Topotek-SMT-series-Protocol

（Version：V1.00）

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Revision

Data	Version	Descript	Writer
2018.12.03	V1.0.0	SMT series protocol（SMT18SQ6, SMT18st, SMT30SQ6）	Liang
2020.04.22		English version	Cai

Catalog

1. Introduction

This tele-com protocols is based on SMT series optical zoom tracking gimbal system，包括 SMT10sQ3/6、SMT18sQ3/6、SMT30sQ3/6，SMT18sT、SMT30sT.

2. Command Format

1：Frame Structure

12 to 27 char

Frame Head (3char)	Target Bit (2char)	Data Length (1char)	Control Bit (1char)	Identify Bit (3char)	Data1 (char)	。。。。 (char)	Data L (char)	Correlation Bit (2char)
#TP	U/M/D/I/E/P	L	w/r	X1X2X3	D1	。。。。	DL	CRC

Frame Head:

#TP - data length is 2 byte, fixed length command;

#tp - various length command, data length depends on length bit, the maximum length is 0x0F;

Target Bit：（source address, target address）

U	M	D	E	G
Uart	lens	ISP image	Auxiliary equipment	Gimbal

U：UART device address bit, that is, the external control module address is u when the external control module is controlled through the serial port；

M: Zoom lens address bit, the command to lens, such as : zoom， focus;

D：ISP processor address, such as record, photo, TF status ,and so on ;

E：Auxiliary equipment address, such as thermal camera, laser measure(LRF);

G：Gimbal address, such as pitch, yaw control, angle reading；

[Target] same as above;

[Data Length] depends on how many data we have, the maximum length is F;

[Control bit] r->query; w->setup; c->callback

[Data1] data;

[Identifier] to be used for identifying; (see about Appendix I）

[CRC] all converted to HEX except the head. Use accumulation to add up, then convert result to ASC-II, 2 chars, high bit is in front; see attachment in the last page. （see about Appendix II）

Serial Port setting:

Baud Rate :115200， data length is 8, stop bit is 1, CRC is none.

2：Response

(1) correct command:
Control command: echo the same as before, exchange source address and destination;
Query command: put query content in frame Data Bit to echo, exchange source address and destination;
(2) wrong command：
Command failed：#TP dd 2wERE!! RR
Example: #TPMU2wERE!!30
Exchange source address and destination

3. M command

1：ZOOM

1.1 Control

Control bit：w

Identify Bit：ZMC

Data bit：

00	stop
01	zoom in
02	zoom out

Note: zoom in/out shall be used together with stop commands

Uart command example：

#TPUM2wZMC005C stop
#TPUM2wZMC015D zoom in
#TPUM2wZMC025E zoom out

1.2 Reading

Control bit：w

Identify Bit：ZMC

Data bit：00

Uart command example：

send：#TPUM2rZOM0063

receive：#tpMU4rZOM Z0Z1Z2Z3 RR

Z0Z1Z2Z3：use four chars to represent signed char zoom location, high bit is in front;

eg：#tpMU4rZOMFFB447

Z0Z1Z2Z3 = FFB4(char) -> FFB4(Hex) ->-76

Note that zoom location is -76

2：FOCUS

2.1 Control

Control bit：w

Identify Bit：FCC

Data bit：X_0X_1

X_0X_1	
00	stop
01	focus +
02	focus -
10	Auto mode（To be added）
11	Manual mode（To be added）
12	Keying mode（To be added）
20	Trigger one focus（To be added）

Note: focus in/out shall be used together with stop commands

Uart command example：

#TPUM2wFCC003E stop
#TPUM2wFCC013F focus+
#TPUM2wFCC0240 focus-

2.2 Reading

Control bit：w

Identify Bit：FCC

Data bit：00

Uart command example：

send：#TPUM2rFOC0045

receive：#tpMU2rFOC　F0F1F2F3 RR

F0F1F2F3：use four chars to represent signed char zoom location, high bit is in front;

eg：#tpMU4rFOCFFB429

F0F1F2F3 = FFB4(char) -> FFB4(Hex) ->-76

Note that zoom location is -76

3：configure zoom and focus position

Control bit：w

Identify Bit：ZFP

Data bit：Z0Z1Z2Z3 F0F1F2F3

Z0Z1Z2Z3：use four chars to represent signed char zoom location, high bit is in front;

Z0Z1Z2Z3：use four chars to represent signed char focus location, high bit is in front;

Example：set zoom position as -76，focus position as 50，convert -76 and 50 to complement form FFB4 and 0032. Then convert them to be 'F''F''B''4' and '0''0''3''2'; Add frame head、address、frame length、commands and CRC. Finally name it as #tpUM8wZFPFFB400320F.

Note: If only set zoom position, focus value should be filled with 'N''N''N''N'；and the camera will autofocus after setting.

4：IRCUT switch(day/night switch)

Control bit：w

Identify Bit：IRC

Data bit：x_1x_2

00	Day mode
01	Night mode
0A	Reverse status

Uart command example：#TPUM2wIRC0A61

5：Remote device turn on（need customized）

Control bit：w

Identify Bit：SWH

Data bit：X_0X_1

X_0	5	C
	Laser measure, PM2.5 detector	Thermal camera, laser zoom light
X_1	0	1
	Close	Open

Uart command send example：#TPUM2wSWHC178

Control bit：r

Identify Bit：SWH

Data bit：X_0X_1

Send	#TPUM2rSWH005F	
Receive	#TPUM2rSWH X0X1 RR	
X_0	5	C
	Laser measure, PM2.5 detector	Thermal camera, laser zoom light
X_1	0	1
	Close	Open

4. G command

1： Gimbal /PTZ control

Control bit：w
Identify Bit：PTZ
Data bit：x1x2

x1x2	00	01	02	03	04	05
Func	stop	up	down	left	right	Goto Center position
x1x2	06	07	08	09		
Func	Follow	Lock	Lock/follow switch	Gimbal calibration		

Uart command example：#TPUG2wPTZ006A

2：Gimbal speed mode control

Control bit：w
Identify Bit：GSY、GSP、GSR、GSM
Data bit：x1x2

Gimbal_speed_Control	
YAW Cmd	#TPUG 2 w GSY X0X1 RR
	X0X1
	Rotation Speed（-99,99）(0.1deg/s)
PITCH Cmd	#TPUG 2 w GSP X0X1 RR
	X0X1
	Rotation Speed（-99,+99）(0.1deg/s)
ROLL Cmd	#TPUG 2 w GSR X0X1 RR
	X0X1
	Rotation Speed（-99,+99）(0.1deg/s)
Yaw&Pitch	#tpUG 4 w GSM Y0Y1 P0P1 RR
	Y0Y1 P0P1
	Rotation Speed（-99,99）(0.1deg/s)

#TPUG2wGSYE276

Gimbal rotation speed is X0X where X0X1 is 8 signed char（unit is 0.1degree/s），The right direction of Yaw is positive. The up of Pitch is positive. E.g. gimbal rotates at speed 3 degree/sec to left, we have to convert -30 to 0xE2, then further converted to ’E’、’2’. Noe that RR is calibration.

3：Gimbal Angle Control Mode

3.1 Gimbal_Angle_Control

Control bit：w
Identify Bit：GAY、GAP、GAR、GAM
Data bit：see below

Gimbal_Angle_Control		
Yaw	#tpUG 6 w GAY X0X1X2X3 X4X5 RR	
	X0X1X2X3	X4X5
	Angle （-150.00,150.00）	Rotation Speed is (0,99) with precision (0.1deg/s)
Pitch	#tpUG 6 w GAP X0X1X2X3 X4X5 RR	

	X0X1X2X3	X4X5
	Angle （-90.00,+90.00）	Rotation Speed is (0,99) with precision (0.1deg/s)
Roll	#tpUG 6 w GAR X0X1X2X3 X4X5 RR	
	X0X1X2X3	X4X5
	Angle （-90.00,+90.00）	Rotation Speed is (0,99) with precision (0.1deg/s)
Yaw&Pitch	#tpUG C w GAM Y0Y1Y2Y3 Y4Y5 P0P1P2P3 P4P5 RR	
	Y0Y1Y2Y3 / P0P1P2P3	Y4Y5 / P4P5
	Angle （-150.00,150.00）/（-90.00,+90.00）	Rotation Speed is (0,99) with precision (0.1deg/s)

Example:#tpUG6wGAYEF073288

Gimbal rotates at speed of X4X5. X0X1X2X3 indicates angle. They are using 16 bits data to represent string. The right-side of Yaw is positive, the up-side of Pitch is positive. E.g. Angle is -50 degree. We have to use -5000, then convert it to be 16 bit binary number 0xEC78, then further convert it to be 'E'、'C'、'7'、'8'. X4X5 ； Note that RR is calibration.

3.2 Get Gimbal Current Angle

Control bit：r

Identify Bit：GAC

Data bit：00

Uart command example：

send：#TPUG2rGAC0032

receive：#tpUG C r GAC Y0Y1Y2Y3P0P1P2P3R0R1R2R3 CC

Y0Y1Y2Y3	P0P1P2P3	R0R1R2R3
Yaw Angle	Pitch Angle	Roll Angle

Angle is 16 bit binary data. High bit is in front.

Example: Y0Y1Y2Y3 = 'E' 'C' '7' '8' = 0xEC78 = -5000（0.01degree）

3.3 Gimbal angle info send out regularly

Gimbal angle info send out regularly Setting ：

Control bit：w

Identify Bit：GAA

Data bit：X0X1

X0X1	
01	**Enable sending**
00	**Close sending**

Uart command example：#TPUG2wGAA0136

Inquiry the regularly sending status：

Control bit：r

Identify Bit：GAA

Data bit：00

receive:	**#TPGU2rGAA x1x2 RR**
00	**Close**
01	**enable**

Uart command example：#TPUG2rGAA0030

4：Tracking Cursor movement（For dual light gimbal tracking）

4.1 x axis moving

Control bit：w
Identify Bit：SYC
Data bit：$X_0X_1X_2X_3$

4.1 Y axis moving

Control bit：w
Identify Bit：SPC
Data bit：X0X1X2X3

Control the crosshairs to move to x0x1x2x3; x0x1x2x3 indicates the number of pixels deviating from the center point, the 16 bit signed number represented by the character (unit: pixel), the right of X axis is positive, and the lower of Y axis is positive (eg: move to the position of 50 pixels on the left, i.e., convert - 50 hex representation 0xffce to 'f', 'f', 'C', 'e'); RR check bit

Note：Initially, any movement of the transmit cursor will result in a Crosshairs；

5：Tracking control（For dual light gimbal tracking）

Control bit：w
Identify Bit：SUM
Data bit：X_0X_1

X_0X_1	
00	Tracking stop
01	Tracking confirm
02	Secondary tracking (reselect target during existing tracking)

#TPUG2wSUM0061 Tracking stop
#TPUG2wSUM0162 Tracking confirm
#TPUG2wSUM0263 Secondary tracking

Note: if the crosshairs do not appear, the tracking confirmation will be sent directly, and the center point will be the target;

5. D command

1：Record

1.1 control

Control bit：w
Identify Bit：REC
Data bit：x_1x_2

x_1x_2	Function description
00	Stop record
01	Start record
0A	Overturn status

Uart command example：#TPUD2wREC0A54

1.2 inquiry status

Control bit：r
Identify Bit：REC
Data bit：x_1x_2

X_2	0	1
description	No record	Being record

Uart command example：#TPUD2rREC003E

2：Photograph

Control bit：w
Identify Bit：CAP
Data bit：0 1
Uart command example：#TPUD2wCAP013E

3：Menu control

Control bit：w
Identify Bit：MNU
Data bit：0 X

x	1	2	3	4	5	6
描述	up	down	left	right	ok	Menu

Uart command example：#TPUD2wMNU065F

4：Photo resolution

Setting

Control bit：w
Identify Bit：PIC
Data bit：X_0X_1

x_1/x_2	**0**	**1**	**2**	**3**	**A**	**B**	**N**
	400w	800w	1300w	1600w	+	-	null

Note: when it is a dual light lens, x0 / X1 will take effect, otherwise only X1 will take effect;
Uart command example：#TPUD2wPIC0045

Reading

Control bit：r
Identify Bit：PIC
Data bit：00
Data return: X_0X_1（See setting table for data meaning）
Uart command example：#TPUD2rPIC0040

5 Video resolution

Setting
Control bit：w
Identify Bit：VID
Data bit：X_0X_1

x_1/x_2	0	1	A	B	N
	720p	1080p	+	-	null

Note: when it is a dual visible lens, x0 / X1 will take effect, otherwise only X1 will take effect；
Uart command example：#TPUD2wVID004C

Reading
Control bit：r
Identify Bit：VID
Data bit：00
Data return: X_0X_1（See setting table for data meaning）
Uart command example：#TPUD2rVID0047

6：TF card capacity

Control bit：r
Identify Bit：SDC
Data bit：x_1x_2

x_1x_2	Description	x_1x_2	Description
00	Get remaining capacity	01	Get total capacity

Uart command example：#TPUD2rSDC003E

Data meaning read：**$X_0X_1X_2X_3X_4$**
Remaining capacity of TF card（Hexadecimal, big Endian, in MB）
NNNNN：Indicates that the TF card is not inserted

7: Tracking control（Single tracking version）

Control bit：w
Identify Bit：TRC
Data bit：x_0x_1

x_0x_1	00	0A
	Stop	Adaptive to state

Uart command example：#TPUD2wTRC0153

7：ISP control

7.1 AWB

Setting

Control bit：w

Identify Bit：AWB

Data bit：X_0X_1

x_0/x_1	X0 for main lens X1 for sub lens
0	auto
1	night
2	incandescent
3	fluorescent
4	Warm-fluorescent
5	daylight
6	Cloudy- daylight
7	twilight
8	Shade
A	AWB +
B	AWB -
N	null

Note: when it is a dual visible lens, x0 / X1 will take effect, otherwise only X1 will take effect;

Uart command example：#TPUD2wAWB0043

Reading

Control bit：r

Identify Bit：AWB

Data bit：00

Data return: X_0X_1（See setting table for data meaning）

Uart command example：#TPUD2rAWB003E

7.2 ISO

Setting

Control bit：w

Identify Bit：ISO

Data bit：X_0X_1

x_1/x_2	**0**	**1**	**2**	**3**	**4**	**5**	**A**	**B**	**N**
	auto	100	200	400	800	1600	+	-	null

Note: when it is a dual visible lens, x0 / X1 will take effect, otherwise only X1 will take effect;

Uart command example：#TPUD2wISO0054

Reading

Control bit：r

Identify Bit：ISO

Data bit：00

Data return: X_0X_1（See setting table for data meaning）

Uart command example：#TPUD2rISO004F

7.3 EV

Setting

Control bit：w

Identify Bit：EVS

Data bit：X_0X_1

x_1/x_2	0	1	2	3	4	5	6	A	B	N
	-3	-2	-1	0	1	2	3	+	-	null

Note: when it is a dual visible lens, x0 / X1 will take effect, otherwise only X1 will take effect;

Uart command example：#TPUD2wEVS0057

Reading

Control bit：r

Identify Bit：EVS

Data bit：00

Data return: X_0X_1（See setting table for data meaning）

Uart command example：#TPUD2rEVS0052

8 Display mode

Setting

Control bit：w

Identify Bit：PIP

Data bit：X_0X_1

x	0	1	2	3	A	B
	m+s	m only	s+m	s only	+	-

Note: when it is a dual light lens, x0 / X1 will take effect, m main camera, s auxiliary camera;

Uart command example：#TPUD2wPIP0A63

Reading

Control bit：r

Identify Bit：VID

Data bit：00

Data return: X_0X_1（See setting table for data meaning）

Uart command example：#TPUD2rPIP004D

9 Time coordinate

Control bit：w

Identify Bit：see below table

Data bit：see below table

Description	Control bit	Data bit
Latitude	LAT	X_0 X_1...X_A
Longitude	LON	X_0 X_1...X_B
Altitude	ALT	X_0 X_1...X_5
Time	TIM	X_0 X_1...X_E（hh-mm-ss.ss-DD-MM-YY）

Uart command example：#tpUDFwTIM142832.0003121838 2018-12-03 14:28:32

6. E command

1：Thermal camera

1.1 Pseudo color

Setting

Control bit：w

Identify Bit：IMG

Data bit：X_0X_1

X_1X_2	00	01	02	03	04	05	06	07	08	09	0A	0B
descript	White/black	White/black/high tmp red	Red hot	Yellow hot outline	Yellow hot	color 4	color5	color6	color7	color8	Next	Pre

Uart command example：#TPUE2wIMG0A58

Reading

Control bit：r

Identify Bit：IMG

Data bit：00

Data return: X_0X_1（See setting table for data meaning）

Uart command example：#TPUE2rIMG0042

1.2 Digital zoom

Setting

Control bit：w

Identify Bit：DZM

Data bit：X_0X_1

X_0X_1	01	02	03	04	0A	0B
	1x	2x	3x	4x	Zoom+	Zoom-

Uart command example：#TPUE2wDZM0AF5

Reading

Control bit：r

Identify Bit：DZM

Data bit：00

Data return: X_0X_1（See setting table for data meaning）

Uart command example：#TPUE2rDZMF0

1.3 Record

Control bit：w

Identify Bit：REC

Data bit：X_0X_1

X_0X_1	00	01	0A
Record status	Stop	Start	Overturn

1.4 Photograph

Control bit：w

Identify Bit：CAP

Data bit：X_0X_1

X_0X_1	01	02	03
Photo type	raw	HVT	jpeg

2：Laser range finder

Appendix I：Identify Bit

Identify Bit	Description		Identify Bit	Description
ZMC	ZOOM control		REC	Record
FCC	Focus control		CAP	Photograph
ZFP	Setting zoom& focus position		IRC	IR cut switch
PTZ	Gimbal control (PTZ)		MNU	Menu
GAC	Gimbal angle status		GAA	Gimbal angle send out regularly
GSY	Speed control of YAW axis of PTZ		GAY	Angle control of YAW axis of PTZ
GSP	Speed control of Pitch axis of PTZ		GAP	Angle control of Pitch axis of PTZ
GSR	Speed control of Roll axis of PTZ		GAR	Angle control of Roll axis of PTZ
GSM	Speed control of YAW& Pitch axis of PTZ		GAM	Angle control of YAW& Pitch axis of PTZ
SDC	TF card capacity		AWB	Auto white balance
ISO	Photo sensibility		EVS	Exposure compensation
LAT	latitude		ALT	height
LON	longitude		TIM	Time

Appendix II：CRC calculation

```
char CalculateCrc(volatile char *cmd, char len){
    char crc;
    int i;

    crc=0;
    for(i=0; i<len; i++){
        crc += cmd[i];
    }
    return(crc);
}
```

To convert the generated hex to two characters:
eg：#TPUD2wAWB01
The value of the generated CRC is 0x44
Then the final command is a string：#TPUD2wAWB0144

If the product version needs to be upgraded or the functions are required to be changed, please feel free to contact us for further technical support.

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