	target frame height	Reserved

The specific instructions are as follows：

frame selection target tracking settings	Byte1	0x01: Enable frame selection 0x02: Disable frame selection
	Byte2-3	Target frame upper left point x coordinate Range 0-1920
	Byte4-5	Target frame upper left point y coordinate Range 0-1080
	Byte6-7	Target frame width Tracking frame x coordinate value plus width not exceeding 1920
	Byte8-9	Target frame height Tracking frame y coordinate value plus height not exceeding 1080
	Byte10	Reserved

Ack：

Byte1-2
Response code

Note: AI detection must be turned on to perform frame selection target tracking. The framed area must be within the recognition frame area or overlap. When frame selection target tracking is turned on, the gimbal will enter the tracking mode. When you control the gimbal yourself, you must send a shutdown command to put the gimbal into normal mode.

3.2.5 Laser Payload Protocol

3.2.5.1 Laser distance measurement setting command (0x000400)

Description: Request laser distance measurement setting command

Request frame： payload：

Byte 1	Byte2
laser distance measurement setting	Reserved

The specific instructions are as follows:

laser distance measurement setting	Byte1	Byte1 0： Disable； 1： Enable single ranging

Ack:

Byte1-2	Byte3-4
Response code	Laser ranging feedback unit16_t type, unit:0. 1m (no value feedback 0)

3.2.5.2 Laser periodic ranging setting command (0x000406)

Description: Request laser periodic ranging setting command

Request frame： payload:

Byte 1	Byte2
Periodic ranging settings	Reserved

The specific instructions are as follows:

Periodic ranging settings	Byte1	Byte1 0: Disable; 1: Enable 1s periodic ranging

Ack:

Byte1-2
Response code

Status Frame:

Byte1-2	0x00Response code
Byte3-4	Laser ranging distance, uint16_t type, unit: 0. 1 m (no value feedback 0)

3.2.6 SBUS Channel Protocol

3.2.6.1 SBUS channel value range setting command（0x000500）

Description: Set the channel value range of the SBUS remote control

Request frame： payload：

Byte 1-2	Byte3-4	Byte5
Maximum value	Minimum value	Reserved

The specific instructions are as follows：

Set the channel value range of the S bus remote controller	Byte1-2	Set the maximum value of the channel value Data type: unit Data range: 0 - 2047
	Byte3-4	Set the minimum value of the channel value Data type: unit Data range: 0 - 2047, and less than the maximum value
	Byte5	Reserved

Ack：

Byte1-2
Response code

Note: After the configuration is modified, it is necessary to power off and restart the device to take effect.

3.2.6.2 SBUS channel configuration command（0x000501）

Description: Configure the SBUS channel corresponding to the function

Request frame： payload：

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Streaming settings	Zoom settings	Photo settings	Video settings	Gimbal pitch	Gimbal yaw	Gimbal return to center	Reserved

The specific instructions are as follows:

Configure the SBUS channel corresponding to the function	Byte1	Configure the channel for streaming settings, setting range: 0-15, corresponding to channels 1-16
	Byte2	Configure the channel for zoom settings, setting range: 0-15, corresponding to channels 1-16
	Byte3	Configure the channel for photo settings, setting range: 0-15, corresponding to channels 1-16
	Byte3	Configure the channel for video settings, setting range: 0-15, corresponding to channels 1-16
	Byte3	Configure the channel for gimbal pitch, setting range: 0-15, corresponding to channels 1-16
	Byte3	Configure the channel for gimbal yaw, setting range: 0 -15, corresponding to channels 1-16
	Byte3	Configure the channel for gimbal return to center, setting range: 0-15, corresponding to channels 1-16
	Byte3	Reserved

Ack:

Byte1-2
Response code

Note:

1. Streaming settings, photo settings, video settings, and gimbal return to center function are fixed-point switching from maximum to minimum, and each switch performs one operation.
   a. Streaming is infrared, visible light, and split screen rotation;
   b. Photo switch once to take one photo;
   c. Video is switched on once, switched off once;
   d. Gimbal return to center switch once to send one gimbal return to center command once.
2. The middle value of zoom setting is stop , the maximum value is zoom out , and the minimum value is zoom in.
3. The middle value of gimbal yaw and gimbal pitch is stop . The larger the difference from the middle value , the faster the movement.

4. After the configuration is modified, it needs to be powered off and restarted to take effect.

3.2.6.3 SBUS configuration acquisition command（0x000502）

Description: Get the current SBUS configuration, including the range of setting values and the channel corresponding to the function.

Request frame： payload：

Byte 1	Byte2
Get sbus configuration	Reserved

The specific instructions are as follows：

Get the current configuration of SBUS	Byte 1	0x01： Request to get sbus configuration command
	Byte 2	Reserved

返回值：

Byte1-2	Byte3-4	Byte5-6	Byte7	Byte8	Byte9	Byte10	Byte11	Byte12	Byte13	Byte14
Response code	sbus maximum setting value	sbus minimum setting value	streaming setting channel	zoom setting channel	Photo setting channel	video setting channel	Gimbal pitch channel	Gimbal yaw channel	Gimbal return to center channel	Reserved

3.3 ACK Feedback Form

	ACK Value	Description
0x0001-0x01ff Generic error response code	0x0000	OK, success
	0x0001	Failure
	0x0002	Unknown error
	0x0003	Verification failed
	0x0004	Timeout
	0x0005	MD5 verification failed
	0x0006	Insufficient system space

	0x0007	The data length does not match the actual length
	0x0008	In progress, repeat the request
	0x0009	The file does not exist
	0x000A	Error merging files
0x0201 - 0x02ff Pod system error response code	0x0201	Recording video
	0x0202	Failed to open the camera
	0x0203	Photo is being taken
	0x0204	No SD card is inserted