Payload SDK Protocol Specification

Version 0.10

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DJI Innovations

Revisions

Version	Date	Revisions
0.0	Jun 27, 2017	1. First draft.
0.1	Aug 10, 2017	1. Change camera and gimbal command sets. 2. Added a time push command and deleted time acquisition commands in payload state command sets.
0.2	Nov 11, 2017	1. Deleted camera and gimbal command sets. 2. Revised other command sets.
0.3	Nov 11, 2017	1. Added camera and gimbal command sets.
0.4	Dec 18, 2017	1. Change camera and gimbal command sets.
0.5	Jan 10, 2018	1. Change app function command sets. 2. Camera Command set add zoom and focus.
0.6	Feb 06, 2018	1. Add Camera function switch.
0.7	Jun 11, 2018	1. Add Upgrade SKYPORT Version Acquisition and Payload Product Alias Acquisition commands in payload state command set. 2. Revised Transparent Data Transmission (Mobile to Payload), Transparent Data Transmission (Payload to Mobile) and DJI Pilot Floating Window Message Push commands of app function command set. 3. Revised Image Transmission Bandwidth Push and Battery Info Push commands of data push command set. 4. Add Pressure Altitude Push, GPS Raw Data Push and RTK Raw Data Push commands. 5. Revised Format SD Card command of camera command set. 6. Add Gimbal Calibration command in gimbal command set. 7. Add some instructions of widget.
0.8	Jan 15, 2019	1. Add Control Gimbal Angle and Joint Angle and Get Gimbal Calibration Progress commands in gimbal command set. 2. Add OSDK Function command set.

0.9	Jul 31, 2019	1. Add Get Text Input Box Parameters command in app function command set. 2. Add UTC Timestamp Push, Other Payload Type Push and Other Payload Focal Length Push commands in data push command set. 3. Add Positioning command set.
0.10	Mar 27,2020	1. Add Get Gimbal Additional Status command in gimbal command set.

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1 PROFILE

This document describes Payload SDK communication protocol (referred to as PSDK protocol), which is applicable for communications between adapter and payload.

2 PSDK PROTOCOL FORMAT

2.1 DATA PACKET FORMAT

Table 2-1 Data Packet Format

Header									Data	Tail
SOF	Length/ Version	Session/ ACK	Padding/ ENC	RES	CMD_SET	CMD_ID	SEQ	CRC16	DATA	CRC32

Table 2-2 Data Packet Details

Domain	Offset Location	Size (Byte)	Details
SOF	0	1	Data packet initial byte, fixed as 0xAA
Length/Version	1	2	Bit [0-9] - Data packet length, including all bytes of the whole data packet, from SOF to CRC32 Bit [10-15] - Protocol header version, fixed as 0 Note: LSB is at the front and MSB is at the back
Session/ACK	3	1	Bit [0-4] - Session 0 = Does not need an ACK 1 = Needs an ACK (return an ACK packet after the command execution is completed) Bit [5] – Packet type 0 = Command packet 1 = ACK packet Bit [6-7] – reserved
Padding/ENC	4	1	Bit [0-4] – Padding, data length padded in DATA field; during AES encryption of the protocol, it is necessary to pad data in DATA field for AES encryption; the field represents the data length padded Bit [5-7] - ENC 0 = No encryption 1 = AES encryption
RES	5	1	reserved, fixed as 0
CMD SET	6	1	Command set number
CMD ID	7	1	Command ID, for indicating specific operations. Please refer to Command Details in Chapter 3 for more details

SEQ	8	2	Data packet sequence number used as a relatively unique ID of the data packet to distinguish different commands and used for ACK packet matching. The sequence number is generated by a requester; a responder uses the same sequence number as that of the request packet when returning the ACK packet.
CRC16	10	2	CRC16 check values from SOF to SEQ (including SEQ)
DATA	12	N	Frame data
CRC32	12+N	4	CRC32 check values from SOF to DATA (including DATA)

2.2 ACK RETURN CODE

Return code	Specification
0x00	Executed successfully
0x01	Executed unsuccessfully
0x02	Does not support the command

2.3 PROTOCOL ENCRYPTION

ENC field indicates whether the frame is encrypted. If the ENC is 1, the DATA field is subjected to AES encryption. Because the data length for AES encryption has to be an integral multiple of 16, data is padded at the tail part of the DATA field to make the data of the DATA field an integral multiple of 16. PADDING field indicates the number of bytes that are padded. For protocol frame AES encryption, please refer to the source code document psdk_aes.h / psdk_aes.c.

2.4 COMMAND SET AND COMMAND ID

CmdSetId	Description	CmdId	Description
0x01	Payload State Command Set	0x01	Id Verification
		0x02	PSDK Version Acquisition
		0x03	Communication Link Hand-Shake
		0x04	Payload Product Information Acquisition
		0x05	Upgrade SKYPORT Version Acquisition
		0x06	Payload Product Alias Acquisition
0x02	APP Function Command Set	0x01	Transparent Data Transmission (Mobile to Payload)
		0x02	Transparent Data Transmission (Payload to Mobile)
		0x03	DJI Pilot Floating Window Message Push

		Ox04	Get Widget List Length
		0x05	Get Widget List Data
		0x06	Get Widget Value Group Number
		0x07	Get Widget Value Group Data
		0x08	Set Widget Value
0x03	Data Push Command Set	0x01	Image Transmission Bandwidth Push
		0x02	UAV Attitude Push
		0x03	Battery Info Push
		0x04	GPS Data Push
		0x05	UAV State Push
		0x06	APP Time And Date Push
		0x07	Pressure Altitude Push
		0x08	GPS Raw Data Push
		0x09	RTK Raw Data Push
0x04	Camera Command Set	0x01	Set Camera Work Mode
		0x02	Get Camera Work Mode
		0x03	Shoot Photo
		0x04	Get Shoot Photo State
		0x05	Set Shoot Photo Mode
		0x06	Get Shoot Photo Mode
		0x07	Record Video
		0x08	Get Record Video State
		0x09	Get SD Card Parameter
		0x0A	Format SD Card
		0x20	Set Metering Mode
		0x21	Get Metering Mode
		0x22	Set Spot Metering Zone
		0x23	Get Spot Metering Zone
		0x30	Set Focus Mode
		0x31	Get Focus Mode
		0x32	Set Focus Zone
		0x33	Get Focus Zone
		0x34	Set Digital Zoom Factor
		0x35	Get Digital Zoom Factor
		0x36	Get Optical Zoom Specification
		0x37	Set Optical Zoom Focal Length
		0x38	Get Optical Zoom Focal Length
		0x39	Get Optical Zoom Factor
		0x40	Start Continuous Optical Zoom
		0x41	Stop Continuous Optical Zoom
		0x42	Set Focus Assistant Setting
		0x43	Get Focus Assistant Setting

		0x44	Get Focus Ring Value Upper Bound
		0x45	Set Focus Ring Value
		0x46	Get Focus Ring Value
		0x47	Get Digital Zoom Specification
		0xFF	Get Camera Command Set Support State
0x05	Gimbal Command Set	0x01	Get Gimbal State
		0x02	Set Gimbal Mode
		0x03	Gimbal Return Head
		0x04	Control Gimbal Angle Speed
		0x07	Gimbal Calibration
		0xFF	Get Gimbal Command Set Support State

3 COMMAND DETAILS

3.1 PAYLOAD STATE COMMAND SET (0X01)

3.1.1 (0x01) ID Verification

The command is irregularly sent by the SKYPORT adapter to the payload to request ID verification; the payload needs to calculate the MD5 value using the Payload SDK APP KEY and the received random number character string together, and returns the MD5 value to the SKYPORT adapter.

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:16	Random number character string
Payload	ACK packet	1	Return code
		2:17	MD5 value

3.1.2 (0x02) PSDK Version Acquisition

The command is used for acquiring the current PSDK version number.

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2:5	Uint32, PSDK version Note: 0xAABBCCDD represents version AA.BB.CC.DD

3.1.3 (0x03) Communication Link Hand-Shake

The communication link hand-shake is used for checking whether the communication link between the SKYPORT adapter and the payload is normal. After the SKYPORT adapter sends the command to the payload, the payload should directly return the received the same data in data field to the SKYPORT adapter.

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:N	Command packet data, 1<=N<=32
Payload	ACK packet	1	Return code
		2:(N+1)	Same as the command packet data

3.1.4 (0x04) Payload Product Information Acquisition

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2:33	Char, product name with "\0" as the ending character, the max length of product name is 32 bytes
		34:49	Char, product ID
		50:113	Char, developer account with "\0" as the ending character, the max length of developer account is 64 bytes

3.1.5 (0x05) Upgrade SKYPORT Version Acquisition

The command is used for acquiring the support version of SKYPORT for Payload SDK, and users can upgrade the SKYPORT to specified version or the newest one by DJI Assistant 2.

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2:5	Uint32, PSDK version Note: 0xAABBCCDD represents version AA.BB.CC.DD

3.1.6 (0x06) Payload Product Alias Acquisition

The command is used for acquiring the current alias of payload product, if the version of PSDK is not support this command, the product name that first activated can be used.

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code

		2:33	Char, product alias with "\0" as the ending character, the max length of product alias is 32 bytes

3.2 APP FUNCTION COMMAND SET (0X02)

3.2.1 (0x01) Transparent Data Transmission (Mobile to Payload)

The command is used for transparently transmitting data from Mobile SDK to payload end.

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:N	Data transmitted, 1<=N<=32
Payload	ACK packet	----	Does not provide an ACK

3.2.2 (0x02) Transparent Data Transmission (Payload to Mobile)

The command is used for transparently transmitting data from payload to Mobile SDK end.

Sending end	Data type	Byte	Specification
Payload	Command packet	1:N	Data transmitted, 1<=N<=128
Adapter	ACK packet	----	Does not provide an ACK

3.2.3 (0x03) DJI Pilot Floating Window Message Push

The command is used to push message to DJI Pilot floating window.

Sending end	Data type	Byte	Specification
Payload	Command packet	1:N	String, UTF8 Coding. The string must end with '\0', the total data length is 1~128
Adapter	ACK packet	----	Does not provide an ACK

3.2.4 (0x04) Get Widget List Length

The command is used for get widget list length, that is, total widgets count. Note: max widget count is 30.

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	----
Payload	ACK packet	1	Return code
		2	Uint8, the total count of widgets defined in PSDK payload

3.2.5 (0x05) Get Widget List Data

The command is used for acquiring detail information of a widget.

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, nth data of the widget list. N starts from 0.
Payload	ACK packet	1	Return code.

<table>
<tr><td></td><td></td><td>2</td><td>Uint8, widget type.
1: Button
2: Switch
3: Range bar
4: Choose list
5: Integer input box</td></tr>
<tr><td></td><td></td><td>3</td><td>Uint8, the widget unique index, starting from 0. The index value determines the order in DJI Pilot widget box. For example, the index 0 is on the top of widget box.</td></tr>
<tr><td></td><td></td><td>4:35</td><td>String, name of widget. The max length of widget name is 32.</td></tr>
<tr><td></td><td></td><td>36:N</td><td>Additional attributes. Only for choose list and integer input box, this field is meaningful. For choose list,
<table>
<tr><th>Byte</th><th>Specification</th></tr>
<tr><td>36</td><td>Uint8, total count of choose items M, and 1<=M<=10.</td></tr>
<tr><td>37:52</td><td>String, name of choose item 1, and the max length of choose name is 16 bytes.</td></tr>
<tr><td>53:68</td><td>String, name of choose item 2, and the max length of choose name is 16 bytes.</td></tr>
<tr><td>…</td><td>…</td></tr>
<tr><td>21+16M:
36+16M</td><td>String, name of choose item M, and the max length of choose name is 16 bytes.</td></tr>
</table>
For integer input box,
<table>
<tr><th>Byte</th><th>Specification</th></tr>
<tr><td>36:67</td><td>String, the append string for input box, and the max length of</td></tr>
</table></td></tr>
</table>

				append string is 32 bytes	

3.2.6 (0x06) Get Widget Value Group Number

The command is used to acquiring count of widget group. Every group include 15 widgets max. If total widget count is more than 15, payload have to split to multiple groups to send value.

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	----
Payload	ACK packet	1	Return code
		2	Uint8, the total count of widget group number

3.2.7 (0x07) Get Widget Value Group Data

The command is used to acquiring value of a widget group.

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, group number, starting with 0
Payload	ACK packet	1	Return code
		2	Uint8, widget count of this group
		3	Uint8, widget type
		4	Uint8, widget index
		5:8	Int32, widget value
		...	...
		6N-3 (1<=N<=15)	Uint8, widget type
		6N-2 (1<=N<=15)	Uint8, widget index
		6N-1:6N+2 (1<=N<=15)	Int32, widget value

3.2.8 (0x08) Set Widget Value

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, widget type
		2	Uint8, widget index
		3	Int32, widget value
Payload	ACK packet	1	Return code

3.2.9 (0x09) Get Text Input Box Parameters

The command is used to get parameters of text input box in DJI Pilot.

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	----
Payload	ACK packet	1	Return code
		2	Uint8, text input box display flag

			0: do not display text input box 1: display text input box
		3:34	String, name of text input box. The max length of name is 32.
		35:66	String, description information of text input box. The max length of description information is 32.

3.3 DATA PUSH COMMAND SET (0X03)

3.3.1 (0x01) Data Transmission Bandwidth Push

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, image link baseband state 0: abnormal, unable to send data via image link 1: normal, able to send data via image link
		2	Uint8, max image link bandwidth
		3	Uint8, reserved
		4	Uint8, connection state Bit [0]: remote controller connection state 0: disconnected; 1: normally connected Bit [1]: downlink image transmission link connection state 0: disconnected; 1: normally connected Bit [2]: downlink data link connection state 0: disconnected; 1: normally connected Bit [3]: App connection state 0: disconnected; 1: normally connected Bit [4:7]: reserved
		5:8	Uint32, PSDK-MSDK direct data transmission channel uplink max bandwidth, unit: Bytes/s Note: uplink specifies from MSDK to PSDK, and the opposite is true.
		9:12	Uint32, PSDK-MSDK direct data transmission channel downlink max bandwidth, unit: Bytes/s

		13:16	Uint32, PSDK network channel max bandwidth, unit: Kb/s
		17	Uint8, real-time bandwidth state flag Bit [0]: PSDK-MSDK direct data transmission channel uplink real-time bandwidth state flag 0: bandwidth beyond limit; 1: bandwidth less than limit Bit [1]: PSDK-MSDK direct data transmission channel downlink real-time bandwidth state flag 0: bandwidth beyond limit; 1: bandwidth less than limit Bit [2]: network channel real-time bandwidth state flag 0: bandwidth beyond limit; 1: bandwidth less than limit; Bit [3:7]:reserved
		18:21	Uint32, PSDK-MSDK direct data transmission channel uplink real-time bandwidth, unit: Bytes/s
		22:25	Uint32, PSDK-MSDK direct data transmission channel downlink real-time bandwidth, unit: Bytes/s
		26:29	Uint32, network channel video stream real-time bandwidth, unit: Kb/s
		30:33	Uint32, network channel non-video data stream real-time bandwidth, unit: Kb/s
		34:37	Uint32, PSDK-OSDK direct data transmission channel uplink max bandwidth, unit: Bytes/s Note: uplink specifies from PSDK to OSDK, and the opposite is true.
		38	Uint8, real-time bandwidth state flag Bit [0]: PSDK-OSDK direct data transmission channel uplink real-time bandwidth state flag 0: bandwidth beyond limit; 1: bandwidth less than limit Bit [1:7]:reserved
		39:42	Uint32, PSDK-OSDK direct data transmission channel uplink real-time bandwidth, unit: Bytes/s

Payload	ACK packet	----	Does not provide an ACK

3.3.2 (0x02) UAV Attitude Push

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:4	Float, quaternion Q0
		5:8	Float, quaternion Q1
		9:12	Float, quaternion Q2
		13:16	Float, quaternion Q3
Payload	ACK packet	----	Does not provide an ACK

3.3.3 (0x03) Battery Info Push

When power off state is 0, ACK packet content is ignored.

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, battery power percentage
		2	Uint8, power off state 0: normally power supply; 1: power off soon
Payload	ACK packet	1	Uint8, Return code
		2	Uint8, power off preparation complete state 0: power off preparation have not been completed 1: power off preparation have been completed

3.3.4 (0x04) GPS Data Push

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:8	Double, GPS longitude, unit: radian.
		9:16	Double, GPS latitude, unit: radian.
		17:18	int16, relative takeoff height, unit: 0.1 m.
		19	Uint8, number of satellites.
		20	Uint8, GPS signal strength. 0: no signal at all; 1: GPS signal is very weak; 2: GPS signal is in medium strength; 3: GPS signal is very strong;
Payload	ACK packet	----	Does not provide an ACK

3.3.5 (0x05) UAV State Push

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, drone function state Bit [0]: compass state 0: normal;

			1: abnormal Bit [1]: motor rotation state 0: not rotating; 1: rotating Bit [2:3]: drone landing state 0: unknown; 1: landed; 2: in the sky Bit [4:7] reserved
		2:3	Uint16, flying duration, starting at the last time the motor rotates, unit: 0.1 s
		4	Uint8, drone type 0: unknown 1: M200 2: M210 3: M210 RTK 4: M600 5: M600 PRO 6: M200 V2 7: M210 V2 8: M210 RTK V2
Payload	ACK packet	----	Does not provide an ACK

3.3.6 (0x06) APP Time and Date Push

When the Mobile APP is accessed, Mobile APP time will be pushed by this command.

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:2	Uint16, year
		3	Uint8, month
		4	Uint8, day
		5	Uint8, hour
		6	Uint8, minute
		7	Uint8, second
Payload	ACK packet	----	Does not provide an ACK

3.3.7 (0x07) Pressure Altitude Push

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:4	Float, absolute altitude measured by barometer
Payload	ACK packet	----	Does not provide an ACK

3.3.8 (0x08) GPS Raw Data Push

Sending end	Data type	Byte	Specification

Adapter	Command packet	1:4	Uint32, date, a integer indicating a GMT date, format: yyyymmdd (decimal).
		5:8	Uint32, time, a integer indicating a GMT time in 24-hour clock, format: hhmmss (decimal).
		9:12	Int32, longitude measured by GPS, unit: E-7 deg.
		13:16	Int32, latitude measured by GPS, unit: E-7 deg.
		17:20	Int32, height above sea level measured by GPS, unit: mm.
		21:24	Float, velocity to the North measured by GPS, unit: cm/s.
		25:28	Float, velocity to the East measured by GPS, unit: cm/s.
		29:32	Float, downward velocity measured by GPS, unit: cm/s.
		33:36	Float, horizontal dilution of precision. <1: ideal; 1-2: excellent; 2-5: good; 5-10: moderate; 10-20: fair; >20: poor.
		37:40	Float, position dilution of precision. <1: ideal; 1-2: excellent; 2-5: good; 5-10: moderate; 10-20: fair; >20: poor.
		41:44	Float, state of GPS fix, three indicating 3D data.
		45:48	Float, vertical position accuracy; the smaller, the better.
		49:52	Float, horizontal position accuracy; the smaller, the better. The value indicates the possible error of the measured position, unit: mm.
		53:56	Float, speed accuracy; the smaller, the better, unit: cm/s.

		57:60	Uint32, number of GPS satellites used for position fix.
		61:64	Uint32, number of GLONASS satellites used for position fix.
		65:66	Uint16, total number of satellites used for position fix.
		67:68	Uint16, times of sending GPS data. When the counter > 65535, it will turn 0 and continue increase every time GPS data is sent.
Payload	ACK packet	----	Does not provide an ACK

3.3.9 (0x09) RTK Raw Data Push

All data has LSB at the front and MSB at the back, and is in a little endian mode.

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:8	Double, longitude measured by RTK, unit: deg.
		8:16	Double, latitude measured by RTK, unit: deg.
		17:20	Float, height above sea level measured by RTK, unit: m.
		21:24	Float, velocity to the North measured by RTK, unit: cm/s.
		25:28	Float, velocity to the East measured by RTK, unit: cm/s.
		29:32	Float, downward velocity measured by RTK, unit: cm/s.
		33:34	Int16, azimuth measured by RTK.
		35	Uint8, type of RTK positioning, indicating different solutions for calculating the position. <1: ideal; 1-2: excellent; 2-5: good; 5-10: moderate; 10-20: fair; >20: poor
		36	Uint8, type of RTK orientation, indicating different solutions for calculating the orientation. <1: ideal; 1-2: excellent; 2-5: good; 5-10: moderate; 10-20: fair;

			>20: poor
Payload	ACK packet	----	Does not provide an ACK

3.3.10 (0x0A) UTC Timestamp Push

The command is used to push UTC timestamp corresponding to rise edge of PPS signal to achieve hardware sync. Note: If the UTC timestamp data package is 500ms later than a rising edge of PPS signal, the UTC timestamp data package should be discarded.

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:2	Uint16, year
		3	Uint8, month
		4	Uint8, day
		5	Uint8, hour
		6	Uint8, minute
		7	Uint8, second
		8:11	Uint32, microsecond
Payload	ACK packet	----	Does not provide an ACK

3.3.11 (0x0B) Other Payload Type Push

The command is used to push type of other payloads mounted on UAV.

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, type of payload mounted on main gimbal interface of UAV 0: unknown 1: ZENMUSE X5S 2: ZENMUSE Z30
Payload	ACK packet	----	Does not provide an ACK

3.3.12 (0x0C) Other Payload Focal Length Push

The command is used to push focal length of other payloads mounted on UAV.

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint16, focal length of payload mounted on main gimbal interface of UAV, unit: 0.1mm
Payload	ACK packet	----	Does not provide an ACK

3.4 CAMERA COMMAND SET (0X04)

3.4.1 (0x01) Set Camera Work Mode

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, camera work mode 0: Shoot photo mode; 1: Record video mode

Payload	ACK packet	1	Return code

3.4.2 (0x02) Get Camera Work Mode

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2	Uint8, camera work mode 0: Shoot photo mode; 1: Record video mode

3.4.3 (0x03) Shoot Photo

Note: only when the camera working mode is shoot photo mode, can the shoot photo command take effect.

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, shoot photo action 0: Stop Shoot Photo (for Stopping Interval Shooting); 1: Start Shoot Photo;
Payload	ACK packet	1	Return code

3.4.4 (0x04) Get Shoot Photo State

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2	Uint8, shoot photo state Bit [0]: Is shooting single photo; Bit [1]: Is shooting interval photo; Bit [2]: Is shooting burst photo; Bit [3]: Is storing photo; Bit [4-7]: Reserved
		3:4	Uint16, countdown of interval photography, unit: s

3.4.5 (0x05) Set Shot Photo Mode

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, Shoot photo type 1: Single shoot; 4: Burst shoot; 6: Interval shoot;
		2	Uint8, number of burst shots (it takes effect when the shoot photo type is burst shot)

		3	Uint8, number of photos under timed shot (it takes effect when the shoot photo type is interval shoot) 0: reserved 1-254: number of interval shoot; 255: keeping photographing until the camera receives the command of stopping interval shoot;
		4	Uint8, time interval of intervals hoot (it takes effect when the shoot photo type is interval shoot) 0: reserved 1 – 255: the time interval between two shoot (unit: s)
Payload	ACK packet	1	Return code

3.4.6 (0x06) Get Shoot Photo Mode

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2	Uint8, Shoot photo type 1: Single shoot; 4: Burst shoot; 6: Interval shoot;
		3	Uint8, number of burst shots (it takes effect when the shoot photo type is burst shot)
		4	Uint8, number of photos under timed shot (it takes effect when the shoot photo type is interval shoot) 0: reserved 1-254: number of interval shoot; 255: keeping photographing until the camera receives the command of stopping interval shoot;
		5	Uint8, time interval of intervals hoot (it takes effect when the shoot photo type is interval shoot) 0: reserved 1 – 255: the time interval between two shoot (unit: s)

3.4.7 (0x07) Record Video

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, video recording action 0: stop video recording; 1: start video recording;
Payload	ACK packet	1	Return code

3.4.8 (0x08) Get Record Video State

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2	Uint8, video recording state 0: not under video recording state; 1: recording;
		3:4	Uint16, the duration of currently recorded video, units

3.4.9 (0x09) Get SD Card Parameter

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2:3	Uint16, SD Card State Bit [0]: Is inserted Bit [1]: Is initializing Bit [2]: Is read only Bit [3]: Is formatted Bit [4]: Is formatting Bit [5]: Is full Bit [6]: Is verified Bit [7]: Is invalid format Bit [8]: Has error Bit [9-15] : Reserved
		4:7	SD card capacity (unit MB, LSB is at the front and MSB is at the back)
		8:11	Remaining SD card capacity (unit MB, LSB is at the front and MSB is at the back)
		12:15	Remaining shots (LSB is at the front and MSB is at the back)
		16:19	Remaining video recording time (unit: second, LSB is at the front and MSB is at the back)

3.4.10 (0x0A) Format SD Card

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2	Uint8, reserved

3.4.11 (0x20) Set Metering Mode

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, metering mode 0 = center metering 1 = average metering 2 = spot metering
Payload	ACK packet	1	Return code

3.4.12 (0x21) Get Metering Mode

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2	Uint8, metering mode 0 = center metering 1 = average metering 2 = spot metering

3.4.13 (0x22) Set Spot Metering Zone

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, spot metering position coordinates Bit [0:3]: column coordinate, 0 - 11 Bit [4:7]: row coordinate, 0 - 7
Payload	ACK packet	1	Return code

3.4.14 (0x23) Get Spot Metering Zone

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2	Uint8, spot metering position coordinates Bit [0:3]: column coordinate, 0 - 11 Bit [4:7]: row coordinate, 0 - 7

3.4.15 (0x30) Set Focus Mode

Sending end	Data type	Byte	Specification

Adapter	Command packet	1	Uint8, focus mode 0 = Manual focus 1 = Auto focus
Payload	ACK packet	1	Return code

3.4.16 (0x31) Get Focus Mode

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2	Uint8, focus mode 0 = Manual focus 1 = Auto focus

3.4.17 (0x32) Set Focus Zone

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:4	Float, horizontal zone coordinates, range from 0.0 to 1.0. The point Bit [0.0, 0.0] represents the top-left angle of the screen.
		5:8	Float, vertical zone coordinates, rang from 0.0 to 1.0.
Payload	ACK packet	1	Return code

3.4.18 (0x33) Get Focus Zone

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2:5	Float, horizontal zone coordinates, range from 0.0 to 1.0. The point Bit [0.0, 0.0] represents the top-left angle of the screen.
		6:9	Float, vertical zone coordinates, rang from 0.0 to 1.0.

3.4.19 (0x34) Set Digital Zoom Factor

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:4	Float, factor. The valid range is from 1.0 to maximum digital zoom factor.
Payload	ACK packet	1	Return code

3.4.20 (0x35) Get Digital Zoom Factor

Sending end	Data type	Byte	Specification

Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2:5	Float, factor. The valid range is from 1.0 to maximum digital zoom factor.

3.4.21 (0x36) Get Optical Zoom specification

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2:3	Uint16. The maximum focal length of the lens in units of 0.1mm.
		4:5	Uint16. The minimum focal length of the lens in units of 0.1mm.
		6:7	Uint16. The minimum interval of focal length change in units of 0.1mm.

3.4.22 (0x37) Set Optical Zoom Focal Length

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:2	Float. Focal length of zoom lens in units of 0.1mm.
Payload	ACK packet	1	Return code

3.4.23 (0x38) Get Optical Zoom Focal Length

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		1:2	Float. Focal length of zoom lens in units of 0.1mm.

3.4.24 (0x39) Get Optical Zoom Factor

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2:5	Float, factor. The valid range is from 1.0 to 30.0.

3.4.25 (0x40) Start Continuous Optical Zoom

Start changing the focal length of the lens in specified direction with specified speed. Focal length change (zooming) should halt when maximum or minimum focal lengths are reached, or Stop Continuous Optical Zoom is called.

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, Zoom speed. 72: SLOWEST. Lens zooms very in slowest speed. 73: SLOW. Lens zooms in slow speed. 74: MODERATELY_SLOW. Lens zooms in speed slightly slower than normal speed. 75: NORMAL. Lens zooms in normal speed. 76: MODERATELY_FAST. Lens zooms very in speed slightly faster than normal speed. 77: FAST. Lens zooms very in fast speed. 78: FASTEST. Lens zooms very in fastest speed.
		2	Uint8, Zoom Direction. 1: ZOOM_IN. Lens will zoom in. The focal length increases, field of view becomes narrower and magnification is higher. 0: ZOOM_OUT. Lens will zoom out. The focal length decreases, field of view becomes wider and magnification is lower.
Payload	ACK packet	1	Return code

3.4.26 (0x41) Stop Continuous Optical Zoom

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	----
Payload	ACK packet	1	Return code

3.4.27 (0x42) Set Focus Assistant Setting

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, focus assistant settings. Bit [0] - the lens focus assistant is enabled for Auto Focusing. Bit [1] - the lens focus assistant is enabled for Manual Focusing.
Payload	ACK packet	1	Return code

3.4.28 (0x43) Get Focus Assistant Setting

Sending end	Data type	Byte	Specification

Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2	Uint8, focus assistant settings. Bit [0] - the lens focus assistant is enabled for Auto Focusing. Bit [1] - the lens focus assistant is enabled for Manual Focusing.

3.4.29 (0x44) Get Focus Ring Value Upper Bound

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2:3	Uint16, lens focusing ring value's max value

3.4.30 (0x45) Set Focus Ring Value

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:2	Uint16, focus ring value. Value can have a range of [0, Focus Ring Value Upper Bound], which represents infinity and the closest possible focal distance respectively.
Payload	ACK packet	1	Return code

3.4.31 (0x46) Get Focus Ring Value

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2:3	Uint16, lens focus ring value

3.4.32 (0x47) Get Digital Zoom specification

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2:5	Float, the maximum digital zoom factor camera supported.

3.4.33 (0xFF) Get Camera Command Set Support State

Sending end	Data type	Byte	Specification

Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2	Uint8, camera command set support state. Bit [0]: camera command se support state. 0: not support camera command set. 1: support camera command set. Bit [1]: optical zoom support state. 0: not support 1: support Bit [2]: digital zoom support state. 0: not support 1: support Bit [3]: focus function support state. 0: not support 1: support Bit [4]: metering function support state. 0: not support 1: support Bit [5-7]: Reserved.

3.5 GIMBAL COMMAND SET (0X05)

3.5.1 (0x01) Get Gimbal State

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	-----
Payload	ACK packet	1	Return code
		2	Uint8, gimbal mode 0: Free mode 1: Following mode 2: FPV mode
		3	Uint8, gimbal state Bit [0]: gimbal mounting direction 0: downward mounting; 1: upward mounting Bit [1]: whether YAW reaches limits 0: does not reach limits; 1: reaches limits Bit [2]: whether ROLL reaches limits 0: does not reach limits; 1: reaches limits

			Bit [3]: whether PITCH reaches limits 0: does not reach limits; 1: reaches limits
		4:5	current PITCH axis angle, unit: 0.1 degree
		6:7	current ROLL axis angle, unit: 0.1 degree
		8:9	current YAW axis angle, unit: 0.1 degree

3.5.2 (0x02) Set Gimbal Mode

Sending end	Data type	Byte	Specification
Adapter	Command packet	1	Uint8, gimbal mode 0: Free mode 1: FPV mode 2: Following mode
Payload	ACK packet	1	Return code

3.5.3 (0x03) Gimbal Return Head

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code

3.5.4 (0x04) Control Gimbal Angle Speed

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:2	Int16, angular speed of the PITCH axis, unit: 0.1°/s, the range is (-1800+1800)
		3:4	Int16, angular speed of the ROLL axis, unit: 0.1°/s, the range is (-1800+1800)
		5:6	Int16, angular speed of the YAW axis, unit: 0.1°/s, the range is (-1800+1800)
		7	Uint8, gimbal control action. 0: Stop control gimbal 1: Control gimbal
Payload	ACK packet	1	Return code

3.5.5 (0x05) Control Gimbal Angle

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:4	Float, angle of the PITCH axis, unit: degree
		5:8	Float, angle of the ROLL axis, unit: degree
		9:12	Float, angle of the YAW axis, unit: degree
Payload	ACK packet	1	Return code

3.5.6 (0x06) Control Gimbal Joint Angle

Sending end	Data type	Byte	Specification

Adapter	Command packet	1:2	Uint16, current joint angle of PITCH axis, unit: 0.1 degree
		3:4	Uint16, current joint angle of ROLL axis, unit: 0.1 degree
		5:6	Uint16, current joint angle of YAW axis, unit: 0.1 degree
Payload	ACK packet	1	Return code

3.5.7 (0x07) Gimbal Calibration

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code

3.5.8 (0x08) Get Gimbal Calibration Progress

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2	Uint8, gimbal calibration progress percentage, range from 0 to 100.
		3	Uint8, gimbal calibration status 0: calibration complete; 1: calibration is processing; 2: calibration failed.

3.5.9 (0x09) Get Gimbal Additional Status

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code
		2:5	Float, rotation speed of PITCH axis in body coordinate, unit: 0.1 degree/s.
		6:9	Float, rotation speed of ROLL axis in body coordinate, unit: 0.1 degree/s.
		10:13	Float, rotation speed of YAW axis in body coordinate, unit: 0.1 degree/s.

3.5.10 (0xFF) Get Gimbal Command Set Support State

Sending end	Data type	Byte	Specification
Adapter	Command packet	----	
Payload	ACK packet	1	Return code

		2	Uint8, gimbal command set support state. 0: not support gimbal command set. 1: support gimbal command set.

3.6 OSDK FUNCTION COMMAND SET (0X06)

3.6.1 (0x01) Transparent Data Transmission (Onboard SDK to Payload SDK)

The command is used for transparently transmitting data from Onboard SDK to payload end.

Sending end	Data type	Byte	Specification
Adapter	Command packet	1:N	Data transmitted, 1<=N<=255
Payload	ACK packet	----	Does not provide an ACK

3.6.2 (0x02) Transparent Data Transmission (Payload SDK to Onboard SDK)

The command is used for transparently transmitting data from payload to Onboard SDK.

Sending end	Data type	Byte	Specification
Payload	Command packet	1:N	Data transmitted, 1<=N<=255
Adapter	ACK packet	----	Does not provide an ACK

3.7 POSITIONING COMMAND SET (0X07)

3.7.1 (0x01) Get Position

The command is used to get position of target points based on synced UTC timestamp when some events are triggered. When users have set structure parameters of payload and interest points (e.g. center point of camera image sensor), the target points is interest points, otherwise the target points is gimbal interface center. Users can use position information of gimbal interface center, position offset between gimbal interface center and RTK main antenna, UAV attitude, gimbal structure parameters and gimbal attitude to calculate position of interest points in payload.

Note: the requested UTC timestamp must be between the time point 2 seconds earlier than the newest synchronized timestamp and the newest synchronized timestamp. Max request frequency of the command is 5Hz. The command support request positions of multiple interest points simultaneously, and count of interest points is not more than 5. Every timestamp requested is sum of base timestamp and corresponding time offset.

Sending end	Data type	Byte	Specification
Payload	Command packet	1	Uint8, target point count, range from 1 to 5
		2	Uint8, task index, specifies sequence number of operations
		3:4	Uint16, year of base timestamp
		5	Uint8, month of base timestamp
		6	Uint8, day of base timestamp

		7	Uint8, hour of base timestamp
		8	Uint8, minute of base timestamp
		9	Uint8, second of base timestamp
		10:11	Uint16, event index and target point index of target point 1 Bit [0:12]: event index, specifies sequence number of events Bit [13:15]: target point index, specifies sequence number of target points
		12:15	Uint32, time offset between base timestamp and time of event of target point 1, range from 0 to 2000000, unit: microsecond
		...	...
		6N+4:6N+5 (1<=N<=5)	Uint16, event index and target point index of target point N Bit [0:12]: event index, specifies sequence number of events Bit [13:15]: target point index, specifies sequence number of target points
		6N+6:6N+9 (1<=N<=5)	Uint32, time offset between base timestamp and time of event of target point N, range from 0 to 2000000, unit: microsecond
Adapter	ACK packet	1	Return code
		2	Uint8, target point count, range from 1 to 5
		3	Uint8, task index, specifies sequence number of operations
		4:5	Uint16, year of base timestamp
		6	Uint8, month of base timestamp
		7	Uint8, day of base timestamp
		8	Uint8, hour of base timestamp
		9	Uint8, minute of base timestamp
		10	Uint8, second of base timestamp
		11:12	Uint16, event index and target point index of target point 1 Bit [0:12]: event index, specifies sequence number of events Bit [13:15]: target point index, specifies sequence number of target points

		13:16	Uint32, time offset between base timestamp and time of event of target point 1, range from 0 to 2000000, unit: microsecond
		17	Uint8, position solution property of target point 1 0: position solution is not available 16: single point position solution 34: float position solution 50: fixed point position solution
		18	Uint8, reserved
		19:20	Int16, UAV attitude angle in pitch axis of target point 1, range from -180 to 180, unit: degree
		21:22	Int16, UAV attitude angle in roll axis of target point 1, range from -180 to 180, unit: degree
		23:24	Int16, UAV attitude angle in yaw axis of target point 1, range from -180 to 180, unit: degree
		25:26	Int16, position offset from RTK main antenna to target point in N direction of NED coordinate system of target point 1, unit: mm
		27:28	Int16, position offset from RTK main antenna to target point in E direction of NED coordinate system of target point 1, unit: mm
		29:30	Int16, position offset from RTK main antenna to target point in D direction of NED coordinate system of target point 1, unit: mm
		31:38	Double, longitude at target point of target point 1, unit: degree
		39:46	Double, latitude at target point of target point 1, unit: degree
		47:54	Double, height above sea level at target point of target point 1, unit: m
		55:58	Float, longitude standard deviation of target point 1
		59:62	Float, latitude standard deviation of target point 1

		63:66	Float, height standard deviation of target point 1
		...	...
		56N-45:56N-44 (1<=N<=5)	Uint16, event index and target point index of target point N Bit [0:12]: event index, specifies sequence number of events Bit [13:15]: target point index, specifies sequence number of target points
		56N-43:56N-40 (1<=N<=5)	Uint32, time offset between base timestamp and time of event of target point N, range from 0 to 2000000, unit: microsecond
		56N-39 (1<=N<=5)	Uint8, position solution property of target point N 0: position solution is not available 16: single point position solution 34: float position solution 50: fixed point position solution
		56N-38 (1<=N<=5)	Uint8, reserved
		56N-37:56N-36 (1<=N<=5)	Int16, UAV attitude angle in pitch axis of target point N, range from -180 to 180, unit: degree
		56N-35:56N-34 (1<=N<=5)	Int16, UAV attitude angle in roll axis of target point N, range from -180 to 180, unit: degree
		56N-33:56N-32 (1<=N<=5)	Int16, UAV attitude angle in yaw axis of target point N, range from -180 to 180, unit: degree
		56N-31:56N-30 (1<=N<=5)	Int16, position offset from RTK main antenna to target point in N direction of NED coordinate system of target point N, unit: mm
		56N-29:56N-28 (1<=N<=5)	Int16, position offset from RTK main antenna to target point in E direction of NED coordinate system of target point N, unit: mm
		56N-27:56N-26 (1<=N<=5)	Int16, position offset from RTK main antenna to target point in D direction of NED coordinate system of target point N, unit: mm
		56N-25:56N-18 (1<=N<=5)	Double, longitude at target point of target point N, unit: degree

		56N-17:56N-10 (1<=N<=5)	Double, latitude at target point of target point N, unit: degree
		56N-9:56N-2 (1<=N<=5)	Double, height above sea level at target point of target point N, unit: m
		56N-1:56N+2 (1<=N<=5)	Float, longitude standard deviation of target point N
		56N+3:56N+6 (1<=N<=5)	Float, latitude standard deviation of target point N
		56N+7:56N+10 (1<=N<=5)	Float, height standard deviation of target point N