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SIYI Gimbal Camera External SDK Protocol Document Update Log





Version	Change Date	Change Details	Remarks
V0.1.1	2025.02.26	Added Appendix 1 and Appendix 2	Added gimbal control command support list

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CHAPTER 1 Protocol Description

1、 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

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CHAPTER 2 Communication Commands

0x00: TCP Heartbeat

CMD_ID:0x00-----TCP Heartbeat			
Send Data Format			
Index	Data Type	Data Name	Description
ACK Data Format:			
			No ACK response

Notes:

- Heartbeat packet: 55 66 01 01 00 00 00 00 00 59 8B
- Only supported in TCP connection

0x01: Request Firmware Version

CMD_ID:0x01-----Request Firmware Version			
sendData Format			
Index	Data Type	Data Name	Description
ACK Data Format			
	uint32_t	camera_firmware_ver	Camera firmware version number
	uint32_t	gimbal_firmware_ver	Gimbal firmware version number
	uint32_t	zoom_firmware_ver	Zoom module firmware version number

Eg: 0x6E030203 --> Corresponding version: v3.2.3

Notes:

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·The 4th byte (high byte) should be ignored.

·Since the camera system requires a startup time of up to **30 seconds**, the firmware version cannot be retrieved during this period. Any request made before system initialization will return a firmware version of **0.0.0** (all zeros).

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0x02: Request Gimbal Hardware ID

CMD_ID:0x02----- Request Gimbal Hardware ID			
Send Data Format			
No.	Data Type	Name	Description
ACK Data Format			
	UInt8_t	hardware_id[12]	Hardware ID string (10-digit)

Note: The first two bytes correspond to the hexadecimal product ID as follows:

0x6B: ZR10 10x Optical Zoom Gimbal Camera

0x73: A8 Mini Gimbal Camera

0x75: A2 Mini Gimbal Camera

0x78: ZR30 Gimbal Camera

0x7A: Quad-Spectrum Gimbal Camera

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0x04: Auto Focus

CMD_ID:0x04-----Auto Focus			
Send Data Format			
No.	Data Type	Name	Description
	uint8_t	auto_focus	1: Trigger single autofocus
	uint16_t	touch_x	X coordinate, range corresponds to video stream width
	uint16_t	touch_y	Y coordinate, range corresponds to video stream height
ACK Data Format			
1	uint8_t	sta	1: Success, 0: Error

Note:

Only supported by optical zoom cameras. In split zoom mode, the X-coordinate range is half of the video stream width.

0x05: Manual Zoom with Autofocus

CMD_ID:0x05-----Manual Zoom with Autofocus			
Send Data Format			
No.	Data Type	Name	Description
1	int8_t	zoom	1: Zoom in, 0: Stop zooming (send after release), -1: Zoom out
ACK Data Format			
1	uint16_t	zoom_multiple	Current (hybrid) zoom level (zoom_multiple /10, accurate to one decimal place)

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0x06: Manual Focus

CMD_ID:0x06-----Manual Focus			
Send Data Format			
No.	Data Type	Name	Description
1	int8_t	focus	1: Far focus, 0: Stop focusing (send after release), -1: Near focus
ACK Data Format			
	uint8_t	sta	1: Success 0: Error

Note: Only supported by optical zoom cameras.

0x07: Gimbal Rotation Control

CMD_ID:0x07-----Gimbal Rotation			
Send Data Format			
No.	Data Type	Name	Description
1	int8_t	turn_yaw	-100 ~ 0 ~ 100: Negative/positive values indicate direction. The further the slide, the greater the value and rotation speed. Send 0 after release to stop rotation. (Swipe right: 0(-100))
2	int8_t	turn_pitch	-100 ~ 0 ~ 100: Same as yaw (Swipe up:(-100))
ACK Data Format			
	uint8_t	sta	1: Success 0: Error

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0x08: One-Key Centering

CMD_ID:0x08-----One-Key Centering			
Send Data Format			
Index	Data Type	Data Name	Description
1	uint8_t	center_pos	1: One-key center 2: Center downward 3: Center 4: Downward
ACK Data Format			
1	uint8_t	sta	1: Success 0: Error

0x0A: Request Camera System Information

(Formerly "Request Gimbal Configuration Information")

CMD_ID:0x0A-----Request Camera System Information			
Send Data Format			
Index	Data Type	Data Name	Description
ACK Data Format			
1	uint8_t	reserved	
2	uint8_t	hdr_sta	0: Off 1: On
3	uint8_t	reserved	
4	uint8_t	record_sta	0: Not recording 1: Recording 2: No TF card

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			3: Video data loss (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 Direction 0: Reserved 1: Normal 2: Inverted
7	uint8_t	video_hdmi_or_cvbs	HDMI and CVBS Video Output Status 0: HDMI video output ON CVBS video output OFF 1: HDMI video output OFF CVBS video output ON
8	uint8_t	zoom_linkage	Zoom Linkage Switch 0: Off 1: On

0x0B: Function Feedback Response

CMD_ID:0x0B-----Function Feedback Response			
Send Data Format			
Index	Data Type	Data Name	Description
ACK Data Format			
1	uint8_t	info_type	0: Photo captured successfully

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			1: Photo failed (check TF card), 2: HDR on 3: HDR off 4: Video recording failed (check TF card) 5: Recording started 6: Recording stopped
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0x0C: Capture Photo / Record Video

CMD_ID:0x0C-----Capture Photo			
Send Data Format			
Index	Data Type	Data Name	Description
	uint8_t	func_type	0: Capture photo 1: HDR toggle (not supported) 2: Start recording 3: Lock mode 4: Follow mode 5: FPV mode 6: Enable HDMI output (reboot required) 7: Enable CVBS output (reboot required) 8: Disable HDMI/CVBS (reboot required) 9: Tilt downward 10: Zoom linkage
ACK Data Format			
			No ACK response

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0x0D: Request Gimbal Attitude Data

CMD_ID:0x0D-----Request Gimbal Attitude Data			
Send Data Format			
Index	Data Type	Parameter Name	Description
ACK 数据格式			
	int16_t	yaw	Yaw angle
	int16_t	pitch	Pitch angle
	int16_t	roll	Roll angle
	int16_t	yaw_velocity	Gyroscope yaw angular velocity
	int16_t	pitch_velocity	Gyroscope pitch angular velocity
	int16_t	roll_velocity	Gyroscope roll angular velocity

Notes:

The actual angle values are obtained by dividing the received data by 10, with a precision of one decimal place.

It is recommended to use command 0x25 to set the data transmission frequency, allowing attitude data to be sent continuously at a specified interval.

The rotation sequence follows Yaw axis → Roll axis → Pitch axis, and the coordinate system follows the NED (North-East-Down) convention. The yaw angle is derived from a magnetic encoder.

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0x0E: Set Gimbal Attitude Angles

CMD_ID:0x0E-----Set Gimbal Attitude Angles			
send 数据格式 Send Data Format			
Index	Data Type	Parameter 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

Angle Control Range:

yaw:

A2 mini: Fixed, non-rotatable

A8 mini: -135.0° to 135.0°

ZR10: Same as A8 mini

ZR30: -270.0° to 270.0°

ZT30: Unlimited

pitch:

A2 mini: -90.0° to 25.0°

A8 mini: -90.0° to 25.0°

ZR10: Same as A8 mini

ZR30: Same as A8 mini

ZT30: Same as A8 mini

The control angle precision is one decimal place. For example, if specifying a yaw of 60.5° , the yaw field should be set to 605.

The returned actual angles in the ACK message should be divided by 10 to obtain the real values, with one decimal place precision.

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0x0F: Absolute Zoom Auto Focus

CMD_ID:0x0F-----Absolute Zoom Auto Focus			
Send Data Format			
Index	Data Type	Parameter Name	Description
1	uint8_t	Absolute_movement_int	Integer part of the specified zoom (0X1 ~ 0X1E)
2	uint8_t	Absolute_movement_float	Decimal part of the specified zoom (0X0 ~ 0X9)
ACK Data Format			
	uint8_t	Absolute_movement_ask	Return success: 1

0x10: Request Video Stitching Mode

CMD_ID:0x10-----Request Video Stitching Mode			
Send Data Format			
NO.	Data Type	Parameter Name	Description
ACK Data Format			
1	uint8_t	vdisp_mode	Video stitching mode: 0: Stitching mode (Main stream: Zoom & Thermal, Sub stream: Wide angle) 1: Stitching mode (Main stream: Wide angle & Thermal, Sub stream: Zoom) 2: Stitching mode (Main stream: Zoom & Wide angle, Sub stream: Thermal) 3: Non-stitching mode (Main stream: Zoom, Sub stream: Thermal) 4: Non-stitching mode (Main stream:

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			<p>Zoom, Sub stream: Wide angle)</p> <p>5: Non-stitching mode (Main stream: Wide angle, Sub stream: Thermal)</p> <p>6: Non-stitching mode (Main stream: Wide angle, Sub stream: Zoom)</p> <p>7: Non-stitching mode (Main stream: Thermal, Sub stream: Zoom)</p> <p>8: Non-stitching mode (Main stream: Thermal, Sub stream: Wide angle)</p>
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0x11: Set Video Stitching Mode

CMD_ID:0x11-----Set Video Stitching Mode			
Send Data Format			
Index	Data Type	Parameter Name	Description
1	uint8_t	vdisp_mode	<p>Video stitching mode:</p> <p>0: Stitching mode (Main stream: Zoom & Thermal, Sub stream: Wide angle)</p> <p>1: Stitching mode (Main stream: Wide angle & Thermal, Sub stream: Zoom)</p> <p>2: Stitching mode (Main stream: Zoom & Wide angle, Sub stream: Thermal)</p> <p>3: Non-stitching mode (Main stream: Zoom, Sub stream: Thermal)</p> <p>4: Non-stitching mode (Main stream: Zoom, Sub stream: Wide angle)</p> <p>5: Non-stitching mode (Main stream: Wide angle, Sub stream: Thermal)</p> <p>6: Non-stitching mode (Main stream: Wide angle, Sub stream: Zoom)</p> <p>7: Non-stitching mode (Main stream: Thermal, Sub stream: Zoom)</p> <p>8: Non-stitching mode (Main stream:</p>

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			Thermal, Sub stream: Wide angle)
ACK Data Format			
1	uint8_t	vdisp_mode	<p>Video stitching mode:</p> <p>0: Stitching mode (Main stream: Zoom & Thermal, Sub stream: Wide angle)</p> <p>1: Stitching mode (Main stream: Wide angle & Thermal, Sub stream: Zoom)</p> <p>2: Stitching mode (Main stream: Zoom & Wide angle, Sub stream: Thermal)</p> <p>3: Non-stitching mode (Main stream: Zoom, Sub stream: Thermal)</p> <p>4: Non-stitching mode (Main stream: Zoom, Sub stream: Wide angle)</p> <p>5: Non-stitching mode (Main stream: Wide angle, Sub stream: Thermal)</p> <p>6: Non-stitching mode (Main stream: Wide angle, Sub stream: Zoom)</p> <p>7: Non-stitching mode (Main stream: Thermal, Sub stream: Zoom)</p> <p>8: Non-stitching mode (Main stream: Thermal, Sub stream: Wide angle)</p>

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0x12: Get Temperature at Selected Point

CMD_ID:0x12-----Get Temperature at Selected Point			
Send Data Format			
Index	Data Type	Parameter Name	Description
1	uint16_t	x	X coordinate of the selected point
2	uint16_t	y	Y coordinate of the selected point
3	uint8_t	get_temp_flag	0: Disable measurement, 1: Measure once, 2: Continuous measurement (5Hz)
ACK Data Format			
1	uint16_t	temp	Temperature at the selected point (divide by 100 for two decimal places)
1	uint16_t	x	X coordinate of the selected point
2	uint16_t	y	Y coordinate of the selected point

0x13: Local Temperature Measurement

CMD_ID:0x13-----Local Temperature Measurement			
Send Data Format			
Index	Data Type	Parameter Name	Description
1	uint16_t	startx	Starting X coordinate of the rectangle
2	uint16_t	starty	Starting Y coordinate of the rectangle
3	uint16_t	endx	Ending X coordinate of the rectangle

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4	uint16_t	endy	Ending Y coordinate of the rectangle
5	uint8_t	get_temp_flag	0: Disable measurement, 1: Measure once, 2: Continuous measurement (5Hz)
ACK Data Format			
1	uint16_t	startx	Starting X coordinate of the rectangle
2	uint16_t	starty	Starting Y coordinate of the rectangle
3	uint16_t	endx	Ending X coordinate of the rectangle
4	uint16_t	endy	Ending Y coordinate of the rectangle
5	uint16_t	temp_max	Maximum temperature in the rectangle (divide by 100 for two decimal places)
6	uint16_t	temp_min	Minimum temperature in the rectangle (divide by 100 for two decimal places)
7	uint16_t	temp_max_x	X coordinate of the maximum temperature
8	uint16_t	temp_max_y	Y coordinate of the maximum temperature
9	uint16_t	temp_min_x	X coordinate of the minimum temperature
10	uint16_t	temp_min_y	Y coordinate of the minimum temperature

Note:

The thermal camera has electronic zoom functionality. When zooming electronically, the measurement box will be scaled up or down based on the zoom factor. It is recommended to refer to the camera's returned box for temperature measurement ranges.

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0x14: Global Temperature Measurement

CMD_ID:0x14-----Global Temperature Measurement			
Send Data Format			
Index	Data Type	Parameter Name	Description
1	uint8_t	get_temp_flag	0: Disable measurement, 1: Measure once, 2: Continuous measurement (5Hz)
ACK Data Format			
1	uint16_t	temp_max	Maximum temperature in the frame (divide by 100 for two decimal places)
2	uint16_t	temp_min	Minimum temperature in the frame (divide by 100 for two decimal places)
3	uint16_t	temp_max_x	X coordinate of the maximum temperature in the frame
4	uint16_t	temp_max_y	Y coordinate of the maximum temperature in the frame
5	uint16_t	temp_min_x	X coordinate of the minimum temperature in the frame
6	uint16_t	temp_min_y	Y coordinate of the minimum temperature in the frame

0x15: Request Laser Distance Measurement

CMD_ID:0x15-----Request Laser Distance Measurement			
Send Data Format			
NO.	Data Type	Parameter Name	Description
ACK Data Format			
1	Uint16_t	laser_distance	Laser distance value, low byte first, high byte second, minimum

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			value 50, unit: dm
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Note:

Recommended to use the 0x25 command to set the laser distance data transmission frequency for continuous sending.

Laser distance ranges from 5m to 1200m. If the value is outside this range, the distance will be reported as 0.

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0x16: Request Current Supported Zoom Range

CMD_ID:0x16-----Request Current Supported Zoom Range			
Send Data Format			
NO.	Data Type	Parameter Name	Description
ACK Data Format			
	uint8_t	zoom_max_int	Maximum zoom integer part
	Uint8_t	Zoom_max_float	Maximum zoom decimal part

Note:

Only cameras with zoom capabilities support this command.

0x17: Request Laser Distance Target's Longitude and Latitude

CMD_ID:0x17-----Request Laser Distance Target's Longitude and Latitude			
Send Data Format			
NO.	Data Type	Parameter Name	Description
ACK Data Format			
	int32_t	Lon_degE7	Longitude [degE7] (WGS84, EGM96 ellipsoid)
	int32_t	Lat_degE7	Latitude [degE7] (WGS84, EGM96 ellipsoid)

0x18: Request Current Zoom Magnification

CMD_ID:0x18-----Request Current Zoom Magnification			
Send Data Format			
NO.	Data Type	Parameter Name	Description

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ACK Data Format			
	uint8_t	zoom_int	Current zoom integer part
	Uint8_t	Zoom_float	Current zoom decimal part

0x19: Request Current Gimbal Mode

CMD_ID:0x19-----Request Current Gimbal Mode			
Send Data Format			
NO.	Data Type	Parameter Name	Description
ACK Data Format			
	uint8_t	gimbal_mode	0: Lock mode 1: Follow mode 2: FPV mode (First Person View)

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0x1A: Request Current Thermal Imaging Pseudo-Color

CMD_ID:0x1A-----Request Current Thermal Imaging Pseudo-Color			
Send Data Format			
NO.	Data Type	Parameter Name	Description
ACK Data Format			
	uint8_t	pseudo color	11 color swatches available: 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

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0x1B: Set Thermal Imaging Pseudo-Color

CMD_ID:0x1B-----Set Thermal Imaging Pseudo-Color			
Send Data Format			
Index	Data Type	Parameter Name	Description
	uint8_t	pseudo color	11 color swatches available: 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	【Total of 11 color swatches.】 0: White_Hot 1: Reserved 2: Sepia 3: Ironbow 4: Rainbow 5: Night 6: Aurora 7: Red_Hot

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			8: Jungle
			9: Medical
			10: Black_Hot
			11: Glory_Hot

0x20: Request Camera Encoding Parameters

CMD_ID:0x20-----Request Camera Encoding Parameters			
Send Data Format			
No.	Data Type	Data Name	Description
	uint8_t	req_stream_type	0: Recording stream 1: Main stream 2: Sub-stream
ACK			
1	uint8_t	stream_type	0: Recording stream 1: Main stream 2: Sub-stream
2	uint8_t	VideoEncType	Encoding type: 1: H264, 2: H265
3	uint16_t	Resolution_L	Resolution width
4	uint16_t	Resolution_H	Resolution height
5	uint16_t	VideoBitrate	Fixed bitrate in Kbps
6	uint8_t	VideoFrameRate	Frame rate

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0x21: Set Camera Encoding Parameters

CMD_ID:0x21-----Set Camera Encoding Parameters			
Send Data Format			
NO.	Data Type	Data Name	Description
1	uint8_t	stream_type	0: Set recording stream, 1: Set main stream, 2: Set sub-stream
2	uint8_t	VideoEncType	Encoding type: 1: H264, 2: H265 (Recording stream encoding format cannot be modified)
3	uint16_t	Resolution_L	Resolution width: 1920, 1280
4	uint16_t	Resolution_H	Resolution height: 1080, 720
5	uint16_t	VideoBitrate	Fixed bitrate in Kbps
6	uint8_t	reserve	Reserved
ACK			
1	uint8_t	stream_type	0: Set recording stream, 1: Set main stream, 2: Set sub-stream
2	uint8_t	sta	1: Set successful, 0: Set failed

0x22: Send Aircraft Attitude Data to Gimbal

CMD_ID:0x22-----Send Aircraft Attitude Data to Gimbal			
Send Data Format			
No.	Data Type	Data Name	Description

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1	uin32_t	time_boot_ms	[ms]Timestamp (time since system boot)
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			

Ps: The coordinate system is North-East-Down (NED), with rotation order being yaw -> pitch -> roll. Recommended frequency is 20-50Hz.

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0x23: Send RC Channel Data to Gimbal (Not in Use)

CMD_ID:0x23-----Send RC Channel Data to Gimbal			
Send Data Format			
No.	Data Type	Data Name	Description
1	uint16_t	chan1_raw	[us] RC channel 1 value
2	uint16_t	chan2_raw	[us] RC channel 2 value
3	uint16_t	chan3_raw	[us] RC channel 3 value
4	uint16_t	chan4_raw	[us] RC channel 4 value
5	uint16_t	chan5_raw	[us] RC channel 5 value
6	uint16_t	chan6_raw	[us] RC channel 6 value
7	uint16_t	chan7_raw	[us] RC channel 7 value
8	uint16_t	chan8_raw	[us] RC channel 8 value
9	uint16_t	chan9_raw	[us] RC channel 9 value
10	uint16_t	chan10_raw	[us] RC channel 10 value
11	uint16_t	chan11_raw	[us] RC channel 11 value
12	uint16_t	chan12_raw	[us] RC channel 12 value
13	uint16_t	chan13_raw	[us] RC channel 13 value
14	uint16_t	chan14_raw	[us] RC channel 14 value
15	uint16_t	chan15_raw	[us] RC channel 15 value
16	uint16_t	chan16_raw	[us] RC channel 16 value

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17	uint16_t	chan17_raw	[us] RC channel 17 value
18	uint16_t	chan18_raw	[us] RC channel 18 value
19	uint8_t	chancount	Total number of RC channels being received. This can be larger than 18, indicating that more channels are available but not given in this message. This value should be 0 when no RC channels are available.
20	uint8_t	rsi	Receive signal strength indicator in device-dependent units/scale. Values: [0-254], 255: invalid/unknown.
ACK			

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0x24: Request Flight Controller to Send Data Stream to Gimbal

CMD_ID:0x24-----Request 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 in use)
2	uint8_t	data_freq	Output frequency: 0: Turn off 1: 2Hz 2: 4Hz 3: 5Hz 4: 10Hz 5: 20Hz 6: 50Hz 7: 100Hz
ACK			
1	uint8_t	data_type	1: Attitude Data 2: RC Channel Data

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0x25: Request Gimbal to Send Data Stream

CMD_ID:0x25-----Request Gimbal to Send Data Stream			
Send Data Format			
No.	Data Type	Data Name	Description
1	uint8_t	data_type	1: Attitude Data 2: Laser Range Data 3: Magnetic Encoder Angle Data 4: Motor Voltage Data
2	uint8_t	data_freq	Output frequency: 0: Turn off 1: 2Hz 2: 4Hz 3: 5Hz 4: 10Hz 5: 20Hz 6: 50Hz 7: 100Hz Note: Laser data output frequency ignores this setting and is based on actual output frequency.
ACK			
1	uint8_t	data_type	1: Attitude Data 2: Laser Range Data

Note: Laser Range Data frequency cannot be set; any non-zero value will start sending.

0x26: Request Gimbal Magnetic Encoder Angle Data

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CMD_ID:0x26-----Request Gimbal Magnetic Encoder Angle Data			
Send Data Format			
No.	Data Type	Data Name	Description
ACK Data Format			
	int16_t	yaw_angle	Yaw angle
	int16_t	pitch_angle	Pitch angle
	int16_t	roll_angle	Roll angle

Note: The above data should be divided by 10 to obtain the actual angle, with a precision of one decimal place.

Note: It is recommended to use the 0x25 command to set the attitude data transmission frequency, so that the data can be actively and continuously sent at the specified frequency.

0x27: Request Gimbal Control Mode Data

CMD_ID:0x27-----Request Gimbal Control Mode Data			
Send Data Format			
No.	Data Type	Data Name	Description
ACK Data Format			
	uint8_t	Control_mode	Control mode: 0.Attitude_Mode 1.Weak_Mode 2. Middle_Mode 3. FPV_Mode 4. Motor_Close

Note: This command is only available for ArduPilot debugging and is not supported by other systems.

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0x28: Request Gimbal Weak Control Threshold Data

CMD_ID:0x28-----Request Gimbal Weak Control Threshold Data			
Send Data Format			
No.	Data Type	Data Name	Description
ACK Data Format			
	int16_t	Weak_control_limit_value	Weak control mode voltage limit range (10-50, divided by 10 for actual value, precision to 1 decimal)
	int16_t	Voltage_threshold	Voltage threshold (20-50, divided by 10 for actual value, precision to 1 decimal)
	int16_t	Angular_error_threshold	Angular error threshold (30-300, divided by 10 for actual value, precision to 1 decimal)

Note: The control threshold data is the actual threshold value after dividing by 10, with a precision of 1 decimal place.

This command is only available for ArduPilot debugging and is not supported by other systems.

0x29: Request Gimbal Motor Voltage Data

CMD_ID:0x29-----Request Gimbal Motor Voltage Data			
Send Data Format			
No.	Data Type	Data Name	Description
	int16_t	Weak_control_limit_value	Yaw motor voltage (divided by 1000 for actual value, precision to 3 decimal)

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	int16_t	Voltage_threshold	Pitch motor voltage (divided by 1000 for actual value, precision to 3 decimal)
	int16_t	Angular_error_threshold	Roll motor voltage (divided by 1000 for actual value, precision to 3 decimal)
ACK Data Format			
	uint8_t	sta	1: Success, 0: Failure

Note: The control threshold data is the actual threshold value after dividing by 10, with a precision of 1 decimal place.

This command is only available for ArduPilot debugging and is not supported by other systems.

0x2A: Request Gimbal Motor Voltage Data

CMD_ID:0x2A-----Request Gimbal Motor Voltage Data			
Send Data Format			
No.	Data Type	Data Name	Description
ACK Data Format			
	int16_t	yaw_voltage	Yaw motor voltage
	int16_t	pitch_voltage	Pitch motor voltage
	int16_t	roll_voltage	Roll motor voltage

Note: The above data is the actual voltage after dividing by 1000, with a precision of 3 decimal places.

Note: It is recommended to use the 0x25 command to set the motor voltage data transmission frequency, allowing continuous sending at the specified frequency.

0x30: Set UTC Time

CMD_ID:0x 30 -----Set UTC Time			
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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: Invalid time format

0x31: Request Gimbal System Information

CMD_ID:0x 31 -----Request gimbal board information			
Send Data Format			
No.	Data Type	Name	Description
ACK Data Format			
1	Uint8_t	laser_state	1: Laser ranging enabled, 0: Laser ranging disabled

0x32: Set Laser Ranging State

CMD_ID:0x 32 -----Set laser ranging state			
Send Data Format:			
No.	Data Type	Name	Description
1	Uint8_t	laser_state	1: Laser ranging enabled 0: Laser ranging disabled
ACK Data Format			
1	Uint8_t	Sta	1: Setting successful

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			0: Setting failed
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0x33: Request Thermal Imaging Output Mode

CMD_ID:0x 33 -----Request thermal imaging output mode			
Send Data Format			
No.	Data Type	Name	Description
ACK Data Format			
1	uint8_t	mode	0: 30fps, 1: 25fps + Temperature frame output

0x34: Set Thermal Imaging Output Mode

CMD_ID:0x 34 -----Set thermal imaging output mode			
Send Data Format			
No.	Data Type	Name	Description
1	uint8_t	mode	0: 30fps, 1: 25fps + Temperature frame output
ACK Data Format			
1	uint8_t	mode	0: 30fps, 1: 25fps + Temperature frame output

0x35: Obtain a Single Temperature Frame

CMD_ID:0x 35 -----Obtain a single temperature frame			
Send Data Format			
No.	Data Type	Name	Description
ACK Data Format			

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1	uint8_t	ack	1: Acquisition successful
---	---------	-----	---------------------------

0x37: Request Thermal Imaging Gain Mode

CMD_ID:0x 37 -----Request thermal imaging gain mode			
Send Data Format			
No.	Data Type	Name	Description
ACK Data Format			
1	uint8_t	Ir_gain	0: Low gain, 1: High gain

0x38: Set Thermal Imaging Gain Mode

CMD_ID:0x 38 -----Set thermal imaging gain mode			
Send Data Format			
No.	Data Type	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

0x39: Request Thermal Imaging Environmental Correction Parameters

CMD_ID:0x 39 -----Retrieve thermal imaging environmental correction parameters			
Send Data Format			
No.	Data Type	Data Name	Description

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ACK Data Format			
1	uint16_t	Dist	Distance (unit: m)
2	uint16_t	Ems	Target emissivity (%)
3	uint16_t	Hum	Environmental humidity (%)
4	uint16_t	Ta	Atmospheric temperature (unit: °C)
5	uint16_t	Tu	Reflective temperature (unit: °C)

All parameters in this protocol are divided by 100 and retain two decimal places.

0x3A: Set Thermal Imaging Environmental Correction Parameters

CMD_ID:0x 3A -----Set thermal imaging environmental correction parameters			
Send Data Format			
No.	Data Type	Data Name	Description
1	uint16_t	Dist	Distance (unit: m)
2	uint16_t	Ems	Target emissivity (%)
3	uint16_t	Hum	Environmental humidity (%)
4	uint16_t	Ta	Atmospheric temperature (unit: °C)
5	uint16_t	Tu	Reflective temperature (unit: °C)
ACK Data Format			
1	uint8_t	ack	1: Successfully set

All parameters in this protocol are divided by 100 and retain two decimal places.

0x3B: Request Thermal Imaging Environmental Correction Switch

CMD_ID:0x 3B -----Request thermal imaging environmental correction switch			
Send Data Format			
No.	Data Type	Data Name	Description

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ACK Data Format			
1	uint8_t	EnvCorrect	0: Off, 1: On

0x3C: Set Thermal Imaging Environmental Correction Switch

CMD_ID:0x 3C -----Set thermal imaging environmental correction switch			
Send Data Format			
No.	Data Type	Data Name	Description
1	uint8_t	EnvCorrect	0: Off, 1: On
ACK Data Format			
1	uint8_t	EnvCorrect	0: Off, 1: On

0x3E: Send Raw GPS Data to Gimbal

CMD_ID:0x 3E-----Send raw GPS data to the gimbal			
Send Data Format			
No.	Data Type	Data Name	Date 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	int32_t	vn	[m E3/s] X Speed
7	int32_t	ve	[m E3/s] Y Speed
8	int32_t	vd	[m E3/s] Z Speed
ACK Data Format			

SIYI

--	--	--	--

0x40: Request System Time

CMD_ID:0x 40 -----Request system time			
Send Data Format			
No.	Data Type	Data Name	Description
ACK Data Format			
1	uint64_t	time_unix_usec	Timestamp (UNIX epoch time, unit: μ s).
2	uint32_t	time_boot_ms	Timestamp (time since system startup, unit: ms).

0x41: Single-Axis Attitude Control

CMD_ID:0x41-----Set Gimbal Single-Axis Attitude Angle			
Send Data Format			
Sequence	Data Type	Data Name	Data Description
	int16_t	angle	The target angle to be set
	uint8_t	single_control_flag	Angle to control: 0 for yaw, 1 for pitch
ACK Data Format			
	int16_t	yaw	Current yaw angle
	int16_t	pitch	Current pitch angle
	int16_t	roll	Current roll angle

Angle Control Range:

Yaw:

A8 mini: -135.0° to 135.0°

Pitch:

A8 mini: -90.0° to 25.0°

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Notes:

Angle precision is 1 decimal place. For example, if you want to set yaw to 60.5°, the yaw field should be set to 605.

The returned actual angle is divided by 10, with 1 decimal place precision.

0x42: Request Thermal Imaging Threshold Range Switch

CMD_ID:0x42----- CMD_ID_EX_SDK_GET_IR_THRESH_MAP_STA			
Send Data Format			
Sequenc e	Data Type	Data Name	Data Description
ACK Data Format			
1	uint8_t	ir_thresh_sta	0: Off, 1: On

0x43: Set thermal imaging threshold image switch state

CMD_ID:0x 43 ----- CMD_ID_EX_SDK_SET_IR_THRESH_MAP_STA			
Send data format			
Serial Number	data type	Data name	Data Description
1	uint8_t	ir_thresh_sta	0: close 1: open
ACK data format			
1	uint8_t	ir_thresh_sta	0: close 1: open

0x44: Request thermal imaging threshold image parameters

CMD_ID:0x 44 ----- CMD_ID_EX_SDK_GET_IR_THRESH_PARAM			
--	--	--	--

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Send data format			
Serial Number	data type	Data name	Data Description
ACK data format			
1	uint8_t	Thresh1_switch	0: threshold region 1 hide 1: threshold region 1 display
2	Int16_t[2]	Thresh1_temp	Minimum and maximum temperatures in threshold region 1(Minimum always first)
3	uint8_t[3]	Thresh1_color	The color (RGB) of the threshold region 1
4	uint8_t	Thresh2_switch	0: threshold region 2 hide 1: threshold region 2 display
5	Int16_t[2]	Thresh2_temp	Minimum and maximum temperatures in threshold region 2(Minimum always first)
6	uint8_t[3]	Thresh2_color	The color (RGB) of the threshold region 2
7	uint8_t	Thresh3_switch	0: threshold region 3 hide 1: threshold region 3 display
8	Int16_t[2]	Thresh3_temp	Minimum and maximum temperatures in threshold region 3(Minimum always first)
9	uint8_t[3]	Thresh3_color	The color (RGB) of the threshold region 3

0x45: Set thermal imaging threshold image parameters

CMD_ID:0x 45 ----- CMD_ID_EX_SDK_SET_IR_THRESH_PARAM			
Send data format			
Serial Number	Serial Number	Serial Number	Serial Number
1	uint8_t	Thresh1_switch	0: threshold region 1 hide 1: threshold region 1 display
2	Int16_t[2]	Thresh1_temp	Minimum and maximum temperatures in threshold region 1(Minimum always first)
3	uint8_t[3]	Thresh1_color	The color (RGB) of the threshold region 1
4	uint8_t	Thresh2_switch	0: threshold region 2 hide 1: threshold region 2 display
5	Int16_t[2]	Thresh2_temp	Minimum and maximum temperatures in

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			threshold region 2(Minimum always first)
6	uint8_t[3]	Thresh2_color	The color (RGB) of the threshold region 2
7	uint8_t	Thresh3_switch	0: threshold region 3 hide 1: threshold region 3 display
8	Int16_t[2]	Thresh3_temp	Minimum and maximum temperatures in threshold region 3(Minimum always first)
9	uint8_t[3]	Thresh3_color	The color (RGB) of the threshold region 3
ACK data format			
1	uint8_t	ack	1: success

0x46: Request Thermal imaging threshold precision

CMD_ID:0x 46 ----- CMD_ID_EX_SDK_GET_IR_THRESH_PRECISION			
Send data format			
Serial Number	Serial Number	Serial Number	Serial Number
ACK data format			
1	uint8_t	precision	1: max accurate,2:mid accurate,3:min accurate

0x47: Set Thermal imaging threshold precision

CMD_ID:0x 47 ----- CMD_ID_EX_SDK_SET_IR_THRESH_PRECISION			
Send data format			
Serial Number	Serial Number	Serial Number	Serial Number
1	uint8_t	precision	1: max accurate,2:mid accurate,3:min accurate
ACK data format			
1	uint8_t	precision	1: max accurate,2:mid accurate,3:min accurate

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0x48: Format SD Card

CMD_ID:0x 48 ----- CMD_ID_EX_SDK_SD_FORMAT			
Send Data Format			
Index	Data Type	Data Name	Description
1	uint8_t	format_sta	0: Format failed, 1: Format successful
ACK Data Format			
1	uint8_t	format_sta	0: Format failed, 1: Format successful

0x49: get_picture_name_type

CMD_ID:0x 49 ----- CMD_ID_EX_SDK_GET_PIC_NAME_TYPE			
Send data format			
index	Date type	Date name	Description
1	uint8_t	File_type	0: picture 1: temp raw file 2:record video
ACK data format			
1	uint8_t	File_type	0: picture 1: temp raw file 2: record video
2	uint8_t	File_name_type	0: reserve 1: index 2: time stamp

0x4A: set_picture_name_type

CMD_ID:0x 4A ----- CMD_ID_EX_SDK_GET_PIC_NAME_TYPE			
Send data format			
index	Date type	Date name	Description
1	uint8_t	File_type	0: picture 1: temp raw file 2: record video
1	uint8_t	File_name_type	0: reserve 1: index 2: time stamp
ACK data format			
1	uint8_t	File_type	0: picture 1: temp raw file 2: record video

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1	uint8_t	File_name_type	0: reserve 1: index 2: time stamp
---	---------	----------------	-----------------------------------

0x4B: Request HDMI OSD Display Status

CMD_ID:0x 4B ----- CMD_ID_EX_SDK_GET_MAVLINK_OSD_FLAG			
Send Data Format			
Index	Data Type	Data Name	Description
ACK Data Format			
1	uint8_t	Osd_sta	0: Off, 1: On

0x4C: Set HDMI OSD Display Status

CMD_ID:0x 4C ----- CMD_ID_EX_SDK_SET_MAVLINK_OSD_FLAG			
Send Data Format			
Index	Data Type	Data Name	Description
1	uint8_t	Osd_sta	0: Off, 1: On
ACK Data Format			
1	uint8_t	Osd_sta	0: Off, 1: On

0x4D: Get AI Mode Status

[The camera itself cannot enable AI mode; an AI module is required to activate it.]

CMD_ID:0x4D-----Get AI Module Tracking Target Coordinate Stream Status			
Send Data Format			
Index	Data Type	Data Name	Description

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ACK Data Format			
1	uint8_t	sta	0: Not enabled, 1: AI mode enabled

0x4E: Get AI Module Tracking Target Coordinate Stream Status

CMD_ID:0x4E-----Get AI Module Tracking Target Coordinate Stream Status			
Send Data Format			
Index	Data Type	Data Name	Description
ACK Data Format			
1	uint8_t	sta	0: Not enabled 1: Outputting coordinate stream 2: AI recognition not enabled 3: AI tracking target not enabled

0x50: AI Module Target Tracking Coordinate Stream

[Automatically sent when set by CMD 0x4F, no request needed.]

[Origin is at the center of the recognition box, pixel coordinates are based on a width of 1280 and height of 720.]

CMD_ID:0x50-----AI Module Target Tracking Coordinate Stream			
Send Data Format			

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Index	Data Type	Data Name	Description
ACK Data Format:			
1	uint16_t	pos_x	Target tracking coordinate X
2	uint16_t	pos_y	Target tracking coordinate Y
3	uint16_t	pos_width	Target tracking box width
4	uint16_t	pos_height	Target tracking box height
5	uint8_t	Target_ID	Target Type ID 0: Human 1: Car 2: Bus 3: Truck 255: Any object
6	uint8_t	Track_Sta	Tracking Status 0: Normal tracking (AI) 1: Intermittent loss (can recover) 2: Lost 3: User canceled tracking 4: Normal tracking (any object)

0x51: Set AI Module Tracking Coordinate Stream Status

[The rate is the frame rate of the video stream and cannot be modified.]

CMD_ID:0x51-----AI Module Tracking Coordinate Stream Status			
Send Data Format			
Index	Data Type	Data Name	Description
	uint8_t	track_action	1: Enable output 0: Disable output

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ACK Data Format			
1	uint8_t	sta	1: Output enabled 0: Output disabled

0x4F: Manually Update Thermal Imaging Shutter

CMD_ID:0x4F-----Manually Update Thermal Imaging Shutter			
Send Data Format			
Index	Data Type	Data Name	Description
ACK Data Format:			
1	Uint8_t	ack	1: Update successful

0x70: Request Weak Control Mode

CMD_ID:0x 70 -----Request Weak Control Mode			
Send Data Format			
Index	Data Type	Data Name	Description
ACK Data Format			
1	Uint8_t	Weak_mode__state	1: Weak mode enabled 0: Weak mode disabled

0x71: Set Weak Control Mode

CMD_ID:0x 71 -----Set Weak Control Mode			
Send Data Format			
Index	Data Type	Data Name	Description

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1	Uint8_t	Weak_mode__state	1: Enable weak mode 0: Disable weak mode
ACK Data Format			
1	Uint8_t	Sta	1: Success 0: Failure
2	Uint8_t	Weak_mode__state	1: Weak mode enabled 0: Weak mode disabled

0x80: Gimbal Camera Soft Reboot

CMD_ID:0x 80 -----Gimbal Camera Soft Reboot			
Send Data Format			
Index	Data Type	Data Name	Description
1	uint8_t	Camera_reboot	0: No action, 1: Camera reboot
2	uint8_t	Gimbal_reset	0: No action, 1: Gimbal reboot
ACK 数据格式			
1	uint8_t	Camera_reboot_sta	0: No action, 1: Camera reboot
2	uint8_t	Gimbal_reset_sta	0: No action, 1: Gimbal reboot

0x81: Get Gimbal Camera IP Address

CMD_ID:0x 81 -----Get Gimbal Camera IP Address			
Send Data Format			
Index	Data Type	Data Name	Description
ACK Data Format			
1	uint32_t	IP	IP Address

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2	uint32_t	Mask	Subnet Mask
3	uint32_t	Gateway	Gateway

0x82: Set Gimbal Camera IP Address

CMD_ID:0x 82 -----Set Gimbal Camera IP Address			
Send Data Format			
Index	Data Type	Data Name	Description
1	uint32_t	IP	IP Address
2	uint32_t	Mask	Subnet Mask
3	uint32_t	Gateway	Gateway
ACK Data Format			
1	uint8_t	Ack	1: Successfully Set

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CHAPTER 3 Communication Interfaces

1. TTL Serial Port

Baud Rate: 115200

Data Bits: 8 bits

Stop Bits: 1 bit

Parity: None

2. UDP Communication

IP Address: 192.168.144.25

Port: 37260

3. TCP Communication

IP Address: 192.168.144.25

Port: 37260

Heartbeat Packet: 55 66 01 01 00 00 00 00 00 59 8B

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CHAPTER 4 Communication Data Example

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 01 00 0F 04 05 60 BB

focus 1

55 66 01 01 00 00 00 06 01 de 31

Take Photo

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

Start Video Recording

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

Pan/Tilt 100 100

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

Auto Focus

55 66 01 05 00 00 00 04 01 2c 01 64 00 1f 8a

focus -1

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

One-Key Centering

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55 66 01 01 00 00 00 08 01 d1 12

Gimbal Status Information

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

Retrieve Hardware ID

55 66 01 00 00 00 00 02 07 f4

Retrieve 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

Retrieve Attitude Data

55 66 01 00 00 00 00 0d e8 05

Set Gimbal Control Angle (-90°, 0°) (Facing Down)

55 66 01 04 00 00 00 0E 00 00 7C FC 4F A4

Set HDMI Video Output (A8 Mini Supported, Takes Effect After Restart)

55 66 01 01 00 00 00 0c 06 f2 ae

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Set CVBS Video Output (A8 Mini Supported, Takes Effect After Restart)

55 66 01 01 00 00 00 0c 07 d3 be

Disable CVBS and HDMI Output (A8 Mini Supported, Takes Effect After Restart)

55 66 01 01 00 00 00 0c 08 3c 4f

Retrieve Current Video Stitching Mode

55 66 01 00 00 00 00 10 74 c6

Set Current Video Stitching Mode

55 66 01 01 00 00 00 11 01 3a ab

Retrieve Temperature at a Specific Point

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

Retrieve Maximum and Minimum Temperatures of Entire Image with Coordinates

55 66 01 01 00 00 00 14 01 cf 54

Read Laser Ranging Distance (Low Byte First, High Byte Last, Supported by Four-Sensor Gimbal)

55 66 01 00 00 00 00 15 D1 96

Retrieve Maximum Zoom Value in Current State

55 66 01 00 00 00 00 16 B2 A6

Retrieve Current Zoom Value

55 66 01 00 00 00 00 18 7C 47

Retrieve Current Gimbal Mode

55 66 01 00 00 00 00 19 5D 57

Retrieve Pseudo-Color Settings

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

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Set Pseudo-Color Mode (Iron Red)

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

Retrieve Camera Encoding Parameters

55 66 01 01 00 00 00 20 00 BF 8D

Set Camera Encoding Parameters: Main Stream HD H.265 Bitrate 1.5M

55 66 01 09 00 00 00 21 01 02 00 05 d0 02 dc 05 00 58 45

Set Camera Encoding Parameters: Main Stream Ultra HD H.265 Bitrate 2.0M

55 66 01 09 00 00 00 21 01 02 80 07 38 04 d0 07 00 5a 68

Set Recording Stream 2K Resolution H.265 Bitrate 15M

55 66 01 09 00 00 00 21 00 02 00 0a a0 05 98 3a 00 15 f3

Set Recording Stream 4K Resolution H.265 Bitrate 15M

55 66 01 09 00 00 00 21 00 02 00 0f 70 08 98 3a 00 70 be

Request Thermal Imaging Output Mode

55 66 01 00 00 00 00 33 75 d2

Set Thermal Imaging Output Mode

55 66 01 01 00 00 00 34 01 29 52

Retrieve Single Frame of Raw Thermal Imaging Data

55 66 01 00 00 00 00 35 b3 b2

Send GPS Coordinates (Longitude 22.27683°E, Latitude 114.17612°N)

55 66 01 20 00 01 00 3e 00 00 00 00 ac 2c 47 0d b0 e4 0d 44 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 80 62

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CHAPTER 4 CRC16 Checksum

```
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;
}
```


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}

```
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,0xcdbc,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,
```

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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
};

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CHAPTER 6 Advanced Integration Guide for SIYI Gimbal SDK

To assist developers, especially those working on Linux platforms, in developing and debugging the SIYI Gimbal SDK, we have created this demo example.



Note:

Before using this document, please make sure to read Chapters 1 to 5 of the manual in full.

This document uses the UDP communication protocol:

1. Refer to Chapter 4 "SDK Communication Data Examples" in this manual, and fill the corresponding example in hexadecimal format into "send_buff" as needed.

```
int socktd;  
int ret, i, recv_len;  
struct sockaddr_in send_addr, recv_addr;  
unsigned char send_buf[] = {0x55,0x66,0x01,0x01,0x00,0x00,0x00,0x00,0x08,0x01,0xd1,0x12}; //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. Modify the gimbal camera's port number and IP address to match your corresponding settings, ensuring that the double quotes around the IP address are retained.

```
#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.

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```
/* 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 without modification.

```
/* 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 returned by the gimbal camera without modification.

```
/* 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 format without modification.

```
// 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 steps above, compile and run the SDK. The following printed data will appear, indicating that the data can be sent and received correctly. At this point, please observe whether the gimbal camera performs the corresponding actions.

SIYI

```
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$
```



Note:

When using the SDK for UDP communication with the gimbal camera, ensure that the device and the gimbal camera are on the same network segment, meaning the Ubuntu system should be able to ping the gimbal camera's IP address. If communication still cannot be established, it is possible that the Windows firewall is interfering with the data transmission. Try temporarily disabling the Windows firewall.

Related code example:

```
#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

int main(int argc, char *argv[])
```

SIYI

```
{  
    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 corresponding to functionality, hexadecimal data  
  
    unsigned char recv_buf[RECV_BUUF_SIZE] = {0};  
  
    /* Create a UDP socket  
        AF_INET:    IPv4 address  
        SOCK_DGRAM: UDP protocol  
        0:          Automatically select the corresponding default protocol  
    */  
    if ((sockfd = socket(AF_INET, SOCK_DGRAM, 0)) < 0) {  
        perror("socket");  
        exit(1);  
    }  
  
    /* Set the IP address and port number of the gimbal camera  
        sin_family:    IPv4 address  
        sin_addr.s_addr: Gimbal camera IP address  
        sin_port:      Gimbal camera port number  
    */  
    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:      Socket file descriptor
```

SIYI

```
send_buf:      The starting address of the data to be sent in memory
sizeof(send_buf): Length of the data to be sent
0:            Send flag, usually 0
(struct sockaddr *)&send_addr: Structure pointer of the data receiving end's
address (including IP address and port number)
addr_len:     Size of the data receiving end address structure
*/
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 returned data from the gimbal camera
sockfd:       Socket file descriptor
recv_buf:    Memory location where the received data will be stored
RECV_BUUF_SIZE: Size of the buffer, i.e., the expected maximum data length
0:          Receive flag, usually 0
(struct sockaddr *)&recv_addr: Structure that will be filled with the sending end's
address (including IP and port)
&addr_len:   The location to store the actual size of the sender's address after
the call
*/
recv_len = recvfrom(sockfd, recv_buf, RECV_BUUF_SIZE, 0, (struct sockaddr
*)&recv_addr, &addr_len);
if (recv_len < 0) {
    perror("recvfrom");
    exit(1);
}
```

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

// Close the socket
close(sockfd);

return 0;
}
```


SIYI

CHAPTER 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.

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.  
}
```

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```
"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:

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```
{
  "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

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		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	Description
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:

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```
{  
  "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

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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	[File list.

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	<pre>{ "name": "aa.jpg", "url": "http://xxx/yyy/aa.jpg" }, { "name": "bb.jpg", "url": "http://xxx/yyy/bb.jpg" },]</pre>	
--	--	--

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"
      },
    ]
  }
}
```

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```
{
  "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
}
```


Appendix 1: Supported Versions of Control Commands

Product Type	Firmware Type	Firmware Version
ZT30	Camera	(NAND Flash) Quad-Sensor Gimbal Firmware svn1527 svn1774 v0.2.7 2025-01-14
	Gimbal	ZT30 Gimbal Main Control Firmware v0.2.8 svn8441 2024-01-14
	Zoom Version	ZT30 Zoom Module Firmware v0.1.6 svn6792 2023-07-10
ZT6	Camera	ZT6 Camera Flash Firmware svn1528 svn1652 v0.1.9 2024-10-14
	Gimbal	ZT6 Gimbal Firmware v0.2.3 svn8050 2024-09-12
ZR10	Camera	ZR10 Encoder Board Flash Firmware v0.3.5 svn1315 svn1467 2024-04-16
	Gimbal	ZR10 Gimbal Firmware v0.4.0 svn7635 2024-04-16
	Zoom Board	ZR10 Zoom Module Firmware v0.2.3 svn7084 2023-10-13
ZR30	Camera	ZR30Camera Flash Firmware (nand flash) v0.1.6 svn1370 2024-01-24
	Gimbal	ZR30Gimbal Main Control Firmware v0.2.2 svn7410 2024-01-23
	Zoom Board	ZR30Zoom Module Firmware v0.1.6 svn6792 2023-08-16
A2 mini	Camera	A2 mini FPV Firmware v0.1.6 svn 1008 svn1101 2023-09-26
	Gimbal	A2miniGimbal Main Board Firmware v0.2.9 svn8505 2025-02-11
A8 mini	Camera	A8 miniGimbal Camera Flash Firmware v0.2.8 svn1729 2024-12-18
	Gimbal	A8 min iGimbal Main Board Firmware v0.3.9 svn8405 2025-1-7

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Appendix 2: Control Command Support List

Note: Commands not listed in the table are supported by the entire series of models.

TTL Interface:

Command	Data Name	Data Description		ZT3 0	ZT 6	ZR1 0	ZR3 0	A8mi ni
0x01: Request Firmware Version	camera_firmware_ver	Camera firmware version		✓	✓	✓	✓	✓
	gimbal_firmware_ver	Gimbal firmware version		✓	✓	✓	✓	✓
	zoom_firmware_ver	Zoom firmware version		✓		✓	✓	
0x04: Auto Focus				✓		✓	✓	
0x06: Manual Focus				✓		✓	✓	
0x07: Gimbal Rotation			ZR3 0 does not reply	✓	✓	✓	✓	✓
0x0A: Request Camera System Info	reserved							
	hdr_sta							
	reserved							
	record_sta				✓	✓	✓	✓
	gimbal_motion_mode				✓	✓	✓	✓
	gimbal_mounting_dir					✓	✓	✓
	video_hdmi_or_cvbs					✓		✓
0x0B: Return Function Feedback	info_type	0: Photo successful		✓		✓	✓	✓
		1: Photo failed		✓		✓	✓	✓
		2: HDR mode enabled						
		3: HDR mode						
	zoom_linkage							

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		disabled						
		4: Video recording failed		✓		✓	✓	✓
		5.: Start video recording						
		6: End video recording						
0x0C: Photo, video, etc.	func_type	0: Take photo		✓	✓	✓	✓	✓
		1: Switch HDR						
		2: Video recording		✓	✓	✓	✓	✓
		3: Lock mode		✓	✓	✓	✓	✓
		4: Follow mode		✓	✓	✓	✓	✓
		5: FPV mode		✓	✓	✓	✓	✓
		6: Set HDMI video output			✓		✓	✓
		7: Set CVBS video output			✓			✓
		8: Turn off all HDMI/CVBS video outputs			✓		✓	✓
		9: One-click downward						✓
		10: Zoom linkage						
CMD_ID: 0x10 — Request Video Stitching Mode		0: Stitching mode - Main stream:		✓	✓			

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		Zoom & Thermal imaging, Sub stream: Wide-angle						
		1: Stitching mode - Main stream: Wide-angle & Thermal imaging, Sub stream: Zoom		✓				
		2: Stitching mode - Main stream: Zoom & Wide-angle, Sub stream: Thermal imaging		✓				
		3: Non-stitching mode - Main stream: Zoom, Sub stream: Thermal imaging		✓	✓			
		4: Non-stitching mode - Main stream: Zoom, Sub stream:		✓				

SIYI

		Wide-angle						
		5: Non-stitching mode - Main stream: Wide-angle, Sub stream: Thermal imaging		✓				
		6: Non-stitching mode - Main stream: Wide-angle, Sub stream: Zoom		✓				
		7: Non-stitching mode - Main stream: Thermal imaging, Sub stream: Zoom		✓	✓			
		8: Non-stitching mode - Main stream: Thermal imaging, Sub stream: Wide-angle		✓				
0x11: Set Video Stitching Mode		0: Stitching Mode (Main Stream:		✓	✓			

SIYI

		Zoom & Thermal, Sub Stream: Wide-Angle)						
		1: Stitching Mode (Main Stream: Wide-Angle & Thermal, Sub Stream: Zoom)		✓				
		2: Stitching Mode (Main Stream: Zoom & Wide-Angle, Sub Stream: Thermal)		✓				
		3: Non-Stitching Mode (Main Stream: Zoom, Sub Stream: Thermal)		✓	✓			
		4: Non-Stitching Mode (Main Stream: Zoom, Sub Stream: Wide-Angle)		✓				

SIYI

		le)						
		5: Non-Stitching Mode (Main Stream: Wide-Angle, Sub Stream: Thermal)		✓				
		6: Non-Stitching Mode (Main Stream: Wide-Angle, Sub Stream: Zoom)		✓				
		7: Non-Stitching Mode (Main Stream: Thermal, Sub Stream: Zoom)		✓	✓			
0x12: Get selected point temperature				✓	✓			
0x13: Local temperature measurement				✓	✓			
0x14: Global temperature measurement				✓	✓			
0x15: Request laser ranging distance				✓				
0x17: Request				✓				

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latitude and longitude of laser ranging target								
0x1A: Request current thermal imaging pseudo-color				✓	✓			
0x1B: Set thermal imaging pseudo-color				✓	✓			
0x23: Send RC channel data to gimbal								
0x24: Request flight controller to send data stream to gimbal								
0x25: Request gimbal to send data stream				✓				
0x27: Request gimbal control mode data				✓				
0x27: Request gimbal control mode data				✓				
0x28: Request gimbal weak control threshold data				✓				
0x29: Set gimbal weak control threshold data				✓				
0x2A: Request gimbal motor				✓				

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voltage data								
0x31: Request gimbal system information				✓				
0x32: Set laser ranging status				✓				
0x33: Request thermal imaging output mode				✓	✓			
0x34: Set thermal imaging output mode				✓	✓			
0x35: Get a single temperature frame				✓	✓			
0x37: Request thermal imaging gain mode				✓	✓			
0x38: Set thermal imaging gain mode				✓	✓			
0x39: Request thermal imaging environmental correction parameters				✓	✓			
0x3A: Set thermal imaging environmental correction parameters				✓	✓			
00x3B: Request				✓	✓			

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thermal imaging environmental correction switch								
0x3C: Set thermal imaging environmental correction switch				✓	✓			
0x3E: Send GPS raw data to gimbal			ZR10 and ZR30 have no response.	✓	✓	✓	✓	✓
0x40: Request system time								
0x41: Single-axis attitude control			A8 mini responds with 0x0E.					✓
0x42: Request thermal imaging threshold image switch state								
0x43: Set thermal imaging threshold image switch state								
0x44: Request thermal imaging threshold image parameters								
0x45: Set thermal								

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imaging threshold image parameters								
0x46: Request Thermal imaging threshold precision								
0x47: Set Thermal imaging threshold precision								
0x48: Format SD Card			ZT30, ZR30, and A8 mini have no response.	✓		✓	✓	✓
0x49: get_picture_name_type				✓				
0x4A: set_picture_name_type				✓				
0x4B: Request HDMI OSD Display Status								✓
0x4C: Set HDMI OSD Display Status								✓
0x4D: Get AI Mode Status				✓	✓			✓
0x4E: Request AI module tracking target coordinate information stream status				✓	✓			✓

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0x4F: Manually update thermal imaging shutter				✓	✓			
0x50: AI module tracking target coordinate information stream				✓	✓			
0x51: Set AI module tracking target coordinate information stream status				✓	✓			✓
0x70: Request weak control mode				✓				
0x71: Set weak control mode				✓				
0x80: Gimbal camera soft reboot				✓				✓
0x81: Get gimbal camera IP address								
0x82: Set gimbal camera IP address								

SIYI

UDP Interface:

Command	Data Name	Data Description	Remarks	ZT 30	Z T6	ZR 10	ZR 30	A2mini	A8mini
0x01: Get Firmware Version	camera_firmware_ver	Camera firmware version		✓	✓	✓		✓	✓
	gimbal_firmware_ver	Gimbal firmware version		✓	✓	✓		✓	✓
	zoom_firmware_ver	Zoom firmware version		✓		✓			
0x02: Get Hardware ID				✓	✓	✓		✓	✓
0x04: Auto Focus				✓		✓	✓		
0x05: Manual Zoom				✓	✓	✓	✓		✓
0x06: Manual Focus				✓		✓	✓		
0x07: Gimbal Rotation			No response from A2 mini	✓	✓	✓	✓	✓	✓
0x0A: Request Camera System Information	reserved								
	hdr_sta								
	reserved								
	record_sta			✓	✓	✓	✓		✓
	gimbal_motion_mode			✓	✓	✓	✓	✓	✓
	gimbal_mounting_dir			✓	✓	✓	✓	✓	✓
	video_hdmi_or_cvbs			✓	✓		✓		✓
zoom_linkage				✓	✓				
0x0B: Return Function	info_type	0: Photo							

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Feedback Information		capture successful							
		1: Photo capture failed							
		2: HDR mode enabled							
		3: HDR mode disabled							
		4: Video recording failed							
		6: Video recording stopped							
		6: Video recording stopped							
0x0C: Capture Photo / Record Video	func_type	0: Take a photo		✓	✓	✓	✓		✓
		1: HDR mode switch							
		2: Start/stop video recording		✓	✓	✓			✓
		3: Lock mode		✓	✓	✓	✓		✓
		4: Follow mode		✓	✓	✓	✓		✓
		5: FPV mode		✓	✓	✓	✓		✓
		6: Set HDMI					✓		✓

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		video output							
		7: Set CVBS video output							✓
		8: Disable all HDMI/ CVBS video output					✓		✓
		9: One-key downward view		✓	✓				✓
		10: Linked zoom		✓	✓				
0x0D: Get Gimbal Attitude				✓	✓	✓		✓	✓
0x0E: Set Gimbal Attitude Data			No response from ZR30	✓	✓	✓	✓	✓	✓
0x0F: Absolute Zoom			No response from ZR30	✓	✓	✓	✓		✓
0x10: Request Video Stitching Mode		0: Stitching mode (Main stream: Zoom &		✓	✓				

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		Thermal imaging, Substream: Wide angle)							
		1: Stitching mode (Main stream: Wide angle & Thermal imaging, Substream: Zoom)		✓					
		2: Stitching mode (Main stream: Zoom & Wide angle, Substream: Thermal imaging)		✓					
		3: Non-stitching mode (Main stream: Zoom, Substream: Thermal imaging)		✓	✓				

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		4: Non-stitching mode (Main stream: Zoom, Sub stream: Wide angle)		✓					
		5: Non-stitching mode (Main stream: Wide angle, Sub stream: Thermal imaging)		✓					
		6: Non-stitching mode (Main stream: Wide angle, Sub stream: Zoom)		✓					
		7: Non-stitching mode (Main stream: Thermal imaging, Sub		✓	✓				

SIYI

		stream: Zoom)							
		8: Non-stitching mode (Main stream: Thermal imaging, Sub stream: Wide angle)		✓					
0x11: Set Video Stitching Mode		0: Stitching Mode (Main Stream: Zoom & Thermal Imaging, Sub Stream: Wide Angle)		✓	✓				
		1: Stitching Mode (Main Stream: Wide Angle & Thermal Imaging, Sub Stream: Zoom)		✓					
		2: Stitching Mode (Main		✓					

SIYI

	Stream: Zoom & Wide Angle, Sub Stream: Therma l Imagin g)							
	3: Non-Sti tching Mode (Main Stream: Zoom, Sub Stream: Therma l Imagin g)		✓	✓				
	4: Non-Sti tching Mode (Main Stream: Zoom, Sub Stream: Wide Angle)		✓					
	5: Non-Sti tching Mode (Main Stream: Wide Angle, Sub Stream: Therma l		✓					

SIYI

		Imaging)							
		6: Non-Stitching Mode (Main Stream: Wide Angle, Sub Stream: Zoom)		✓					
		7: Non-Stitching Mode (Main Stream: Thermal Imaging, Sub Stream: Zoom)		✓	✓				
0x12: Get Temperature at Selected Point				✓	✓				
0x13: Local Temperature Measurement				✓	✓				
0x14: Global Temperature Measurement				✓	✓				
0x15: Request Laser Distance Measurement				✓					
0x16: Request Supported Zoom Range				✓	✓	✓			
0x17: Request Latitude and Longitude				✓					

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Information of Laser Rangefinder Target									
0x18: Request Current Zoom Magnification				✓	✓	✓			
0x19: Request Current Gimbal Mode				✓	✓	✓			
0x1A: Request Current Thermal Imaging Pseudo-Color				✓	✓				
0x1B: Set Thermal Imaging Pseudo-Color				✓	✓				
0x22: Send Aircraft Attitude Data to Gimbal				✓	✓	✓	✓	✓	
0x23: Send RC Channel Data to Gimbal									
0x24: Request Flight Control Data Stream to Gimbal									
0x25: Request Gimbal Data Stream				✓					
0x26: Request Gimbal Magnetic Encoder Angle Data				✓					
0x27: Request				✓					

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Gimbal Control Mode Data									
0x28: Request Gimbal Weak Control Threshold Data				✓					
0x29: Set Gimbal Weak Control Threshold Data				✓					
0x2A: Request Gimbal Motor Voltage Data				✓					
0x30: Set UTC Time				✓	✓	✓	✓	✓	
0x31: Request Gimbal System Information				✓					
0x32: Set Laser Rangefinder Status				✓					
0x33: Request Thermal Imaging Output Mode				✓	✓				
0x34: Set Thermal Imaging Output Mode				✓	✓				
0x35: Get One Temperature Frame				✓	✓				
0x37: Request				✓	✓				

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Thermal Imaging Gain Mode									
0x38: Set Thermal Imaging Gain Mode				✓	✓				
0x39: Request Thermal Imaging Environmental Correction Parameters				✓	✓				
0x3A: Set Thermal Imaging Environmental Correction Parameters				✓	✓				
0x3B: Request Thermal Imaging Environmental Correction Switch				✓	✓				
0x3C: Set Thermal Imaging Environmental Correction Switch				✓	✓				
0x3E: Send GPS Raw Data to Gimbal			ZR10, ZR30, and A8 mini no resp	✓	✓	✓	✓		✓

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			onse · 4o						
0x40: Request System Time									
0x41: Single Axis Attitude Control			A8 mini responded with 0x0 E.						✓
0x42: Request Thermal Imaging Threshold Range Switch									
0x43: Set thermal imaging threshold image switch state									
0x44: Request thermal imaging threshold image parameters									
0x45: Set thermal imaging threshold image parameters									
0x46: Request Thermal imaging threshold precision									
0x47: Set Thermal imaging threshold precision									
0x48: Format SD Card			ZT3 0,	✓	✓	✓	✓		✓

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			ZR3 0, and A8 mini no resp onse .						
0x49: get_picture_name _type				✓					
0x4A: set_picture_name _type				✓					
0x4B: Request HDMI OSD Display Status									✓
0x4C: Set HDMI OSD Display Status									✓
0x4D: Get AI Mode Status				✓	✓				✓
0x4E: Get AI Module Target Tracking Coordinate Information Stream Status				✓	✓				✓
0x4F: Manually Update Thermal Imaging Shutter				✓	✓				
0x50: AI Module Target Tracking Coordinate				✓	✓				

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Information Stream									
0x51: Set AI Module Target Tracking Coordinate Information Stream Status				✓	✓				✓
0x70: Request Weak Control Mode				✓					
0x71: Set Weak Control Mode				✓					
0x80: Gimbal Camera Soft Reboot				✓					✓
0x81: Get Gimbal Camera IP Address									
0x82: Set Gimbal Camera IP Address									

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TCP interface:

Command	Data Name	Description	Remarks	ZT 30	ZT 6	ZR 10	ZR 30	A8mini
0x00: TCP Heartbeat				✓	✓	✓	✓	
0x01: Get Version Number	camera_firmware_ver	Camera firmware version		✓	✓	✓		
	gimbal_firmware_ver	Gimbal firmware version		✓	✓	✓		
	zoom_firmware_ver	Zoom firmware version		✓		✓		
0x02: 获取硬件ID IDGet Hardware ID				✓	✓	✓		
0x04: Auto Focus				✓		✓	✓	
0x05: Manual Zoom				✓	✓	✓	✓	
0x06: Manual Focus				✓		✓	✓	
0x07: Gimbal Rotation				✓	✓	✓	✓	
0x08: One-Key Reset to Center				✓	✓	✓	✓	
0x0A: Request Camera System Information	reserved							
	hdr_sta							
	reserved							
	record_sta			✓	✓	✓	✓	
	gimbal_motion_mode			✓	✓	✓	✓	
	gimbal_mounting_dir			✓	✓	✓	✓	
	video_hdmi_or_cvbs			✓	✓		✓	
	zoom_linkage			✓	✓			
0x0B: Return Function Feedback Information	info_type	0: Photo captured successfully						
		1: Photo capture failed						
		2: HDR mode enabled						

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		3: HDR mode disabled						
		4: Video recording failed						
		5: Video recording started						
		6: Video recording stopped						
0x0C: Photo Capture, Video Recording, etc.	func_type	0: Photo Capture		✓	✓	✓	✓	
		2: Video Recording						
		2: Video Recording		✓	✓	✓		
		3: Lock Mode		✓	✓	✓	✓	
		4: Follow Mode		✓	✓	✓	✓	
		5: FPV Mode		✓	✓	✓	✓	
		6: Set HDMI Video Output					✓	
		7: Set CVBS Video Output						
		8: Disable All HDMI/CVBS Video Outputs					✓	
		9: One-Key Downward View		✓	✓			
		10: Linked Zoom		✓	✓			

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0x0D: Get Gimbal Attitude				✓	✓	✓		
0x0E: Set Gimbal Attitude Data			ZR30 No Response	✓	✓	✓	✓	
0x0F: Absolute Zoom			ZR30 No Response	✓	✓	✓	✓	
0x10: Request Video Stitching Mode		0: Stitched Mode (Main stream: Zoom & Thermal Imaging, Sub stream: Wide Angle)		✓	✓			
		1: Stitched Mode (Main stream: Wide Angle & Thermal Imaging, Sub stream: Zoom)		✓				
		2: Stitched Mode (Main stream: Zoom & Wide Angle, Sub stream: Thermal Imaging)		✓				
		3: Non-Stitched Mode (Main		✓	✓			

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		stream: Zoom, Sub stream: Thermal Imaging)						
		4: Non-Stitch ed Mode (Main stream: Zoom, Sub stream: Wide Angle)		✓				
		55: Non-Stitch ed Mode (Main stream: Wide Angle, Sub stream: Thermal Imaging)		✓				
		6: Non-Stitch ed Mode (Main stream: Wide Angle, Sub stream: Zoom)		✓				
		7: Non-Stitch ed Mode (Main stream: Thermal Imaging, Sub stream: Zoom)		✓	✓			
		8: Non-Stitch ed Mode (Main		✓				

SIYI

		stream: Thermal Imaging, Sub stream: Wide Angle)						
0x11: Set Video Stitching Mode		0: Stitched Mode (Main stream: Zoom & Thermal Imaging, Sub stream: Wide Angle)		✓	✓			
		1: Stitched Mode (Main stream: Wide Angle & Thermal Imaging, Sub stream: Zoom)		✓				
		2: Stitched Mode (Main stream: Zoom & Wide Angle, Sub stream: Thermal Imaging)		✓				
		3: Non-Stitched Mode (Main stream: Zoom, Sub stream: Thermal Imaging)		✓	✓			
		4: Non-Stitched Mode (Main stream: Zoom, Sub stream: Wide Angle)		✓				
		5: Non-Stitched Mode (Main stream: Wide Angle, Sub stream: Thermal Imaging)		✓				

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		6: Non-Stitched Mode (Main stream: Wide Angle, Sub stream: Zoom)		✓				
		7: Non-Stitched Mode (Main stream: Thermal Imaging, Sub stream: Zoom)		✓	✓			
0x12: Get the temperature at the selected point				✓	✓			
0x13: Local temperature measurement				✓	✓			
0x14: Global temperature measurement				✓	✓			
0x15: Request laser ranging distance				✓				
0x16: Request the current supported zoom range				✓	✓	✓		
0x17: Request the latitude and longitude of the laser ranging target				✓		✓		
0x18: Request the current zoom level				✓	✓	✓		
0x19: Request the current				✓	✓	✓		

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gimbal mode								
0x1A: Request the current thermal imaging pseudocolor				✓	✓			
0x1B: Set thermal imaging pseudocolor				✓	✓			
0x20: Request camera encoding parameters				✓	✓	✓	✓	
0x21: Set camera encoding parameters				✓	✓	✓	✓	
0x22: Send the aircraft attitude data to the gimbal				✓	✓	✓	✓	
0x23: Send RC channel data to the gimbal								
0x24: Request flight control to send data stream to the gimbal								
0x26: Request gimbal magnetic encoding angle data				✓				
0x26: Request gimbal magnetic				✓				

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encoding angle data								
0x27: Request gimbal control mode data				✓				
0x28: Request gimbal weak control threshold data				✓				
0x29: Set gimbal weak control threshold data				✓				
0x2A: Request gimbal motor voltage data				✓				
0x30: Set UTC time				✓	✓	✓	✓	
0x31: Request gimbal system information				✓				
0x32: Set laser ranging status				✓				
0x33: Request thermal imaging output mode				✓	✓			
0x34: Set thermal imaging output mode				✓	✓			
0x35: Get a single temperature frame				✓	✓			

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0x37: Request thermal imaging gain mode				✓	✓			
0x38: Set thermal imaging gain mode				✓	✓			
0x39: Request thermal imaging environmental correction parameters				✓	✓			
0x3A: Set thermal imaging environmental correction parameters				✓	✓			
0x3B: Request thermal imaging environmental correction switch				✓	✓			
0x3C: Set thermal imaging environmental correction switch				✓	✓			
0x3E: Send GPS raw data to the gimbal			ZR10, ZR30 no response.	✓	✓	✓	✓	
0x40: Request system time								

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0x41: Single-axis attitude control								
0x42: Request thermal imaging threshold range switch								
0x43: Set thermal imaging threshold image switch state								
0x44: Request thermal imaging threshold image parameters								
0x45: Set thermal imaging threshold image parameters								
0x46: Request Thermal imaging threshold precision								
0x47: Set Thermal imaging threshold precision								
0x48: Format SD card			ZT30, ZR30 no response	✓	✓	✓	✓	
0x49: get_picture_name_type				✓				
0x4A: set_picture_name_type				✓				

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0x4B: Request HDMI OSD (On-Screen Display) status								
0x4C: Set HDMI OSD display status								
0x4D: Get AI mode status				✓	✓			
0x4E: Get the AI module's tracking target coordinate stream status				✓	✓			
0x4F: Manually update thermal imaging shutter				✓	✓			
0x50: AI module's tracking target coordinate information stream				✓	✓			
0x51: Set AI module's tracking target coordinate information stream status				✓	✓			
0x70: Request weak control mode				✓				
0x71: Set weak control				✓				

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mode								
0x80: Gimbal camera soft reboot				✓				
0x81: Get gimbal camera IP address								
0x82: Set gimbal camera IP address								