Viewpro Gimbal Camera Protocol V3.1

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Content

1. Serial Control Connection:

TTL 3.3v UART baud: 115200, 8/1/N, HEX

Use 'USB to TTL' cable to connect
White cable (the 'RX' of cable) ----------- TX
Green cable (the 'TX' of cable) ----------- RX
Black cable (the 'GND' of cable) ---------- GND

Viewport Version control box
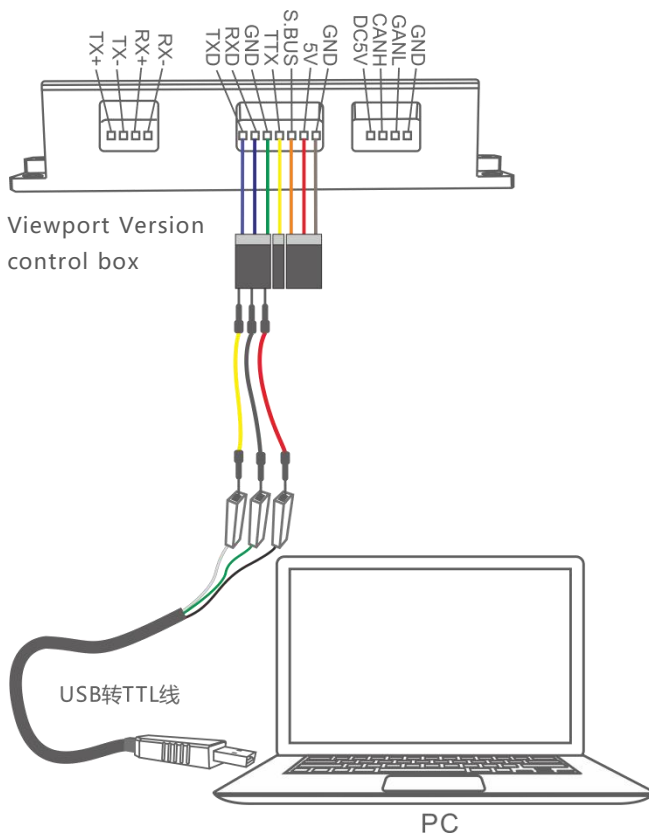
Standard Version control box

USB转TTL线

USB转TTL线

普通版控制盒

PC

PC
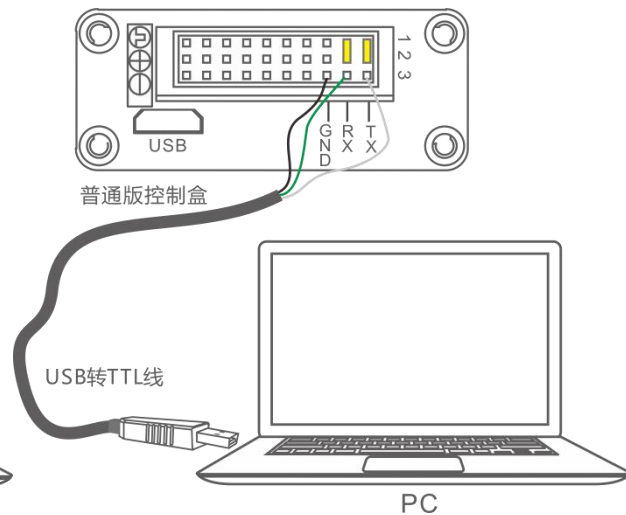
Please connect your RX to TXD, and TX to RXD as shown in the figures.
Note：
After sending "AA 55 08 06 FF", TX2(TTX), RX2(S.BUS), GND will be the second serial port of the gimbal, UART baud: 115200

RX1/ RX2 and TX1 / TX2 must be connected with yellow jumper caps before connecting UART/FTDI devices.
Please connect your RX to TX, and TX to RX as shown in the figures.
CAUTION!!
1) the signals inside red frame are all TTL signals, DO NOT connect these pin headers to any power(VCC) or ground(GND)!
2) The other signals is for PWM input signals to control the gimbal,
PWM in: connect to your PWM receiver signals (does not include AV, AV output is for CVBS video signal)
5V out: for your PWM receiver power supply.
GND: connect to your PWM receiver GND.

2. CMD_CONTROL -control gimbal Movement:

FF 01 0F 10 RM PM YM Rsl Rsh Ral Rah Psl Psh Pal Pah Ysl Ysh Yal Yah CS
  HEAD CONTRL MODE SPEED ANGLE SPEED ANGLE SPEED ANGLE CHECKSUM

RM: Roll control Mode,**00**=MODE_NO_CONTRL, **01**=MODE_SPEED, **02** = MODE_ANGLE, **03** = MODE_SPEED_ANGLE ,**04** = MODE_RC, **05**=MODE_ANGLE_REF_FRAME, **06** = MODE_RC_HIGH_RES.

ROLL SPEED: RS= **0xRshRsl**   Rsl = low byte; Rsh= high byte (2 byte signed, little-endian order), units: 0,1220740379 degree/sec;

ROLL ANGLE: RA= **0xRahRal** Ral = low byte ; Rah= high byte (2 byte signed, little-endian order), units: 0.02197265625 degree/sec;

PM Psl Psh Pal Pah: Pitch control, same as roll control formats

YM Ysl Ysh Yal Yah: Yaw control, same as roll control formats
    sl= Speed Low byte, sh = speed high byte, al= angle low byte, ah= angle high byte.

If use RC mode, PA/YA is RC value should be -500~500, (-500 is PWM 1000ms, 0 is PWM 1500ms, 500 is PWM 2000ms)

CS = body checksum, checksum is calculated as a sum of bytes from 'RM' to 'YAH' modulo 256.

example1: ROLL no control, PITCH speed mode 1.22degree/sec, YAW speed mode 1.22degree/sec. FF 01 0F 10 00 01 01 00 00 00 00 0A 00 00 00 0A 00 00 00 16
Example2: ROLL no control，PITCH angle mode to 40 degree down REF home position，YAW angle mode 40 degree left REF home position. FF 01 0F 10 00 05 05 00 00 00 00 00 00 1C 07 00 00 E4 F8 09
Example3: RC control pitch down(PWM = 1920, PA value = 1920-1500 = 420), RC control Yaw left (PWM = 1050, YA value =1050-1500 = -450) FF 01 0F 10 00 04 04 00 00 00 00 00 00 A4 01 00 00 3E FE E9
Example4: at all mode, stop command pitch and yaw use the command: FF 01 0F 10 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Name	Type	Min	Max	Possible values, remarks
Legacy format: mode is common for all axes				
CONTROL_MODE	1u			Bits 0..3 for mode, bits 4..7 for flags.
				Modes:
				MODE_NO_CONTROL=0
				If this mode is set for all axes, finish serial control and restore normal RC control. If set for single axis, does not change its current control mode.
				MODE_SPEED=1
				Camera travels with the given speed in the Euler coordinates until the next CMD_CONTROL command comes. Given angle is ignored.
				MODE_ANGLE=2*
				Camera travels to the given Euler angle with the fixed speed. Speed is decreased near target to keep control smooth. Low-pass filter may be applied for the same reason.
				MODE_SPEED_ANGLE=3
				Camera travels with the given speed. Additionally, controller keeps the given angle and fix accumulated error by the outer PI-loop. This mode allows the most precise type of control (see fig.1 for example), but it requires pretty fast update rate to keep it smooth, or apply low-pass filtering for speed and angle.
				MODE_RC=4*
				The ANGLE parameter is used as RC signal and overrides any other signal source, assigned to this axis. Normal working range is -500..500. A special value -10000 encodes a "signal lost" condition. The flag CONTROL_FLAG_AUTO_TASK can affect this mode (see below).
				MODE_RC_HIGH_RES=6*
				The same as the MODE_RC, but the range of the ANGLE parameter has better resolution: -16384..16384. A special value -32768 encodes a "signal lost" condition.

				MODE_ANGLE_REL_FRAME=5* First, the neutral point of a camera relative to a frame is found in the Euler coordinates for a given axis. Than, the given angle (in ±360° range) is added to this point, and camera travels to it. Note that the given angle does not relate to a particular motor, it relates to global Euler angles! Flags: CONTROL_FLAG_AUTO_TASK=(1<<6)

				- If mode is one of the <**MODE_ANGLE, MODE_ANGLE_REL_FRAME**>, the task is processed with the speed and acceleration configured for *automated tasks.* If the SPEED parameter is provided, it's used instead. When all target angles are reached with the 1- degree tolerance, confirmation is sent: CMD_CONFIRM(CMD_CONTROL, 1). Use this flag to move gimbal to a certain position as fast as possible, and receive confirmation when the target is reached. CONTROL_FLAG_FORCE_RC_SPEED=(1<<6) 　　- If mode is **MODE_RC**, this flag forces a control in the "SPEED" mode, with the dead-band, trimming and inversion settings are NOT applied to the provided RC signal, but the LPF, Expo curve and ACC limiter are still applied. Use this flag to control gimbal from remote applications, where signal is well-defined and you need to have a direction of rotation that does not depend on gimbal's "Inverse" and "Mode" parameters. CONTROL_FLAG_HIGH_RES_SPEED=(1<<7) 　　Speed units changed to 0.001 deg/sec for extremely slow motion (like timelapse shooting) * In the control modes "MODE_ANGLE", "MODE_RC", and "MODE_ANGLE_REL_FRAME", if the "SPEED" parameter is not provided (set to zero), the speed is defined by the RC settings. Relationship: SPEED = settings.RC_SPEED*16.
Extended format : mode is set independently for each axes				
CONTROL_MODE[3]	1u*3			see definition above
The remaining part is common for all formats				
axis = (1..3)	SPEED	2s	- - -	- - -	Speed of rotation. Overrides the speed settings in the GUI and from the adjustable variables. Notes: 　·　If the acceleration limiter is enabled in the RC settings, the actual speed is filtered by it;

				· For the modes "MODE_ANGLE", "MODE_RC", "MODE_ANGLE_REL_FRAME", the value may be omitted (set to 0). if this case, speed is taken from the RC settings; Also, in these modes, the actual speed is decreased near target to prevent jerks when the ANGLE parameter given with the high rate, changes slowly; *Units: 0,1220740379 deg./sec.* *(0.001 deg./sec., if the CONTROL_FLAG_HIGH_RES_SPEED is set)*
ANGLE	2s	-32768	32767	Depends on the MODE parameter: · MODE_ANGLE, MODE_SPEED_ANGLE: encodes the target angle · MODE_SPEED: ignored · MODE_RC: encodes RC signal in range -500..500 · MODE_RC_HIGH_RES: encodes RC signal in range -16384..16384
				Units: 0,02197265625 degree.

Notes:

· Serial control overrides RC control. To switch back to RC, send this command with the mode=0 for all axes, and all data set to zeros. All parameters that was changed by the CMD_CONTROL_CONFIG, will be restored to their default values.

2.1) CMD_GET_ANGLES_EXT: 3e 3D 00 3D 00

Gimbal feedback data: **3e 3d 36 73 { ...Data body... } cs**

For example :

{3E 3D 36 73 98 FF 98 FF E6 FF FF FF 00 00 00 00 00 00 00 00 00 00 1C F7 1C F7 28 F7 FF FF 00 00 00 00 00 00 00 00 00 00 88 FF 88 FF F8 F6 FF FF 00 00 00 00 00 00 00 00 00 00 4E }

  3E 3D 36 73 = header,

  98 FF 98 FF E6 FF FF FF 00 00 00 00 00 00 00 00 00 00 = ROLL status data, detail as following

 (98 FF=ROLL _IMU_angle int16_t units: 0.02197265625degree

  98 FF=ROLL_RC_TARGET_ANGLE int16_t units: 0.02197265625degree

  E6 FF FF FF =ROLL_STATOR_REL_ANGLE = camera actual Euler angle int32_t units: 0.02197265625degree

  00 00 00 00 00 00 00 00 00 00 = 10 bytes reserved)

  1C F7 1C F7 28 F7 FF FF 00 00 00 00 00 00 00 00 00 00 = pitch status data, same as roll format

  88 FF 88 FF F8 F6 FF FF 00 00 00 00 00 00 00 00 00 00 = yaw status data, same as roll format

  4E =data body checksum= Sum of data body

CMD_GET_ANGLES_EXT - Information about angles in different format

	Name	Type	Min	Max	Possible values, remarks
axis = (1..3)	IMU_ANGLE	2s			IMU angles in 14-bit resolution per full turn *Units: 0,02197265625 degree*
	TARGET_ANGLE	2s			Target angles, in 14-bit resolution *Units: 0,02197265625 degree*
	STATOR_ROTOR_ANGLE	4s			Relative angle of joints between two arms of gimbal structure, measured by encoder or 2nd IMU. Value 0 corresponds to normal position of a gimbal. This angle does not overflow after multiple turns. *Units: 0,02197265625 degree*
	RESERVED	10b			

2.2) Other commands:

Return head:3E 45 01 46 12 12	Look down: 3E 45 01 46 11 11
Center yaw:3E 45 01 46 23 23	Restore Settings: 3E 45 01 46 35 35
Motor on: 3e 45 01 46 0b 0b	Motor off: 3e 45 01 46 0c 0c
follow_yaw_disable: 3E 1F 06 25 01 1F 00 00 00 00 20	follow_yaw_enable: 3E 1F 06 25 01 1F 01 00 00 00 21
query_follow_state: 3E 40 02 42 01 1F 20	save gimbal settings: 3E 20 00 20 00 00

3. Camera_control_cmd: different model use different commands, so please use command according to your actual model

3.1) Z10F, Z18F, Z30F, Q10F, Q18F, Q30F command:

zoom out: 81 01 04 07 37 FF	zoom in: 81 01 04 07 27 FF	stop zoom: 81 01 04 07 00 FF
focus in: 81 01 04 08 27 FF	focus out: 81 01 04 08 37 FF	stop focus: 81 01 04 08 00 FF
Zoom_direct_pos: 81 01 04 47 0p 0q 0r 0s FF		
Query_zoom_position: 81 09 04 47 ff Zoom_position_feedback: 90 50 0p 0q 0r 0s FF 0xpqrs: zoom_position_value		
photograph /record action command: 81 01 04 68 xx FF xx = : 01 photograph 02 start record 03 stop record 04 invert record state 05 switch to record mode or picture mode Inquiry record/photograph state: 81 09 04 68 FF Camera Feedback: 81 09 04 68 00 FF stop record 81 09 04 68 01 FF recording 81 09 04 68 10 FF photograph mode		
day mode: 81 01 04 01 03 ff night mode: 81 01 04 01 02 ff day/night auto switch mode: 81 01 04 51 02 ff		

3.2) Q30XIR command:

Switch Modes: f8 00 12 01 01 00 00 14   VL(Visible Light) only f8 00 12 01 02 00 00 15   IR only f8 00 12 01 03 00 00 16   Fusion-A f8 00 12 01 04 00 00 17   Fusion-B f8 00 12 01 05 00 00 18   PIP f8 00 12 01 06 00 00 19   PIP-A f8 00 12 01 07 00 00 1a   PIP-B
IR Color Palette Settings: f8 00 12 02 00 00 00 14   Iron red f8 00 12 02 01 00 00 15   Amber f8 00 12 02 02 00 00 16   Yellow f8 00 12 02 03 00 00 17   Green blue yellow red f8 00 12 02 04 00 00 18   Black red f8 00 12 02 05 00 00 19   Blue yellow red f8 00 12 02 06 00 00 1a   Blue red yellow f8 00 12 02 07 00 00 1b   Blue green f8 00 12 02 08 00 00 1c   White hot f8 00 12 02 09 00 00 1d   Blue green red f8 00 12 02 0a 00 00 1e   Red warning f8 00 12 02 0b 00 00 1f   Amer-2

Record Operations:

f8 00 82 01 00 00 00 83   Start record (AVI)

f8 00 84 00 00 00 00 84   Stop record

f8 00 80 00 00 00 00 80   Snapshot (RAW)

f8 00 80 01 00 00 00 81   Snapshot (JPEG)

Adjust Display:

f8 00 12 03 07 00 00 1c

Zoom in circle

f8 00 12 03 08 00 00 1d   Zoom 1x

f8 00 12 03 08 01 00 1e   Zoom 2x

f8 00 12 03 08 02 00 1f   Zoom 3x

f8 00 12 03 08 03 00 20   Zoom 4x

3.3) QIR19 command:

IR Color Palette Settings:

f8 00 22 03 00 00 00 25   Iron red

f8 00 22 03 01 00 00 26   Amber

f8 00 22 03 02 00 00 27   Yellow

f8 00 22 03 03 00 00 28   Green blue yellow red

f8 00 22 03 04 00 00 29   Black red

f8 00 22 03 05 00 00 2a   Blue yellow red

f8 00 22 03 06 00 00 2b   Blue red yellow

f8 00 22 03 07 00 00 2c   Blue green

f8 00 22 03 08 00 00 2d   White hot

f8 00 22 03 09 00 00 2e   Blue green red

f8 00 22 03 0a 00 00 2f   Red warning

f8 00 22 03 0b 00 00 30   Amer-2

Record Operations:

f8 00 82 01 00 00 00 83   Start record (AVI)

f8 00 84 00 00 00 00 84   Stop record

f8 00 80 00 00 00 00 80   Snapshot (RAW)

f8 00 80 01 00 00 00 81   Snapshot (JPEG)

Zoom in circle

f8 00 30 01 00 00 00 31   Zoom 1x

f8 00 30 02 00 00 00 32   Zoom 2x

f8 00 30 03 00 00 00 33   Zoom 3x

f8 00 30 04 00 00 00 34   Zoom 4x

3.4) Z6KA7 /Z5S/A7R command

Power on/off:FF 01 00 50 00 00 51	zoom_wide:FF 01 00 40 00 00 41	zoom_tele: FF 01 00 20 00 00 21
stop_zoom: FF 01 00 00 00 00 01	Picture: FF 01 00 07 00 66 6E	Record: FF 01 00 07 00 55 5D
Focus: FF 01 00 80 00 00 81	focus hold: FF 01 01 80 00 00 82	focus release:FF 01 02 80 00 00 83
shoot_under_focus_hold : FF 01 00 07 00 67 6F	picture_interval_2s_time: FF 01 00 07 02 6f 79	picture_interval_3s_time: FF 01 00 07 03 6f 7A
picture_interval_OFF: FF 01 00 07 00 6f 77		

3.5) Z25K/Z40K command

zoom_tele:55 aa da 03 bf a5 80 02 c1	zoom_wide:55 aa da 03 7f a5 80 02 81
stop_zoom:55 aa da 03 3f a5 80 02 41	Photograph :55 aa da 03 fb a5 80 02 fd
Rec_start:55 aa da 03 fd a5 80 02 ff	Rec_stop :55 aa da 03 ff a5 80 03 01
Pic_Mode:55 aa 1b 02 01 00 00 1e	Rec Mode:55 aa 1b 02 02 00 00 1f
Rec_1080P:55 aa da 03 ff a0 80 02 fc	Rec_4K:55 aa da 03 ff a7 80 03 03
Osd_on:55 aa 1f 02 00 40 00 61	Osd_off:55 aa 1f 02 00 30 00 51

3.6) Z10N/Z30N command

zoom_wide:FF 01 00 40 00 00 41	zoom_tele: FF 01 00 20 00 00 21	stop_zoom: FF 01 00 00 00 00 01
start_picture: ff 01 00 07 00 66 6E	start_record: ff 01 00 07 00 65 6d	stop_record: FF 01 00 07 00 64 6C
mode_change: FF 01 00 07 00 67 6F	invert_record: FF 01 00 07 00 55 5D	

3.7) T serials model:

Q10T, Q20T, Q30T, Q30T pro, U30T, U30Tpro, Z36T, Z12TL, Z30TL, Mini Z10TIR, Rugby, Z10TIR, Z10TIR-35, Q10TIR-35, U30TIR, U30TIR-50, Z30TIR-25, Z30TIR-50, Q30TIR, Q30TIR-50, Q30TIR-1352, Q40TIR, Z10TIRM, WK10TIRM, Q10TIRM, Q30TIRM, Q30TIRM pro, Z30TM, ZIR25T, ZIR35T, ZIR50T, ZIR1352T.....

Zoom_out: 81 01 04 07 37 FF	Zoom_in: 81 01 04 07 27 FF	Stop_zoom: 81 01 04 07 00 FF
Auto Focus: 81 01 04 38 02 FF	Manual Focus: 81 01 04 38 03 FF	Auto/Manual: 81 01 04 38 10 FF
Focus_out: 81 01 04 08 37 FF	Focus_in: 81 01 04 08 27 FF	Stop_focus: 81 01 04 08 00 FF
Query_zoom_position: 81 09 04 47 ff		
Zoom_position_feedback: 90 50 0p 0q 0r 0s FF pqrs: zoom_position_value		
Record, photograph, PiP, track, color bar, these commands use 48bytes command as following: Following command is a 48bytes data : cmd_data[48], last byte is checksum, sum of all 47 bytes, low byte.		

3.7.1) Record/photograph command:(TIR/TL/TM/TIRM/IR..T)

Cmd_data[5]= 0X7c

Cmd_data[6]= 0x00：stop record / 0x01：start record / 0x02：photograph

Rec_start: 7E 7E 44 00 00 7C 01 58 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 17
Rec_stop: 7E 7E 44 00 00 7C 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 BC
Photograph: 7E 7E 44 00 00 7C 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 BE

3.7.2) Normal tracking: (TIR/TL/TM/TIRM/IR..T)

cmd_data[5]= 0x00: exit tracking mode. 0X71: enter tracking mode

Cmd_data[11]= 0x00: enter select target mode. 0x01：start tracking

Cmd_data[13]= 0x24: small tracking size. 0x28：mid tracking size. 0x30: big tracking size

0x2c: auto select between small and mid size. 0x3c: auto select between small, mid, big size, 0x38: auto select between mid and big size.

3.7.2.1) Target_tracking

Target_tracking:

7e 7e 44 00 00 71 fe 00 00 00 00 01 01 3c 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ed

3.7.2.2) Stop_tracking

Stop_tracking:

7e 7e 44 00 00 26 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 66

3.7.2.3) Change target,move cursor to the new target

Step1: First send Re-select_target[] ; entering the re-select target mode

Re-select_target[]=

7e 7e 44 00 00 71 fe 00 00 00 00 00 01 3c 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ec

Step 2: move the cursor x, y. speed.

Protocol: cmd_data[5]=0X71 // tracking use '+' cursor cmd_data[11] = 0X00

      cmd_data[7]= 0xXL, X LOW BYTE   cmd_data[8]= 0xXH, X HIGT BYTE

      cmd_data[9]= 0xYL,   Y LOW BYTE   cmd_data[10]= 0xYH, Y HIGH BYTE

Down_cursor_2[]=

7e 7e 44 00 00 71 00 00 00 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 b3

3.7.2.4) Finger tracking mode

cmd_data[5]=0X86, cmd_data[11] = 0X01, cmd_date[13] = track size

      Cmd_data[7]=0xXL,   XLOW BYTE   Cmd_data[8]=0xXH,   XHIGT BYTE

      Cmd_data[9]=0xYL,   YLOW BYTE   Cmd_data[10]=0xYH,   YHIGH BYTE

Track the target at position: (769, 769)

7e 7e 44 00 00 86 00 01 03 01 03 01 00 3c 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0b

Track the target at position: (1025, 769)

7e 7e 44 00 00 86 00 01 04 01 03 01 00 3c 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0C

Track the target at position: (257, 257)

7e 7e 44 00 00 86 00 01 01 01 01 01 00 3c 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 07

1920

(0,0)

(960,540)

1080

3.7.3) SD card inquiry command and feedback command protocol: (TIR/TL/TM/TIRM/IR..T)

7E	7E	44	00	00	Data5	Data6	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	CS

● Inquiry command to get information. 48bytes

Header: 7e 7e 44   CS= sum of all other bytes, mod 256.

❖ format SD card   Data5 = 0x8a Data6 = 00

❖ Inquiry SD card information:

 Data5 = 0x8b

 Data6 =

 02-inquiry SD card status

 03-inquiry SD card total capacity

 04-inquiry SD card remain capacity

 05-inquiry SD card remain pictures quantity capacity

 06-inquiry SD card remain video time capacity

● Feedback command. 8bytes

Data0=BB	Data1=09	Data2	Data3	Data4	Data5	Data6	Data7=CS

 Data2 = 1 : SD card status,

 Data2 = 2 : SD card total capacity

 Data2 = 3 : SD card remain capacity

 Data2 = 4 : SD card remain pictures quantity

 Data2 = 5 : SD card remain video time

◆ Feedback command details ([0] means bit0)

1) SD card status

 BB-----header1 09-----header2   Data2 = 01-----SD card status,

 Data 3:

 [0] : Is inserted

 [1] : Is initializing

 [2] : Is read only

 [3] : Is formatted

 [4] : Is formatting

 [5] : Is full

 [6] : Is verified

 [7] : Is invalid format

 Data4:

 [0] : Has error

 [1] : 1: Is Recording 0: not recording

 [2-7] Reserved

 Data5 res

 Data6 res

 Data7 cs

2) SD card total capacity

 BB-----header1 09-----header2   Data2 = 02-----SD card total capacity

 Data3= ss, Data4=rr, Data5=qq, Data6=pp uint32

 0xppqqrrss = SD car capacity(unit MB,LSB is at the front and MSB is at the back)

 Data7 cs

3）SD card remain capacity

    BB-----header1 09-----header2 Data2 = 03-----SD card remain capacity

    Data3= ss, Data4=rr, Data5 =qq, Data6 =pp uint32

    0xppqqrrss = Remaining SD card capacity(unit MB,LSB is at the front and MAB is at the back)

    Data7 cs

4）SD card remain pictures quantity

    BB-----header1 09-----header2 Data2 = 04----SD card remain pictures quantity

    Data3= ss, Data4=rr, Data5=qq, Data6=pp uint32

    0xppqqrrss = Remaining shots(LSB is at the front and MSB is at the back)

    Data7 cs

5）SD card remain video time

    BB-----header1 09-----header2 Data2 = 05-----: SD card remain video time

    Data3= ss, Data4=rr, Data5=qq, Data6=pp uint32

    0xppqqrrss = Remaining video recording time (unit: second, LSB is at the front and MSB is at the back

    Data7 cs

3.7.4) Picture in picture: (TIR)

Cmd_data[5]=0X78 // video setting

    Cmd_data[14]=0x00: EO+IR(Pip)

                 0x01: IR

                 0x02: IR+EO(Pip)

                 0x03: EO

IR_only[]=
7e 7e 44 00 00 78 00 00 00 00 00 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 b9
IR_EO[]=
7e 7e 44 00 00 78 00 00 00 00 00 00 00 00 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 bA
EO_only[]=
7e 7e 44 00 00 78 00 00 00 00 00 00 00 00 03 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 bb
EO_IR[]=
7e 7e 44 00 00 78 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 b8

3.7.5) Color change:(TIR/IR..T)

Protocol: cmd_data[5]=0X78; cmd_data[15] = 0: white hot 1: black hot 2: red hot

    cmd_data[6]= 0x00: gray, 0x01: color1, 0x02: color2, 0x03: color3, 0x04: color4

color_1:
7e 7e 44 00 00 78 01 00 00 00 00 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ba
black_hot:
7e 7e 44 00 00 78 00 00 00 00 00 00 00 00 01 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ba

3.7.6) Thermal camera Digital Zoom cmd: (TIR/IR..T)

Protocol: cmd_data[5]=0X7d

Cmd_data[6]= 0x81: 1x, 0x82: 2x, 0x83: 3x, 0x84: 4x

IR_DZOOM_1X: 7e 7e 44 00 00 **7D** **81** 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 3E
IR_DZOOM_2X: 7e 7e 44 00 00 **7D** **82** 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 3F

3.7.7) laser light cmd: (TL)

3.5.6.1) Z30TL

Zoom_in_laser: FF 01 01 04 00 1a 20	Zoom_out_laser: FF 01 01 04 01 1a 21
Laser_on: FF 01 01 01 01 00 04	Laser_off: FF 01 01 01 00 00 03

3.5.6.2) Z10TL

zoom_in_laser: FF 01 00 20 00 00 21	zoom_out_laser: FF 01 00 40 00 00 41	zoom_stop_laser: FF 01 00 00 00 00 01
laser_on: FF 01 00 09 00 01 0b	laser_off: FF 01 00 0b 00 01 0d	

3.7.8) Laser Ranger Finder command: (TM/TIRM)

 (Z10TIRM, WK10TIRM, Q10TIRM, Q30TIRM, Z30TM)

Read the ranging result :

Host send:		
10 83 00 7d one time get LRF data 10 83 40 3d continuous get LRF data 10 84 7C stop get LRF data		
LRF feedback data:		
Identifier	parameter	Description
0x01	Byte1	D7：Invalid distance data flag，0 = valid data, 1 = Invalid data D6：Invalid inclination data flag，0 = valid data, 1 = Invalid data D5：Distance data accuracy，0 = 0.5/LSB, 1 = 0.1/LSB D4：Data unit，0 = Meter, 1 = code D3 - D0：Operating mode，0 = Ranging, 1 = Speed measurement
	Byte2	When the data is valid：Distance[D15..D8] When the data is invalid：0x80 = invalid distance data. 0x81=system error
	Byte3	When the data is valid：Distance[D7..D0] When the data is invalid：reserved.
	Byte4	inclination：Angle[D7..D0]，Binary complement format. Do not send inclination angle during speed measurement.
Example: 　1、LRF feedback data：0x10 <u>0x01 0x20 0x12 0xD7 0xFE</u> 0xF8 　　　distance = 0x12D7 = 4823 = 482.3m pitch angle = 0xFE = -2°		

2. LRF feedback data：0x10 0x01 0xA0 0x80 0x00 0x01 0xDE

　invalid distance data(byte4 = 0xA0,　bit7 = 1)　pitch angle = 1°

　Last byte is Checksum = 0x00- byte2-byte3-byte4-byte5

4. Camera settings command: (blue byte for different setting value)

4.1) AA 55 04 08 FF   timezone set, beijing is 8

4.2) AA 55 05 03 FF   OSD on/0ff (refer table A)

4.3) AA 55 06 0F FF   Magnetic Variation set https://skyvector.com/   http://www.magnetic-declination.com/

4.4) AA 55 07 11 FF   OSD input enable/disable (refer table B)

4.5) AA 55 08 02 FF   baudrate setting (refer table C)

4.6) AA 55 09 01 FF   EO digital zoom : 1 on 0: off

4.7) AA 55 0A 96 FF   temperature alarm low byte

4.8) AA 55 0B 00 FF   temperature alarm high byte

4.9) AA 55 0C 01 FF   1: track enable 0: track disable

4.10) AA 55 0D 01 FF   0: stop LRF 1: 1HZ get LRF data 2: continuously get LRF data 3: one time get LRF data

4.11) AA 55 0E 01 FF   1: 4k25fps 2: 1080p25   Z40K/Q40TIR record definition set

4.12) AA 55 0F 01 FF   0: OSD GPS is UAV 1: OSD GPS is target

4.13) AA 55 10 00 FF   s.bus/mavlink channels map set 1: 1~7, 2: 6~12 3: 8~14 4: custom channels, see
      3.14 as following

4.14) AA 55 11 YW PT MO ZM FC RP MU FF custom channels map set. (all byte is hex data, set to 0 if
no control)

AA 55 11 YW PT MO ZM FC RP MU FF
Frame head   body   frame tail

Command format： (do not change red bytes,just change blue bytesas your channel setting), one byte define
two channels,

    bit 0-3 is   chan#A 1100us < >1500us(initial value)

    bit4-7 is   chan#B 1900us < >1500us(initial value)

AA 55 11 YW PT MO ZM FC RP MU FF
         | | | | | | |__Multi :chan# = 0x0M track (1900), chan# = 0x0U stop track (1100)
         | | | | | |_PIC/REC: chan# =0x0R record (1900), chan# =0x0P picture (1100)
         | | | | |__Focus:chan# =0x0F focus in (1900),chan# =0x0C focus out (1100)
         | | | |_____ Zoom: chan# =0x0Z zoom in (1900),chan# =0x0M zoom out (1100)
         | | |___Mode:chan# =0x0M recenter (1900),chan# =0x0O slow speed (1100)|
         | | ___Pitch: chan# =0x0P pitch down (1900),chan# =0x0T pitch up (1100)
         |___Yaw: 0x0Y= yaw right (1900),0x0W = yaw left (1100)

For example: .1(yaw), 2(pitch), 3(mode), 4(zoom), 5(focus),6(picture),7(record),8(stop track),9(start track)

AA 55 11 11 22 33 44 55 76 98 FF
         | | | | | | |__ Multi :channel 8: from 1500 to 1100 channel 9: from 1500 to 1900
         | | | | | |__PIC/REC:channel 6: from 1500 to 1100 take a picture, channel 7: from
         | | | | | 1500 to 1900 start/stop record
         | | | | |__Focus: channel 5: 1100 focus out, 1500 focus stop,1900 focus in
         | | | |_____ Zoom:channel 4: 1100 zoom out, 1500 zoom stop, 1900 zoom in
         | | |___Mode:channel 3: 1100 low speed, 1500 mid speed, 1900 recenter
         | | ___Pitch:channel 2: 1100 pitch up, 1500 pitch stop, 1900 pitch down
         |___Yaw: channel 1: 1100 yaw left, 1500 yaw stop, 1900 yaw right

channel control invert

AA 55 1A IV FF　　　CMD[0X1a] = YPMZ_INVERT_FLAG;　default　IV = ff

IV bit	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
channel	YAW Right	YAW Left	PIT Down	PIT Up	Recenter	Speed adjust	Zoom in	Zoom out
Default	1: 1900	1:1100	1: 1900	1:1100	1: 1900	1: 1100 slow	1: 1900	1:1100
Invert	0: 1100	0:1900	0: 1100	0:1900	0: 1100	0: 1900 slow	0: 1100	0:1900

AA 55 1B IV FF　　　CMD[0X1B] = FPRM_INVERT_FLAG;　default　IV = ff

IV bit	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
channel	Focus in	Focus out	Record start/stop	photograph	Multi high (start/stop track)	Multi low (digita lzoom/manual focus)	reserved	reserved
Default	1: 1900	1:1100	1: 1900	1:1100	1: 1900	1: 1100 slow		
invert	0: 1100	0:1900	0: 1100	0:1900	0: 1100	0: 1900 slow		

4.15)　AA 55 20 01 FF　restore IP address to　192.168.2.119 (T serial model)

4.16)　AA 55 21 10 FF　Z40k/Q40TIR definition OSD on/off　10：　on　20：off

4.17)　AA 55 22 80 FF　Z40k/Q40TIR date OSD on/off　　　80：on　90：off

4.18)　AA 55 23 40 FF　Z40k/Q40TIR OSD on/off　　　30：off　　40：on

4.19)　AA 55 24 A0 FF　Z40k/Q40TIR SD card capacity OSD on/off　　A0: off　　B0: on

4.20)　AA 55 25 C0 FF　Z40k/Q40TIR record time OSD on/off　　　C0：off　D0：on

4.21)　AA 55 1E SZ FF

use track size cmd to set the size you want . just one time, the size will be storage into eeprom: AA 55 1E SZ FF，　note SZ is hex

0x24: Small template 32

0x28: Medium template 64

0x30: Big template 128

The above information can be superimposed, such as：

0x2c: Small template+ Medium template

0x38: Medium template+ Big templatefor

example: you can send AA 55 1E 28 FF , for set track size to medium template

TABLE A : OSD ON/OFF settings

BIT0　0：all OSD on

　　　 1：all OSD off

BIT1　0：cross OSD on

　　　 1：cross OSD off

BIT2　0：pitch& yaw ON

　　　 1: pitch & yaw OFF

BIT3　0：XY shift osd on

　　　 1：XY shift osd off

BIT4　0：GPS OSD ON

　　　 1：GPS OSD OFF

BIT5　0：time OSD ON

　　　 1：time OSD off

BIT6　0：VL-MAG OSD ON

　　　 1：VL-MAG OSD OFF

BIT7　0：SMALL OSD WORD

　　　 1：BIG OSD WORD

Table C:

Baudrate setting

0: 2400

1: 4800

2: 9600

3: 19200

4: 38400

5: 57600

6: 115200 (default)

7: S.BUS mode

TABLE B: OSD input enable/disable

BIT0　0：not save setting

　　　 1：save

BIT1　0：time input disable

　　　 1：time input enable

BIT2　0：GPS time input disable

　　　 1：GPS time input enable

BIT3　0：GPS

　　　　1：MGRS

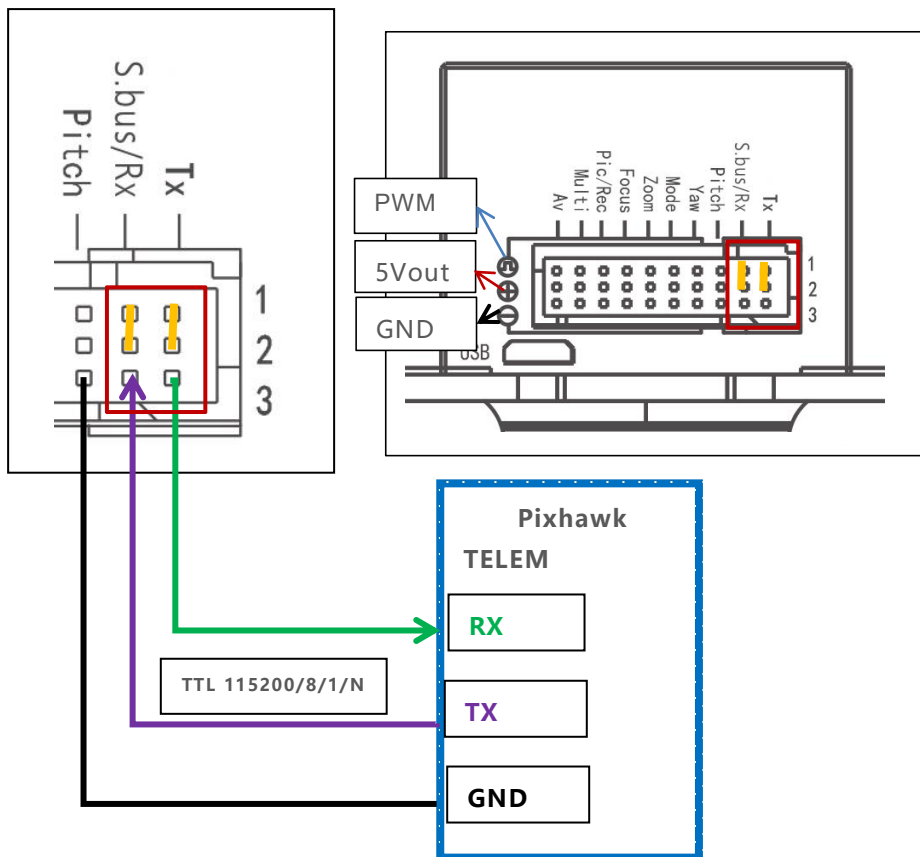BIT4　0：pitch/yaw input disable

　　　 1：pitch/yaw input enable

BIT5　0：VL-MAG input disable

　　　 1：VL-MAG input enable

BIT6　0：zoom times display

　　　 1：fov display

BIT7　0：word have no black frame

　　　 1：word have black frame

Viewpro

## 5. How to connect gimbal to Pixhawk with serial port ?

Step 1: serial port of gimbal connect to Pixhawk serial port (telem1 or telem2)

Step2: Set Pixhawk baudrate to 115200 and protocol select mavlink1. (eg, use mission planner)

Use "RCIN" connect to S.bus port of futaba reciever, user can control gimbal by futaba remote controller.

Gimbal	Pixhawk	Reciever (Futaba)	Remote control transmitter (Futaba)
Tx	Rx		
Rx	Tx		
GND	GND RC IN	S.bus	S.bus
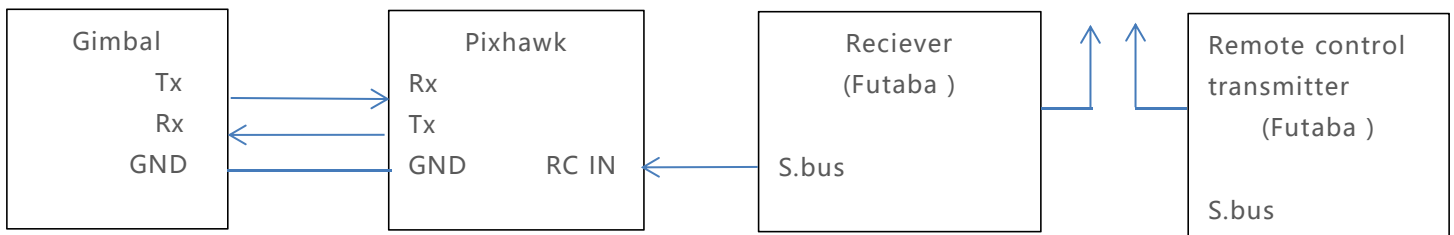
SET channels for control gimbal camera：

AA 55 10 01 FF 1~7ch

AA 55 10 02 FF 6~12ch

AA 55 10 03 FF 8~14ch

AA 55 10 04 FF custom channel mapping as following

     For example: use 7~14chan to control

      AA 55 11 77 88 99 AA BB CC DD FF

6. Viewpro Gimbal Supported Mavlink msg ID List

A)MAVLINK_MSG_ID_SYSTEM_TIME   get time for OSD

B)MAVLINK_MSG_ID_COMMAND_LONG

  1) MAV_CMD_DO_MOUNT_CONFIGURE

    I) MAV_MOUNT_MODE_RETRACT ----off motor function

    Ii) MAV_MOUNT_MODE_NEUTRAL-----home position

  2)MAV_CMD_DO_MOUNT_CONTROL

  I)gimbal_CONTROL_MODE_ANGLE

  II)gimbal_CONTROL_MODE_SPEED

  III)gimbal_CONTROL_MODE_ANGLE_REF_FRAME

  3)MAV_CMD_REQUEST_CAMERA_INFORMATION

  4)MAV_CMD_REQUEST_CAMERA_SETTINGS

  5)MAV_CMD_SET_CAMERA_MODE

  6)MAV_CMD_REQUEST_STORAGE_INFORMATION

  7)MAV_CMD_STORAGE_FORMAT

  8)MAV_CMD_REQUEST_CAMERA_CAPTURE_STATUS

  9)MAV_CMD_IMAGE_START_CAPTURE

  10)MAV_CMD_VIDEO_START_CAPTURE

  11)MAV_CMD_VIDEO_STOP_CAPTURE

  12)MAV_CMD_REQUEST_MESSAGE

  13)MAV_CMD_SET_CAMERA_ZOOM

C)MAVLINK_MSG_ID_ATTITUDE

D)MAVLINK_MSG_ID_GLOBAL_POSITION_INT

E)MAVLINK_MSG_ID_RC_CHANNELS

F)MOUNT_ORIENTATION

G)MAV_CMD_DO_GIMBAL_MANAGER_ATTITUDE

H)MAV_CMD_DO_GIMBAL_MANAGER_TRACK_POINT (1001)

I)MAV_CMD_DO_GIMBAL_MANAGER_TRACK_RECTANGLE (1002)

A) control the gimbal angle,

SP1: MAVLINK_MSG_ID_COMMAND_LONG-->MAV_CMD_DO_MOUNT_CONFIGURE

  s_command_long.param1 = MAV_MOUNT_MODE_MAVLINK_TARGETING

s_command_long.param5 = 2;

  SP2:MAV_CMD_DO_MOUNT_CONTROL

s_command_long.param7 = MAV_MOUNT_MODE_MAVLINK_TARGETING

    angle s_command_long.param1 = angle

B) camera zoom,

MAV_CMD_SET_CAMERA_ZOOM

  1: Zoom Type   Zoom type   CAMERA_ZOOM_TYPE

2: Zoom Value Zoom value. The range of valid values depend on the zoom type.

 (note：CAMERA_ZOOM_TYPE

[Enum] Zoom types for MAV_CMD_SET_CAMERA_ZOOM

Value   Field Name   Description

0   ZOOM_TYPE_STEP   Zoom one step increment (-1 for wide, 1 for tele)

1   ZOOM_TYPE_CONTINUOUS   Continuous zoom up/down until stopped (-1 for wide, 1 for tele, 0 to stop zooming)

2   ZOOM_TYPE_RANGE   Zoom value as proportion of full camera range (a value between 0.0 and 100.0)

3   ZOOM_TYPE_FOCAL_LENGTH Zoom value/variable focal length in milimetres. Note that there is no message to get

the valid zoom range of the camera, so this can type can only be used for cameras where the zoom range is known (implying that this cannot reliably be used in a GCS for an arbitrary camera))

C)photo taking

MAV_CMD_IMAGE_START_CAPTURE

D)recording

MAV_CMD_VIDEO_START_CAPTURE

MAV_CMD_VIDEO_STOP_CAPTURE

E)receive gimbal angle information,

MOUNT_ORIENTATION   (send any data for feedback)

Or MAV_CMD_REQUEST_MESSAGE

F)Set photo and video mode

---MAV_CMD_SET_CAMERA_MODE

G)Get photo and video mode information.

   MAV_CMD_REQUEST_MESSAGE

H)---CAMERA_MODE

CAMERA_MODE

[Enum] Camera Modes.

Value   Field Name   Description

0   CAMERA_MODE_IMAGE   Camera is in image/photo capture mode.

1   CAMERA_MODE_VIDEO   Camera is in video capture mode.

2   CAMERA_MODE_IMAGE_SURVEY

          Camera is in image survey capture mode. It allows for camera controller to do specific settings for surveys.

Camera zoom:

Zoom in

Zoom out

Zoom stop

Take picture:

FD 20 00 00 16 FF 00 4C 00 00 00 00 00 00 00 00 00 00 00 00 80 3F 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 D0 07 01 64 96 AE

COMMAND_LONG {target_system: 1, target_component: 100, command: 2000, confirmation: 0, param1: 0.0, param2: 0.0, param3: 1.0, param4: 0.0, param5: 0.0, param6: 0.0, param7: 0.0}

Start record

Stop record