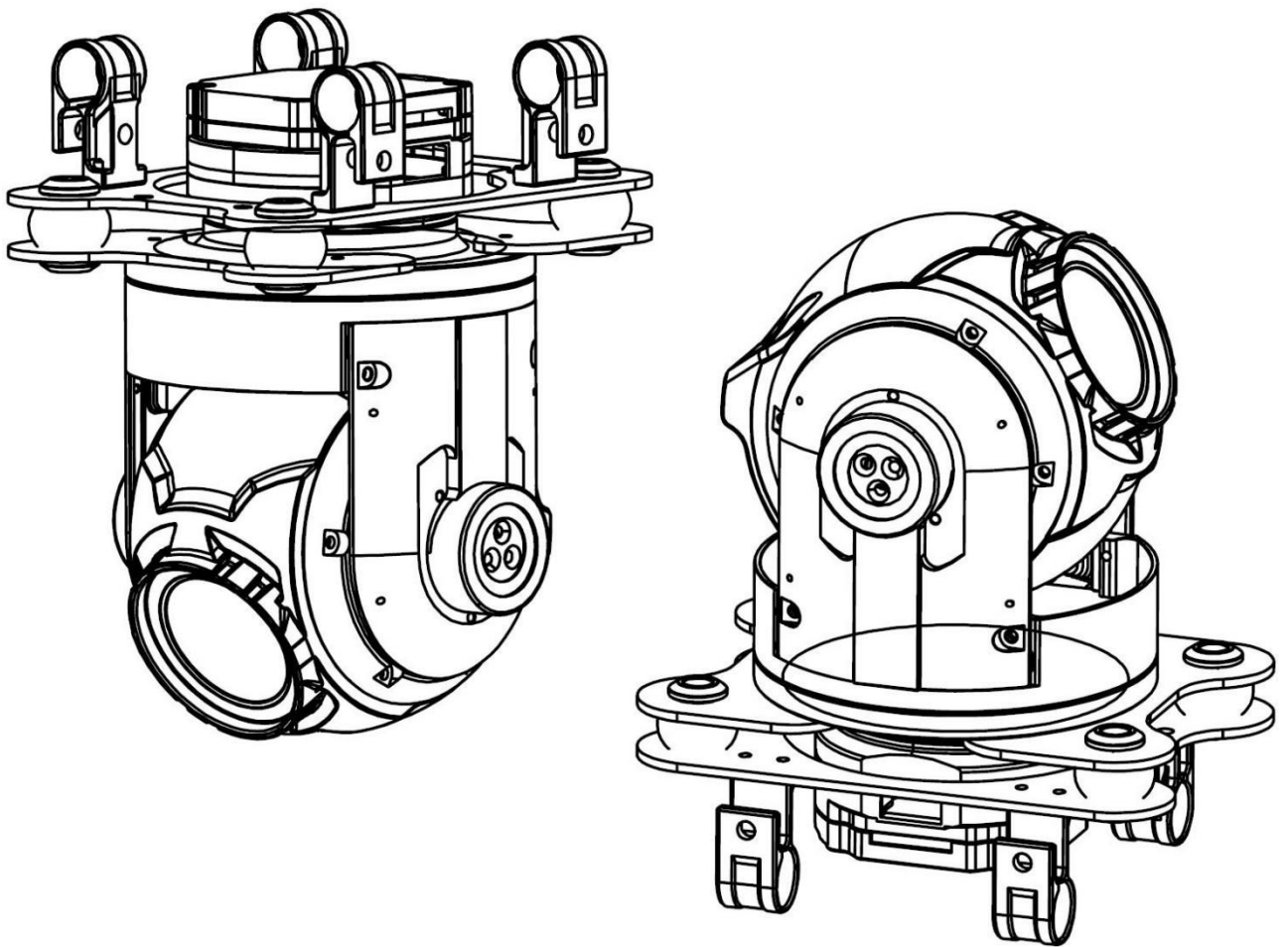


TAROT T10X

10X Optical Zoom Camera 2-axis Gimbal (1080P HDMI output)

User Manual



2023.05.24 Revised V1.1.4

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Warning and Disclaimer

Congratulations on purchasing your new TAROT product. The information in this document affects your safety and your legal rights and responsibilities. Read this entire document carefully to ensure proper configuration before use. Failure to read and follow instructions and warnings in this document may result in serious injury to yourself or others, or damage to your TAROT product or damage to other objects in the vicinity. This document and all other collateral documents are subject to change at the sole discretion of TAROT. For update product information, visit <http://www.tarotrc.com> and click on the product page for this product.

The T10X-2A has been calibrated before leaving the factory. No physical or mechanical modification or adjustment of the gimbal is required or recommended. Do not add any other component or device to the camera. The T10X-2A is a delicate instrument. Please do not disassemble or assemble the T10X-2A yourself, otherwise it will cause the gimbal and camera to work abnormally.

To ensure the safety of flight control system after powering up, we recommend you remove all the propellers and use non-power-supply for the gimbal. Keep the entire components far from children and flammable & combustible materials!

Because TAROT cannot control the specific use, installation, modification, and improper use of users, TAROT will not be liable for the corresponding loss and compensation caused by following conditions:

1. Damage caused by failure to read this user manual carefully.
2. Damage caused by failure to operate in accordance with the relevant laws and regulations.
3. Damage caused by the operator continuing to operate the product in a poor physical or mental condition.
4. Damage caused by improper use or subjective intent.
5. Damage caused by the use of products or accessories not manufactured by our company.
6. Any damages relating to moral damage caused by the occurrence of an accident.
7. Damage caused by products out of warranty or improper maintenance resulting in poor operation of the product.
8. Damage caused by operation in bad weather such as heavy rain, snow, wind or hail.
9. Damage caused by flying in areas unsuitable for manoeuvring such as difficult observation areas, magnetic interference areas, radio interference areas, no-fly zones, etc.
10. Damage to the pod caused by homemade wire or incorrect soldering wire sequences.

I . Product Introduction

Tarot T10X-2A is a two-axis zoom camera Gimbal developed for industrial applications, supporting 10x optical zoom with 1/3 CMOS sensor and 4 million effective pixels, which can present the scenery from several hundred meters away clearly. The pods use professional two-axis mechanical stabilization technology, stabilization accuracy of $\pm 0.01^\circ$. It can be applied to fixed-wing UAVs, rotary-wing UAVs, unmanned helicopters, unmanned vehicles, unmanned boats, inspection robots and other intelligent devices in the fields of firefighting, forest security, public security monitoring, search and rescue, environmental protection law enforcement, etc.

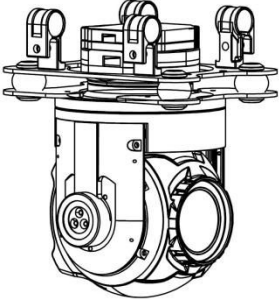
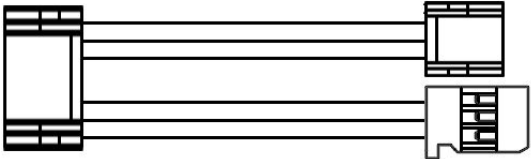
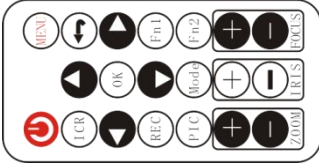

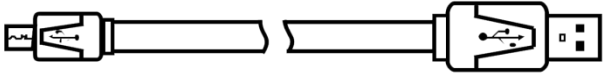
Main Features

- Weight 305g;
- Optical zoom camera supports 10x optical zoom with 4 million effective pixels;
- Field of view range of $66.6^\circ \sim 7.2^\circ$, optical zoom range f:4.9 ~ 49mm;
- Video resolution 1080P@60fps; photo resolution 1920*1080;
- Color mode with minimum illumination up to 0.05 Lux/F1.6;
- Highly optimized servo motor vector control algorithm;
- Mechanical three-axis image stabilization, $\pm 0.01^\circ$ image stabilization accuracy;
 - Aluminum alloy structure design, light and strong, good heat dissipation performance;
 - One-click execution of one-click downward 90-degree look-down Operation;
 - Support SBUS, serial port protocol;
 - Support automatic/manual screen focus;
 - Gimbal can support direct Upright or Inverted adaptive use without setting parameters.

Caution:

In order to ensure the stability of the gimbal after operation, Tarot T10X series gimbal needs 4-6S static time after power on to complete the calibration self-test of the sensor, during this period, please ensure that the gimbal is still hanging on the mounting platform, do not shake, touch or hold the gimbal, through the static self-test can greatly improve the attitude solution and gimbal direction stability.

II. Product List

T10X-2A Gimbal ×1	
S.Bus receiver and serial port debugging connection cable/6P ×1	
Movement infrared remote control ×1	
Micro-SD memory card ×1 (Not included, self-provided)	
Type-C data connection cable ×1 (Not included, self-provided)	

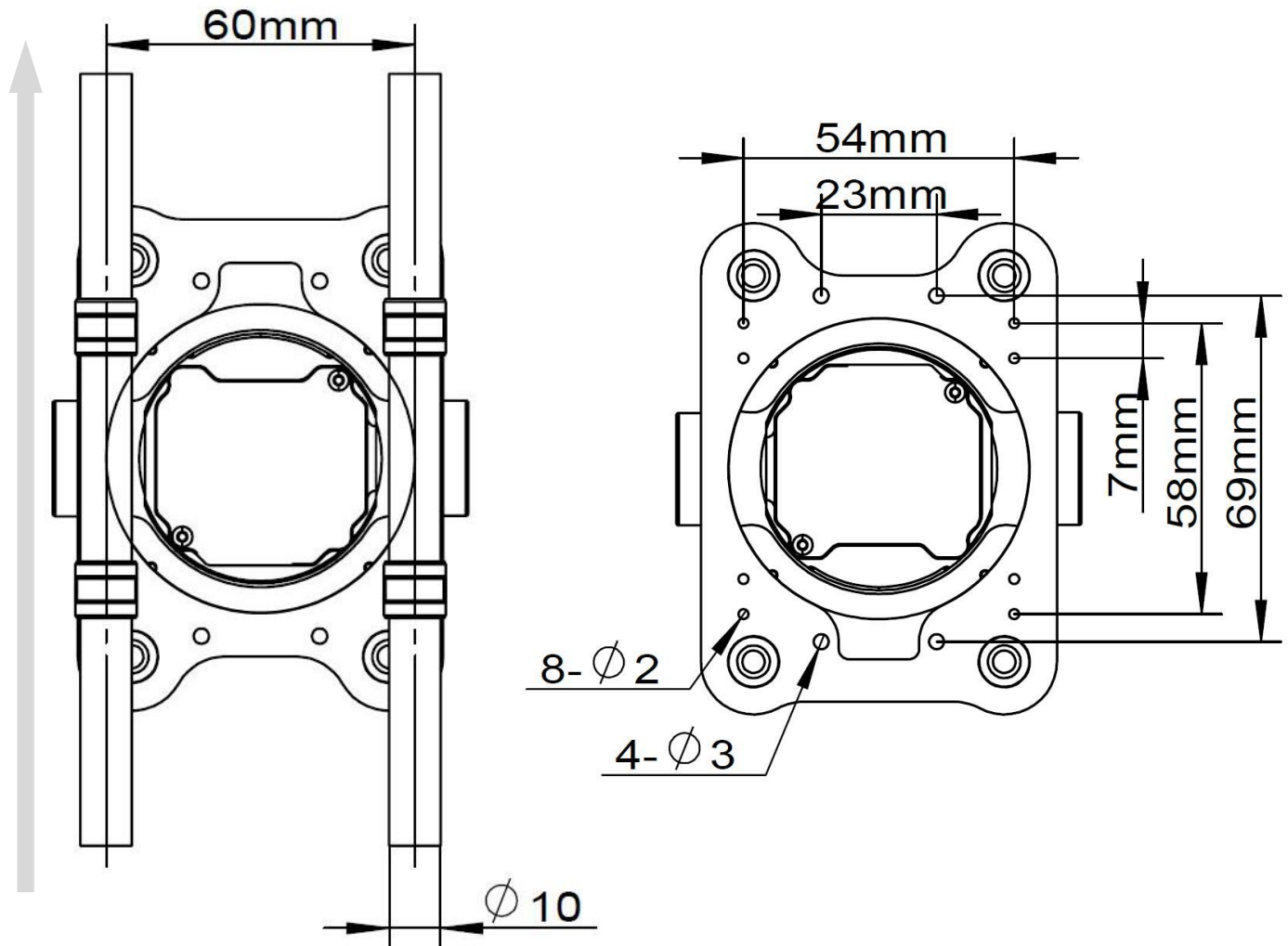
III. Mounting & Configuration

3.1 Gimbal Body Mount

According to the following chart hole size,

- 1: Prepare Gimbal mount tube with $\Phi 10$ pipe diameter spacing of 60mm for direct mounting;
- 2: Or add 4 mounting holes (23mm*69mm) on the frame or mounting plate, use M3 screws to connect to the aluminum post.

Frame head direction

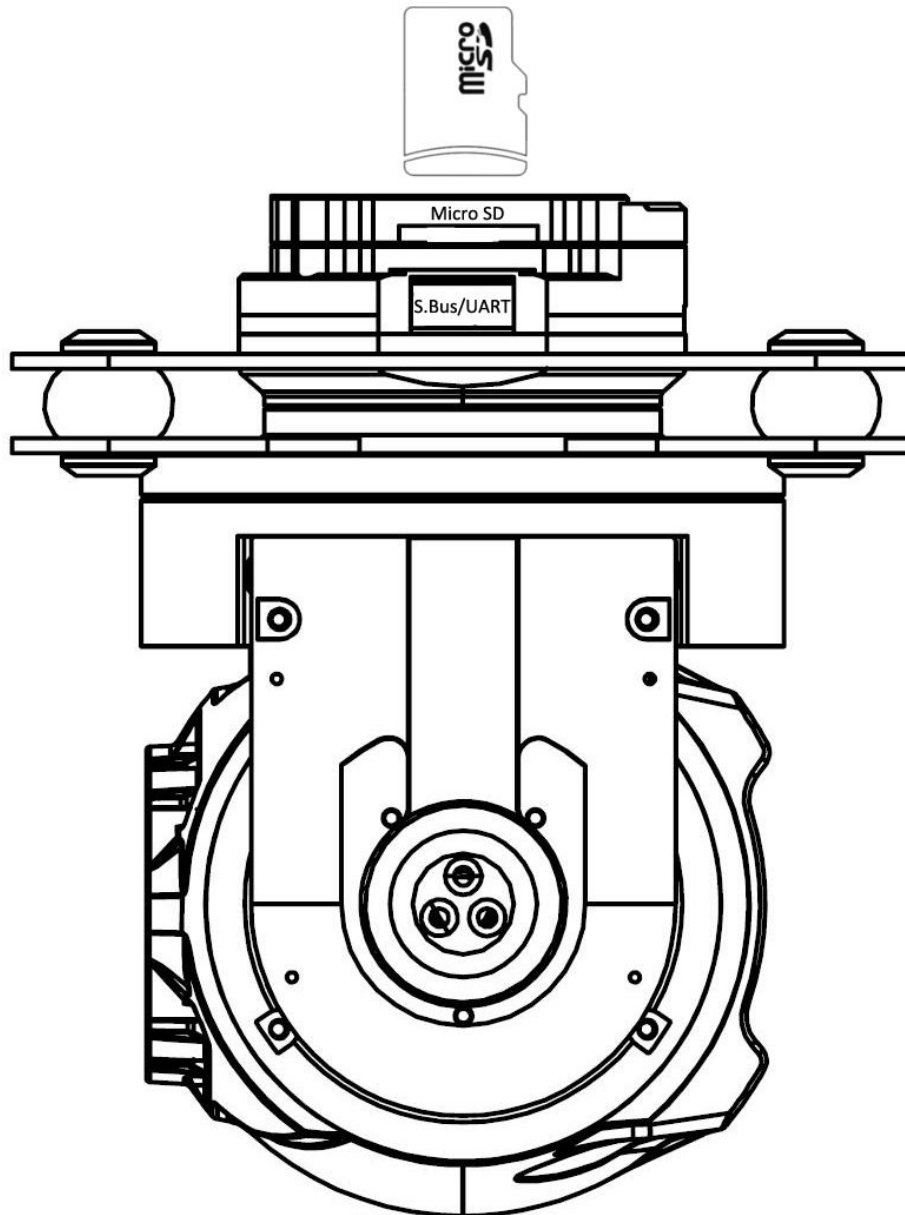


Cautions:

1. Make sure there is enough space on the frame to ensure that the Gimbal camera does not touch the ground when going down vertically;
2. Please ensure that the Gimbal camera is installed in a horizontal position, firm and without looseness, to avoid abnormal vibration affecting the Gimbal image stabilization effect;
3. Make sure there are no foreign objects around the Gimbal camera body to ensure that it does not touch other objects while working.

3.2 Memory Card Installation

As shown in the picture below, the upper part of the Gimbal body has a built-in micro SD card slot location, and the installation of the memory card can be completed by inserting the micro SD card. To remove the SD card, simply press in once and the memory card will be automatically ejected.



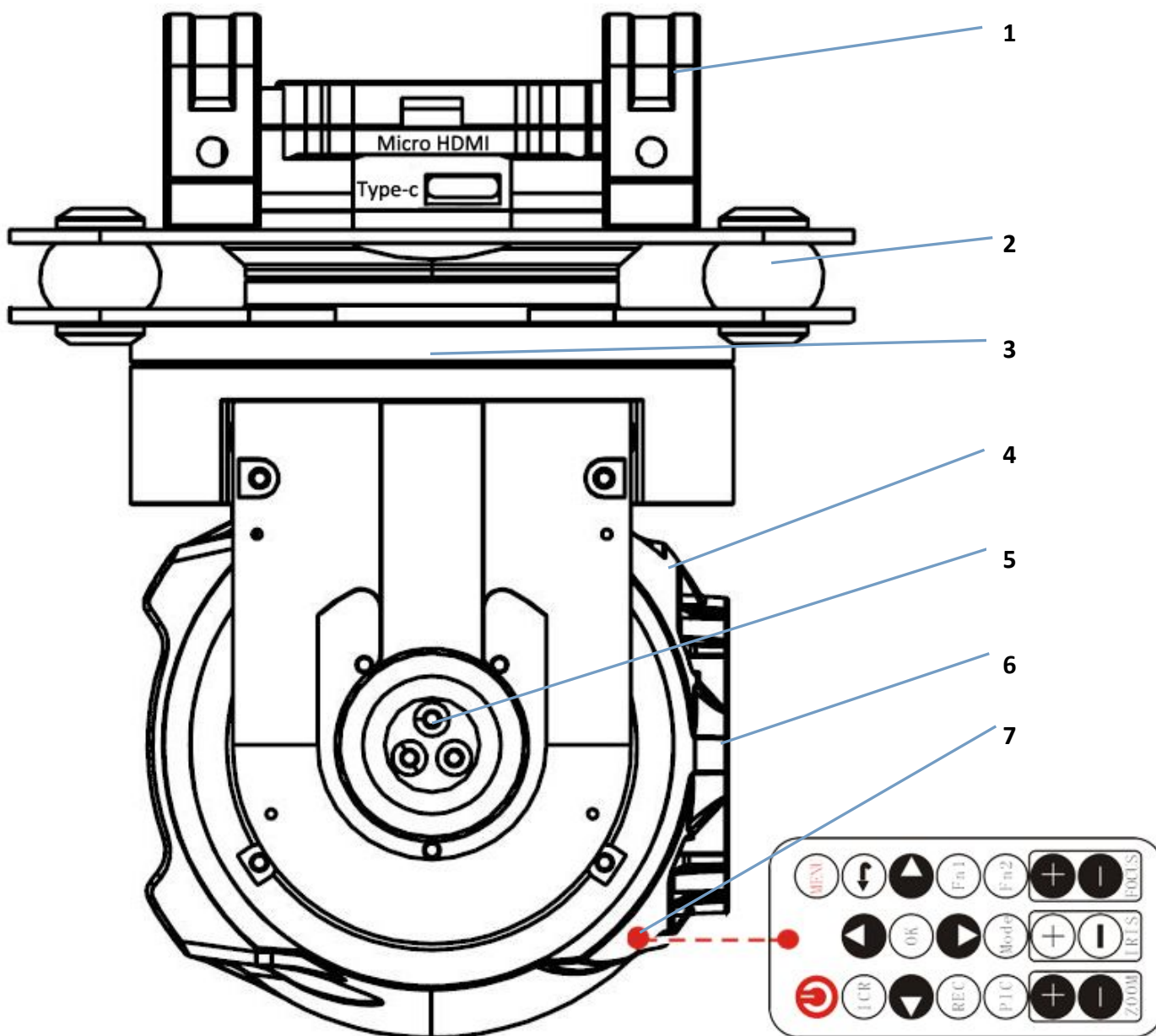
Cautions:

1. Please make sure that the micro SD card is inserted in the right direction to avoid damaging the Gimbal camera;

2. The Gimbal camera can support Micro SD cards up to 32GB in capacity. Since the Gimbal camera requires fast reading and writing of 1080p video data, please use a Micro SD card with Class 10 or UHS-1 specifications and above to ensure proper video recording. Do not pull out the Micro SD card while taking pictures or recording, otherwise the images obtained during recording may be lost.

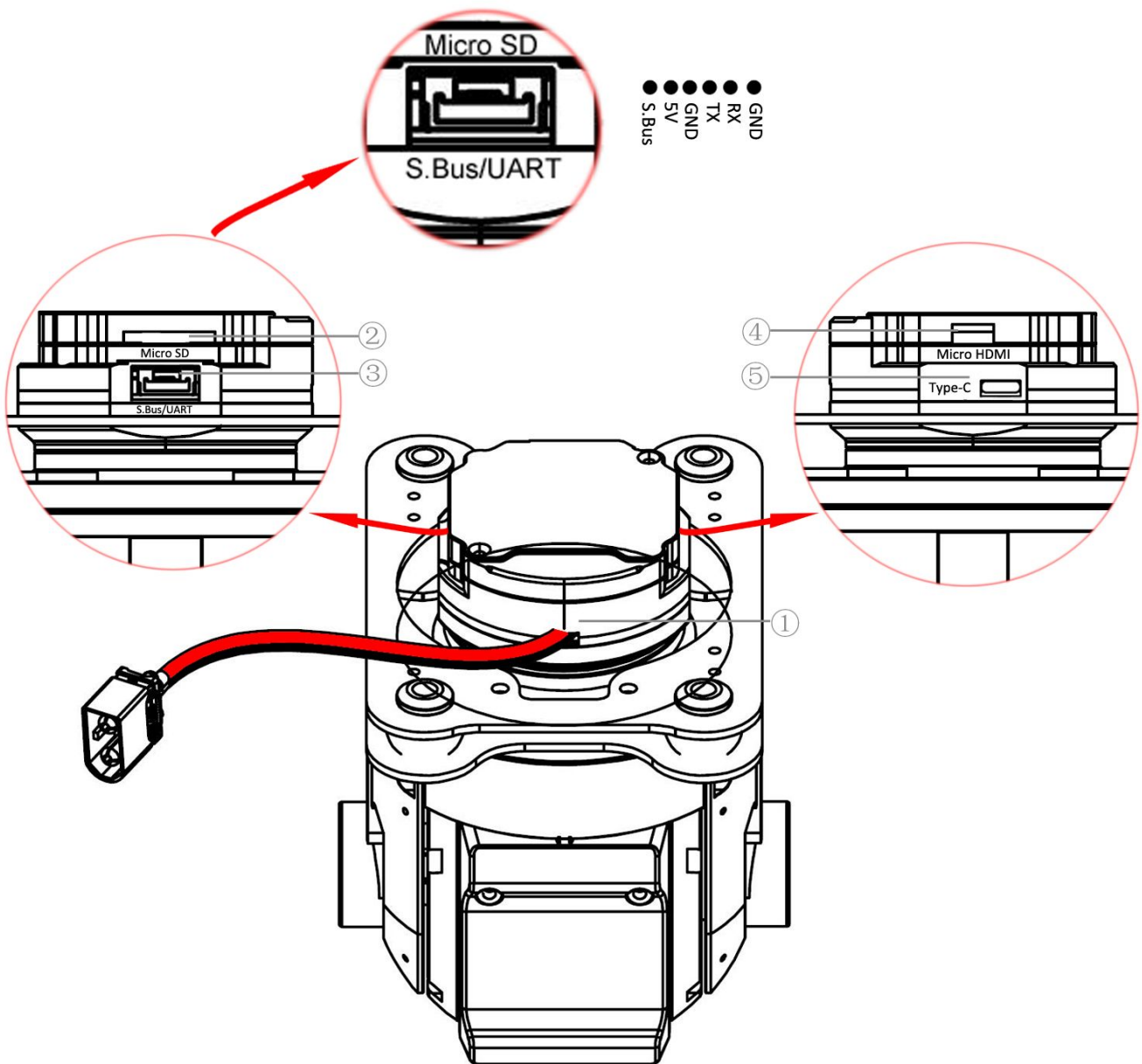
3.3 Gimbal Parts Introduction

3.3.1 Gimbal Overall Introduction



1	Gimbal Suspensions	4	Camera protection frame	7	Movement infrared probe point
2	Gimbal Damping bal	5	Gimbal Tilt axis	8	
3	Gimbal Point axis	6	Movement lens	9	

3.3.2 Gimbal Interface Definition



①	Power connector/XT30	④	Micro HDMI video output connector
②	Micro SD card slot	⑤	Type-C Gimbal debug interface
③	S.Bus and UART serial interface		

①.DC IN	<p>Power supply interface / XT30: DC 12V-27V (3S-6S Lipo, support high-voltage lithium battery)</p> <p>Too low or too high a voltage can cause damage to the Gimbal , If using the same battery to power both the Gimbal camera and the frame, please ensure that the battery voltage meets the specifications of both the Gimbal camera and the frame.</p>
②.Micro SD	<p>Micro SD memory card interface</p> <p>Gimbal cameras can support micro SD cards up to 32GB.Since Gimbal camera requires fast read/write 1080P video data, please use Micro SD card with Class 10 or UHS-1 specification and above to ensure proper video recording.</p> <p>Note: Please do not pull out the micro SD card during the recording process or directly power off, otherwise it will cause the loss of video files.</p>
③.S.Bus/UART	<p>S.Bus receiver interface and UART serial port interface</p> <p>1:S.Bus receiver interface, connect S.Bus receiver through [S.Bus receiver connection cable].</p> <p>2:UART serial interface, you can use the serial protocol to control the Gimbal by connecting this interface, the interface line sequence from left to right: S.Bus signal, 5V, GND, serial TX, RX, GND</p>
④.HDMI	<p>HDMI video output interface</p> <p>Connect the video wireless transmission module to the HDMI output port</p>
⑤.Type-C	<p>Gimbal sets up Type-C port</p> <p>Connect Tarot Gimbal debugging software Tarot Gimbal Assistant</p> <p>Available: S.Bus channel setting, communication protocol setting, GimbalFirmware Upgrade, movement parameter setting</p>

IV. Tarot T10X-2A GimbalTuning Software

4.1 Tuning Software Installation and Setup

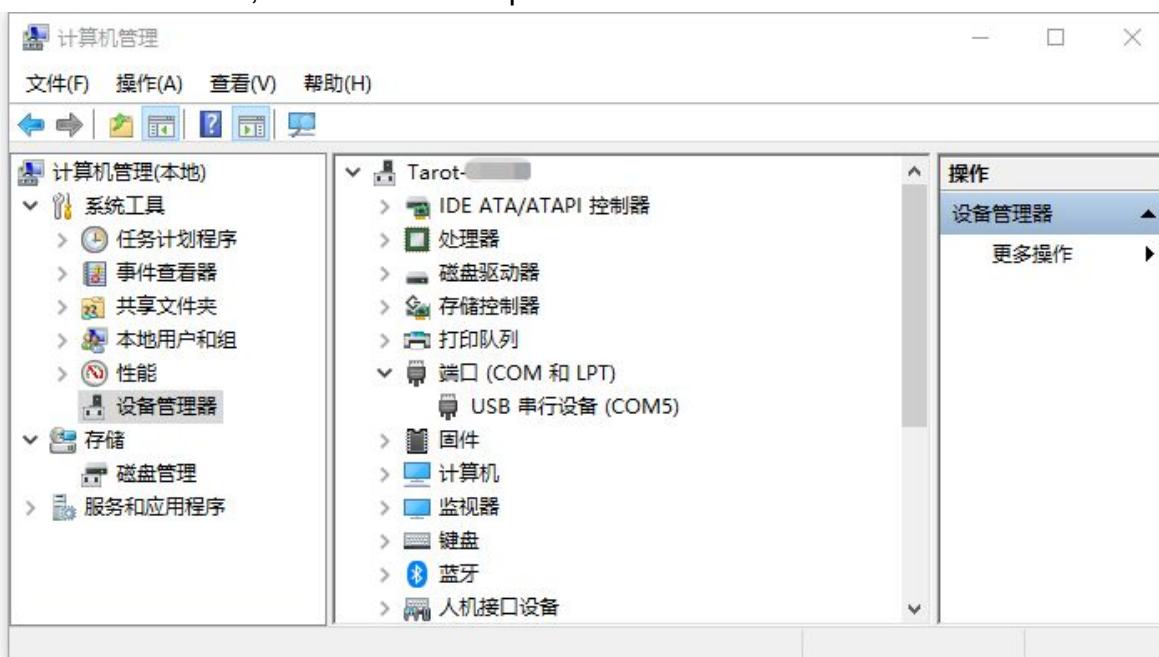
- ① Please go to the official website to download Tarot T10X-PRO Tuning Software at: <http://www.tarotrc.com/>;
- ② Run the driver installation software under the "USB Driver" folder (for Win7 installation, Win10 and above without driver self-identification), follow the prompt steps to complete the driver installation;
- ③ Connect the "Type-C Gimbal debug interface" to the computer via the [Type-C] cable to complete the final installation of the device driver;
- ④ Run Tarot Gimbal Assistant Gimbal Tuning Software "TGA.exe" to perform Gimbal tuning and upgrade Operation.

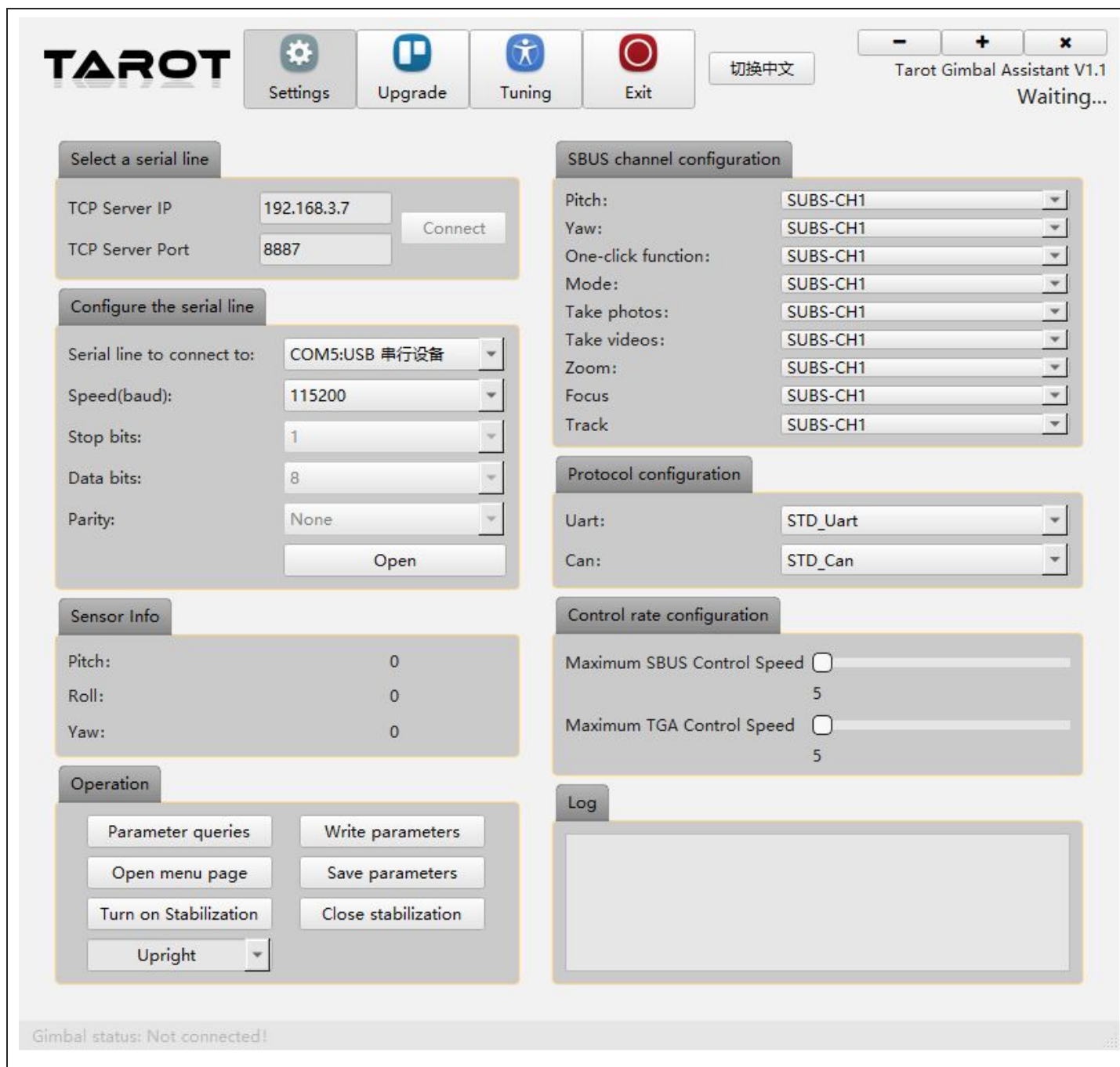
4.2 Introduction of Tarot Gimbal Assistant software

Tarot T10X-2A 2-axis Gimbal , in flight can be stabilized Tilt, Point in the two directions of the angle.

By using the Tarot-Gimbal-Assistant software (hereinafter referred to as TGA software), you can change the S.Bus channel settings, Gimbal function settings and camera parameter settings for the Gimbal.

First, power on your Gimbal and connect the Gimbal [⑤.Type-C Gimbal debug port] to your computer via [Type-C cable].Then check the real port number of Gimbal by "right-clicking" [My Computer] - [Management] - [Device Manager] - [Ports (COM and LPT)]. **(If you are not sure of the real port number, please re-plug the corresponding USB cable, the port number will be refreshed in real time)** ,Run Tuning Software "TGA.exe", select the correct communication port in "Serial line to connect to", and then click "Open".





Notes on the connection between Gimbal and TGA software:

- 1.If you only need to set the parameters of the Gimbal, you only need to plug in the Type-C tuning cable to connect and debug without powering up the Gimbal;
- 2.If you want to set parameters for both Gimbal and movement (go to "Open menu page" to set the movement), you need to power on the Gimbal and then plug in the Type-C cable for debugging;
- 3.If the Gimbal is powered on while the Type-C cable has been successfully connected to the TGA software for tuning, there is a probability that the initial angle of the Gimbal will be shifted, which does not affect the use of the Gimbal, so continue to debug, unplug the Type-C cable after debugging and re-power the Gimbal;
- 4.Gimbal connection process, if you encounter a software crash if the connection is unsuccessful, please plug the Type-C cable again to reconnect.

After selecting the correct port number and clicking on the button "Open", a pop-up window will appear with "Successfully connected " and will automatically refresh the latest parameters and Gimbal data of the current preset.

When you have finished setting the Gimbal parameters, please click the **[Write parameters]** - **[Save parameters]** button in the bottom left corner to ensure that the parameters are written to the Gimbal and that the Gimbal will run with the parameters saved in the parameters memory when it is powered up next time.

If you want to verify whether the parameters are successfully written, you can click "Parameter queries" again to get the real data.

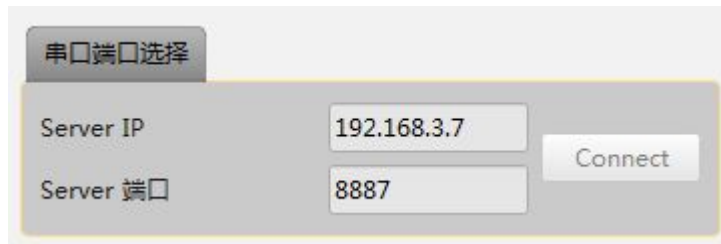


Cautions:

- 1.If you want to verify whether the parameters are successfully written, you can click "Parameter queries" again to get the real data;
- 2.T10X-2A Gimbal supports Upright and Inverted adaptive use without adjusting the "Upright" and "Inverted" parameters on the TGA software interface.

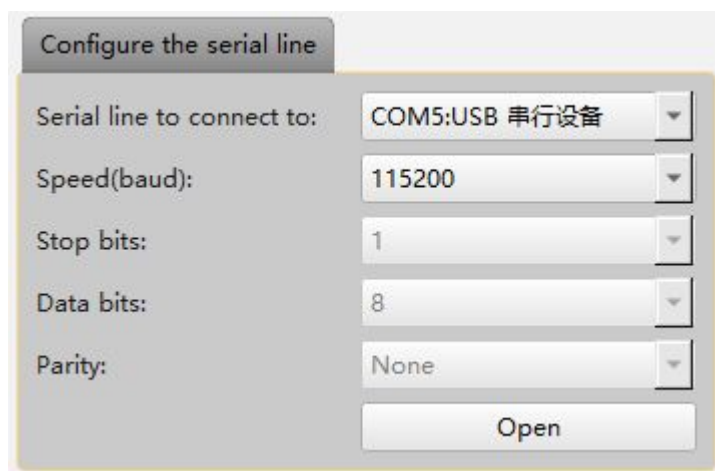
4.3 Operating Instructions for TGA Software Functions

4.3.1 Serial a serial line



Tarot network model Gimbal access IP settings, this model T10X Gimbal do not need to adjust.

4.3.2 Configure the serial line



Serial line to connect to: the port number displayed after driver installation

Speed(baud), Stop bits, Data bits, Parity, values remain unchanged by default

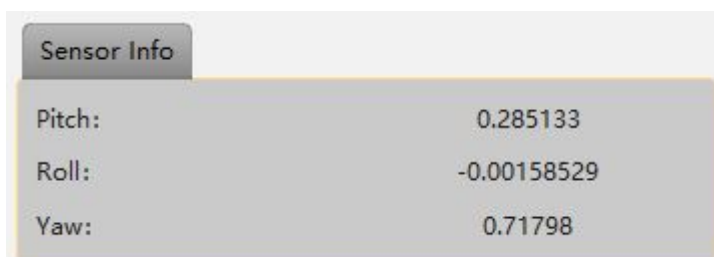
1.Speed(baud):115200

2.Stop bit:1

3.Data bits:8

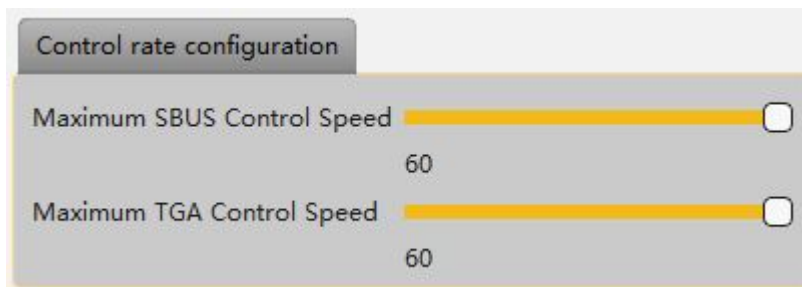
4.Parity:None

4.3.3 Sensor Info



Sensor Information displays real-time angle information for several of Gimbal's current motor axes.

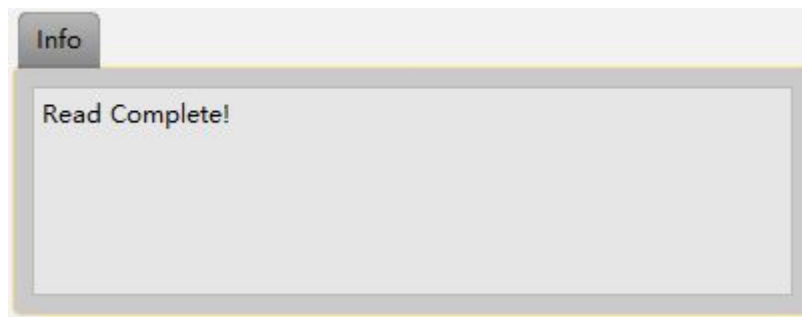
4.3.4 Control Rate Configuration



In order to satisfy different users, users can adjust the maximum control rate of Gimbal according to their Operation habits.

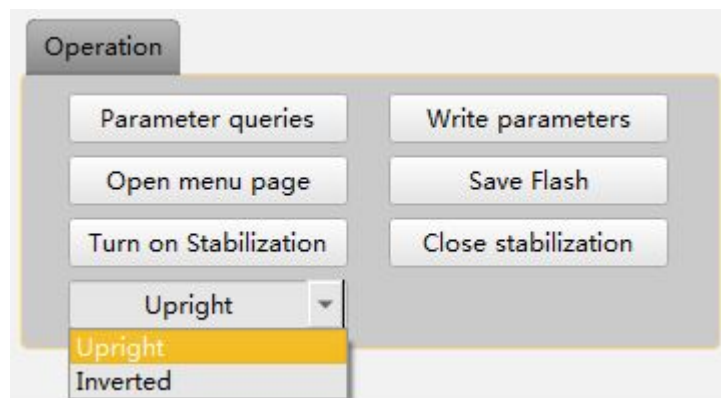
After modifying the control rate, click "Write parameters" and "Save parameters" in turn, the control rate can be adjusted to 5-60 degrees/sec.

4.3.5 Info



Info displays real-time feedback on Gimbal's current Operation.

4.3.6 Operation



The Operation column allows for some control over Gimbal's Operation

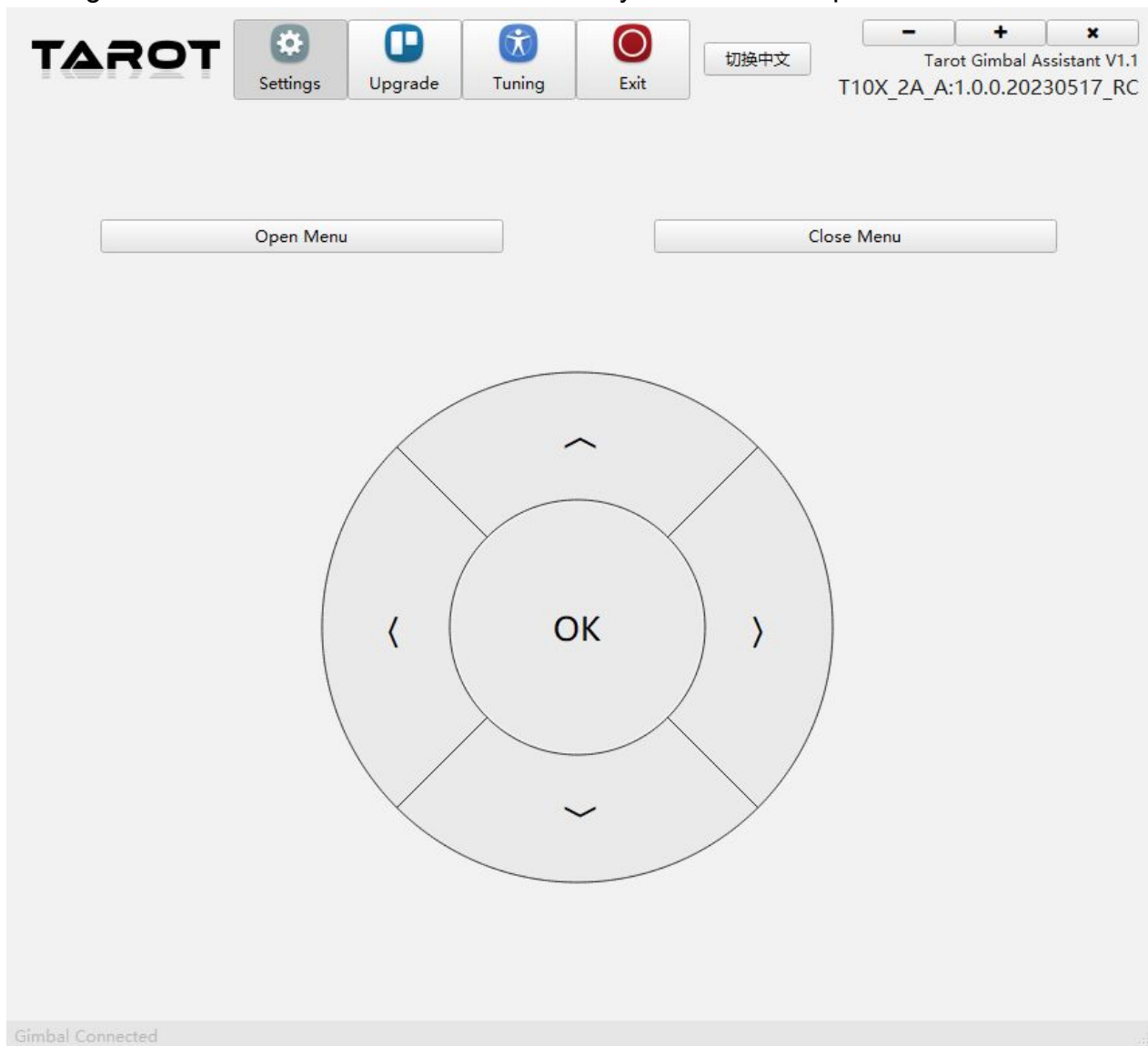
1. Parameter queries: Click to refresh the currently set Gimbal parameters in real time;
2. Write parameters/Save parameters: After setting Operation on Gimbal, you need to click "Write parameters" to write the settings into Gimbal parameters memory parameters; then click "Save parameters" to save the parameters successfully after clicking "Write parameters" successfully, and the new parameters can be saved and displayed next time when you reconnect;
4. Close stabilization/ Turn on Stabilization: Gimbal motor stop / Gimbal motor start operation, for specific needs such as Gimbal Firmware Upgrade before the Gimbal need to shut down the stabilization of the Operation;

5.Upright/Inverted:Gimbal supports Upright installation (hanging below the UAV and mounting platform); supports Inverted installation (hanging above the UAV, unmanned vehicle, unmanned ship and mounting platform) , T10X-2A Gimbal supports Upright and Inverted adaptive use without adjusting the "Upright" and "Inverted" parameters on the TGA software interface.

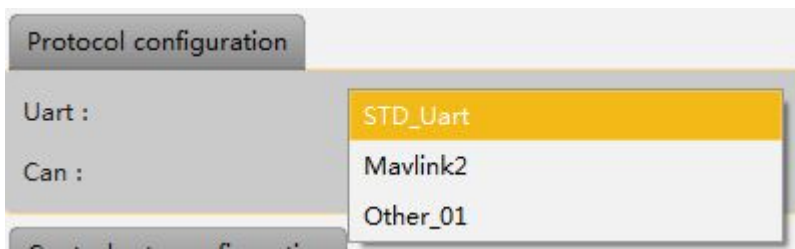
6.Open menu page: The Gimbal can be set to parameters such as output resolution, forward and reverse of the output screen through the "Open menu page" of the TGA debugging software.

Operation steps:

- ①.First power up the Gimbal, then insert the Type-C tuning cable to the Gimbal, select the correct port number and connect the TGA debugging software to debug;
- ②.Connect the HDMI display to the Gimbal's Micro HDMI port via an HDMI HD video cable and wait for the picture to be output properly;
- ③.Click "Open Menu" under the Operation section of the TGA software interface to enter the movement settings;
- ④.Click "Open Menu" to set the parameters of the movement, click "Close Menu" to exit the movement settings after setting, HDMI display at this time the screen has returned to normal video output that is the successful exit of the movement settings;
- ⑤.Click "Settings" on the TGA debug software again to return to the Gimbal settings page;
- ⑥.Re-energize the Gimbal to take effect on the newly set movement parameters.



4.3.7 Protocol configuration



In the TGA protocol configuration interface, communication connection, T10X-2A gimbal can choose "STD_Uart" or "Other_01" protocol control, click "Write Parameters", then "Save Parameters", then power off and restart the T10X gimbal to take effect.



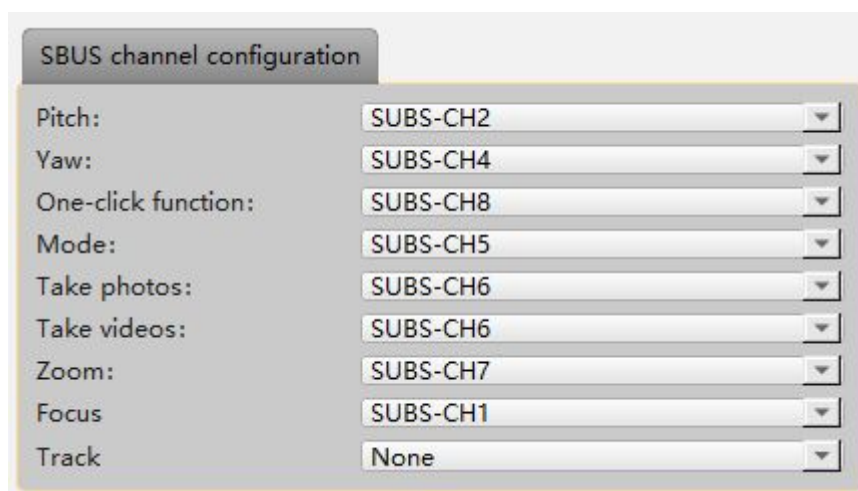
Cautions:

1. T10X-2A gimbal does not support Mavlink2 protocol control at the moment, no need to choose;

4.3.8 S.Bus channel configuration

Connect the Gimbal to the Tarot Gimbal debugging tool TGA.exe through Operation [4.2 Introduction to Tarot Gimbal Assistant software], and adjust the Sbus channel values according to your needs after successful connection.

Tarot-T10X-2A Gimbal factory preset channel values Gimbal [Pitch channel CH2], [Yaw channel CH4], [One-click function channel CH8], [Mode channel CH5], [Take photos/Take videos channel CH6], [Zoom channel CH7], [Focus channel CH1], [Track channel None], please use Tuning Software to modify the corresponding, modified by clicking the bottom left button "Write parameters" and "Save parameters";



Cautions:

1. When you have finished setting the Gimbal parameters, please click the [Write Parameters] - [Save Parameters] button in order to ensure that the parameters are written to the Gimbal, and when the Gimbal is powered up next time, it will run with the parameters saved to the parameters memory;
2. If you want to verify whether the parameters are successfully written, you can click "Parameter queries" again to get the real data;
3. The T10X-2A Gimbal has a 5V power supply for the S.Bus receiver. If your receiver has a separate power supply, please disconnect the 5V output from the S.Bus/UART interface.

① Gimbal Tilt Settings

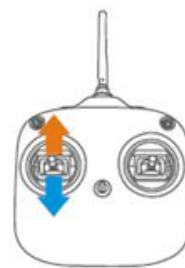
Select a rotary button switch or rocker for Tilt axis control:

Take the rocker as an example-preset CH2:

Rocker up, Gimbal corresponds to Tilt axis upward rotation;

No Operation in the center;

Rocker down, Gimbal corresponds to Tilt axis downward rotation.



② Gimbal Point Settings

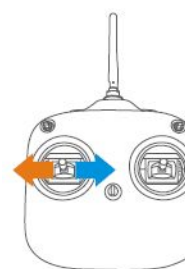
Select a rotary pushbutton switch or rocker for Point axis control:

Take the rocker as an example-preset CH4:

Rocker to the left, Gimbal corresponds to Point axis to turn left;

No Operation in the center;

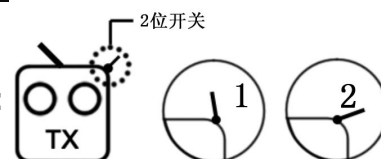
Rocker to the right, Gimbal corresponds to Point axis to the right.



③ Gimbal One-touch down/back center Settings

Select a two- or three-digit switch for mode control:

Two-position (two-position) switch as an example - preset CH8:



A1: Position 1 to position 2: the current position is immediately executed with one key facing downward, looking down 90°;

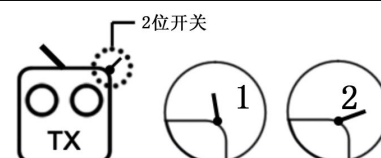
A2: Position 2 to Position 1: Gimbal back to center, back to Gimbal initial energized state.

The settings of position 1 and position 2 can be switched.

④ Gimbal Mode Settings

Select a two- or three-digit switch for mode control:

Two-position (two-position) switch as an example - preset CH5:



Position 1: Follow, Point follow mode, Point follows the vehicle heading change;

Position 2: Locked, Point locked mode, Gimbal Point locked orientation does not move;

The settings of position 1 and position 2 can be switched.

Immediate effect after mode switch (Gimbal's current position will not change)

⑤ Camera Photo and Video Settings

Description: 2 independent channels can be configured to control the photo/video separately; 1 channel can also be configured to unify the control of photo/video.

Channel 1 statistical control as an illustration:

Select a rotary button switch or a three-way switch as a unified control for taking pictures and recording:

Take three-position switch as an example-preset CH6:

Position 1 set to take pictures, middle position 2 no action, position 3 set to record.

A1: Position 2 to Position 1: Take a photo once

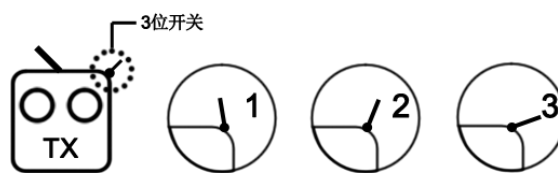
A2: Position 1 to position 2 (back to center): no action

A3: Position 2 to position 1: take a picture again

B1: Position 2 to Position 3: Start video

B2: Position 3 to position 2 (back to center): no action

B3: Position 2 to Position 3: Stop video



The settings of position 1 and position 3 can be switched.

⑥ Camera Zoom Settings

Select a rotary push button switch or a three-position switch for camera zoom control:

Take the three-digit switch as an example-preset CH7:

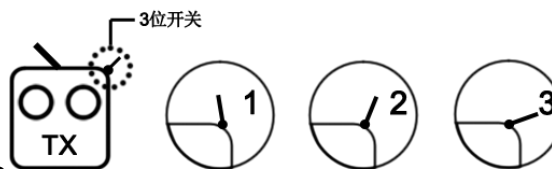
A1: Position 2 to position 1: zoom out

A2: Position 1 to position 2 (back to center): zoom pause

B1: Position 2 to Position 3: zoom in

B2: Position 3 to position 2 (back to center): zoom pause

The settings of position 1 and position 3 can be switched.



⑦ Camera Focus Settings

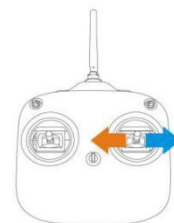
Select a rotary pushbutton switch or rocker for point axis control:

Take the joystick as an example-preset CH1:

Rocker to the left, camera focus+

Center: No Operation

Rocker to the right, camera focus-



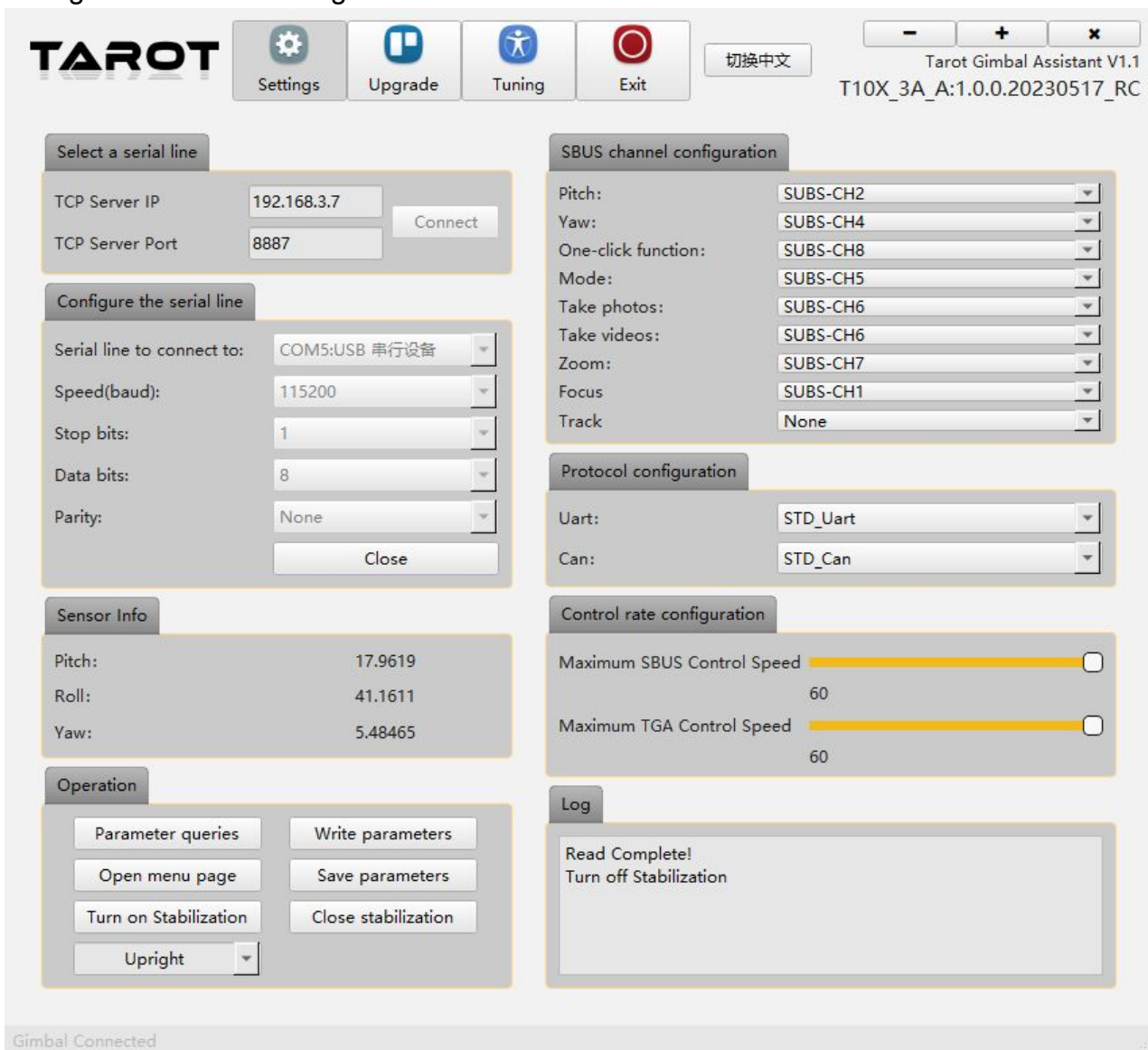
Cautions:

1. The Gimbal function can be changed to control forward and reverse by setting the channel forward and reverse rudder in the Futaba remote control;
2. The effective travel of each channel control can be changed by setting the channel travel in the Futaba remote control;

V. Firmware Upgrade

Upgrade Steps

- 1.You can check the latest version at (<http://www.tarotrc.com>) official website.
- 2.Ensure that the Gimbal is successfully connected to the software and that all information is successfully read.
- 3.Unzip the downloadable firmware package and click on the "Close stabilization" button in the lower right corner of the TGA software to ensure that the Gimbal 3-axis motor has stopped running at this point;
- 4.Click the "Upgrade" button to enter the TGA software upgrade interface, and then click the "Enter upgrade mode" button at the bottom right corner of the interface;
- 5.Click "Enter upgrade mode" button, enter the upgrade program, click "Select the core board firmware" again, select the file "Cube.bin" in the firmware package, click Click the "WRITE" button, the progress bar will reach 100%, and the upper left corner will indicate that the upgrade is complete.;
- 6.X axis / Y axis / Z axis similar to Operation, click in turn, select the corresponding firmware file, click WRITE;
- 7.Click "Exit upgrade mode" after all upgrades are completed, that is, all upgrades are completed.
- 8.Powering down and restarting the Gimbal.



TAROT

Settings Upgrade Tuning Exit

切换中文

- + x

Tarot Gimbal Assistant V1.1
T10X_2A_A:1.0.0.20230517_RC

Firmware upgrade

Upgrade Mode Heartbeat Pack: 0 720.6 0 719.2 ● ● ● ●

0%	Select the core board firmware	WRITE
0%	Select X-axis firmware	WRITE
0%	Select Y-axis firmware	WRITE
0%	Select Z-axis firmware	WRITE

Clear Enter upgrade mode Exit upgrade mode Unlock

云台连接成功

Upgrade Mode Heartbeat Pack: 0 720.6 0 719.2 ● ● ● ●

0%	Select the core board firmware	WRITE
100%	Select X-axis firmware	WRITE
0%	Select Y-axis firmware	WRITE
100%	Select Z-axis firmware	WRITE

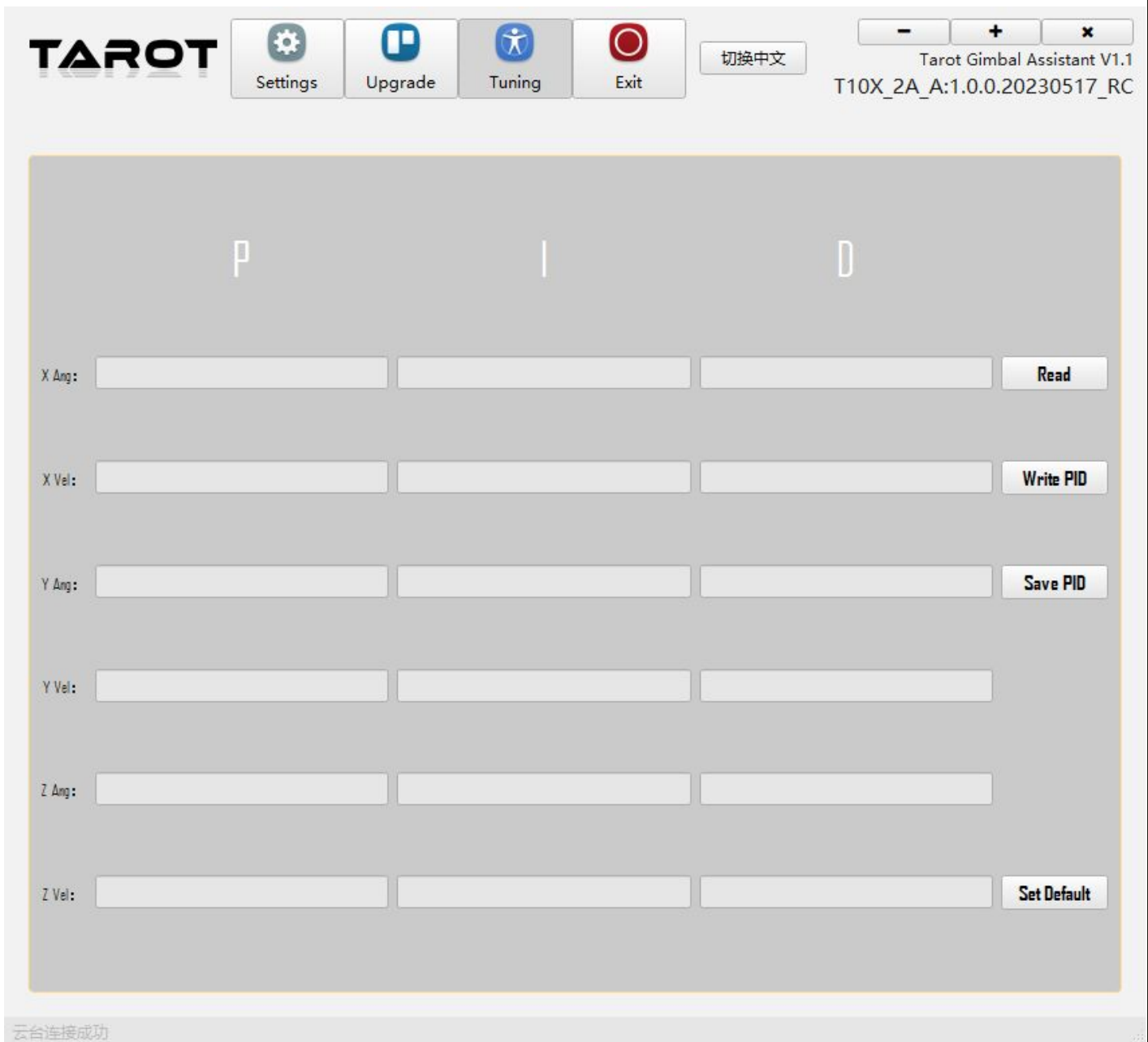
Clear Enter upgrade mode Exit upgrade mode Unlock

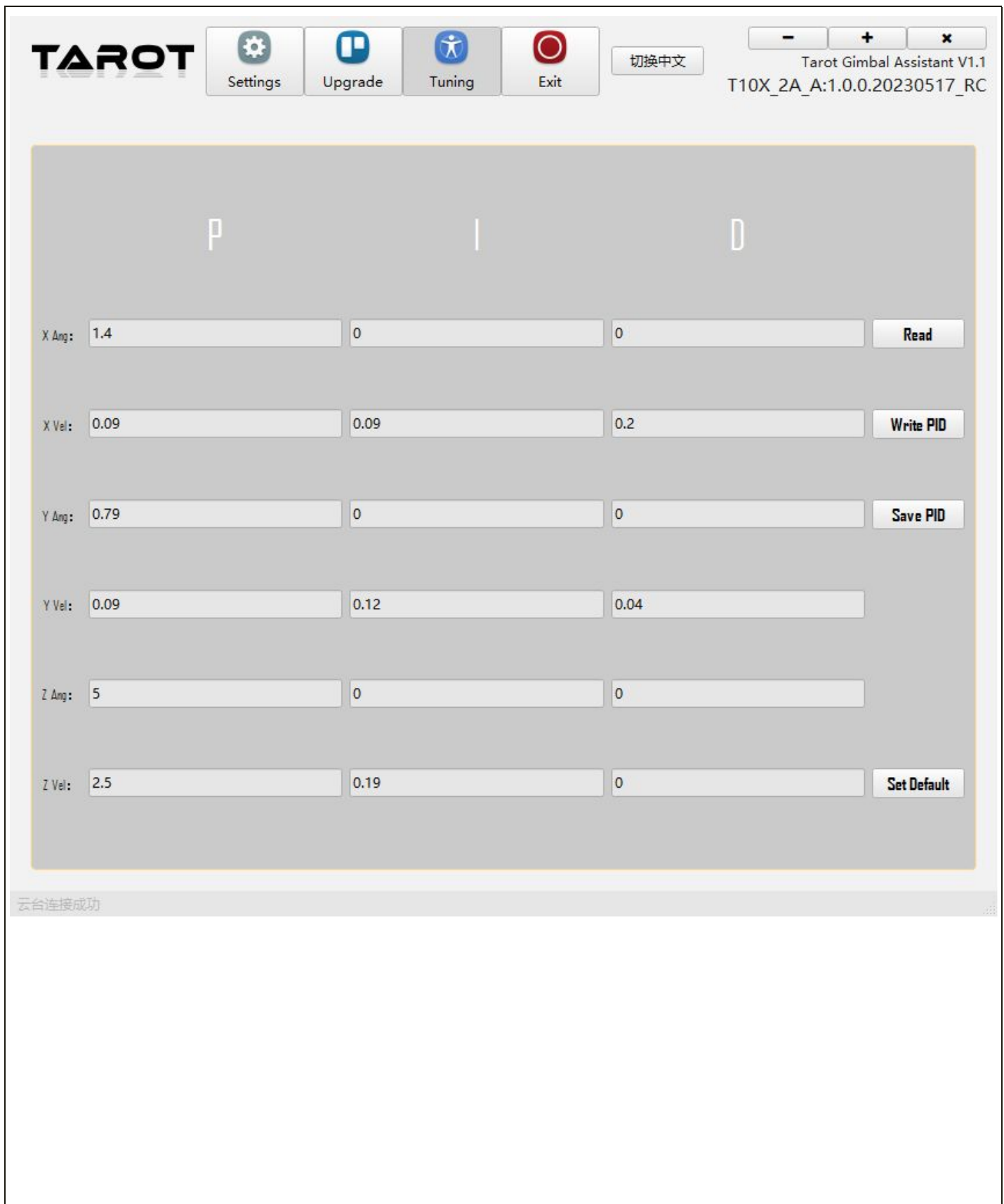
VI. Gimbal PID Tuning

TGA Gimbal Tuning Software supports you to customize the PID parameters of the Gimbal

Note: The Gimbal is factory pre-set to adjust the optimal pid value, which is compatible with most flight situations. If the Gimbal is not perfectly compatible with your flight platform, you can fine-tune the Gimbal PID value by the following ways.

1. Enter the "Tuning" interface of the TGA software and click "Read" to read out the current Gimbal preset PID values.;
2. Fine tune the PID value until Gimbal reaches your satisfaction;
3. If the adjustment process is confusing, you can click " Restore Default" to restore the factory PID value.

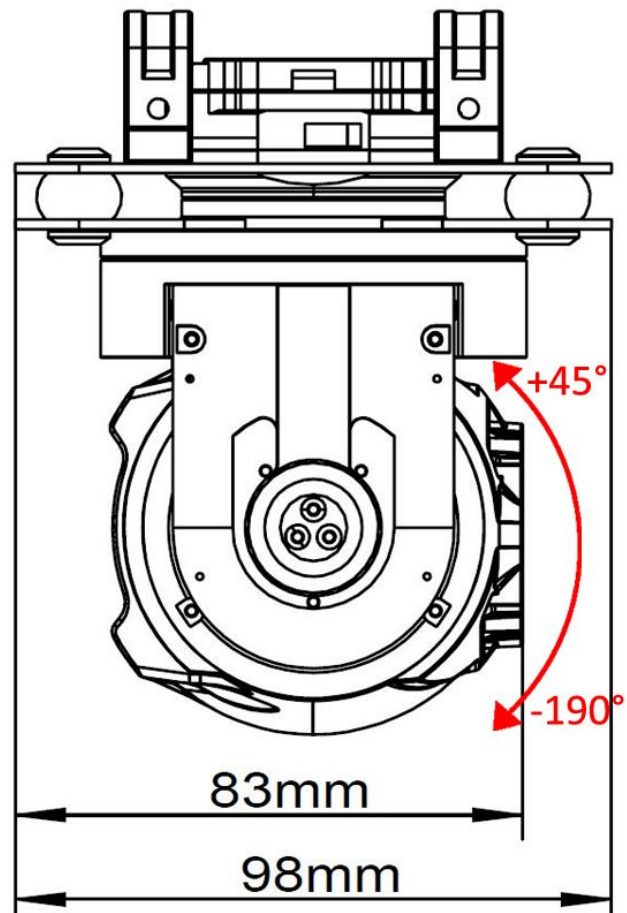
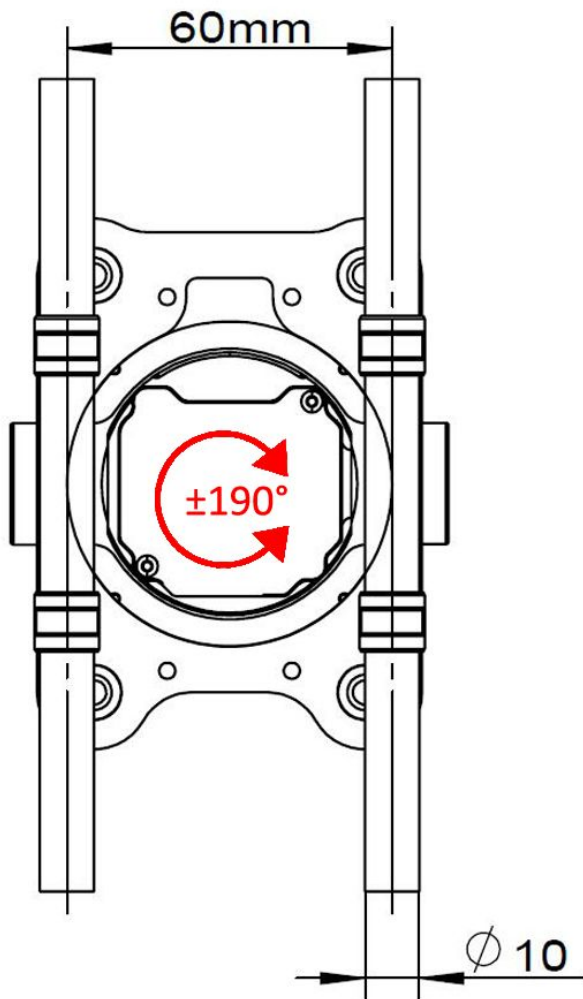
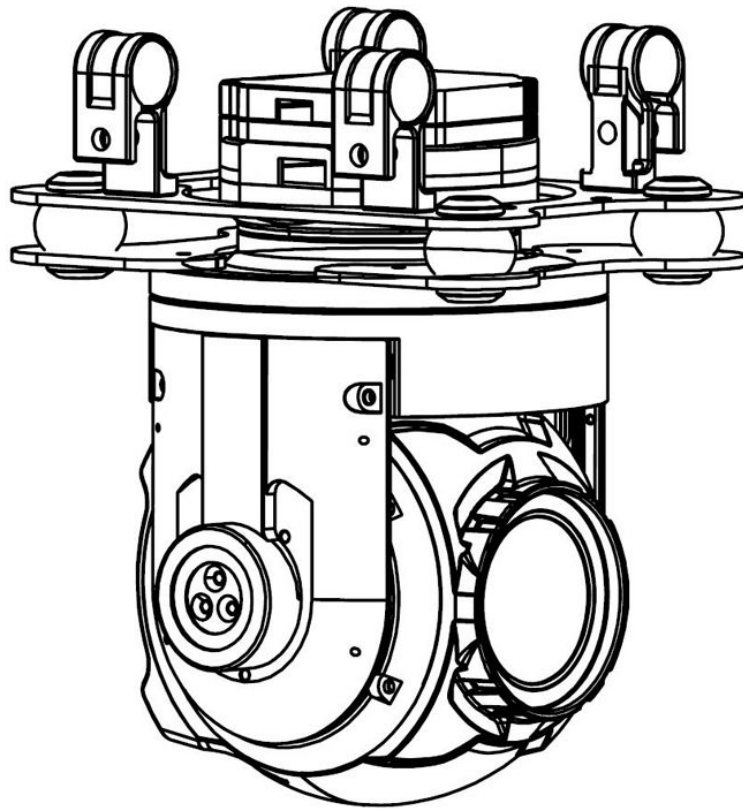




VII. Specification Sheet

	Projects	Parameters
Function Indicators	Video Output	HDMI(1080P 60FPS)
	Support Control Type (Gimbal)	S.Bus、 UART(TTL)
	Advanced Features	One-touch down, auto/manual focus、 Support Upright/Inverted
Cameras Technical Indicators	Sensor Size	1/3" CMOS
	Total Pixels	4 million
	Video Resolution	MOV/1080P@60fps
	Photo Resolution	JPG/1920*1080
	Optical zoom	f:4.9 ~ 49mm
	Field of view (horizontal)	66.6° ~ 7.2°
	Optical zoom	10X
	Output Format	1080P 60FPS / 720P 60FPS / 480P 60FPS
	Minimum Illumination	Color:0.05Lux/F1.6;
	PAL/NTSC	Support
	HDMI cable version	1.4
	Storage function	TF card (up to 32G)
	Minimum Focusing Distance	10 mm - 300 mm
Gimbal Technical Indicators	Steady Image Accuracy	±0.01°
	Maximum controllable speed	PAN :5-60°/s
		TILT :5-60°/s
	Controlled rotation range	PAN :±190°
TILT :-190° ~ +45°		
Complete Technology Indicators	Working environment temperature	-5 ~ 45°C
	Dimensions (LxWxH)	105×78×146mm
	Weight	305g
	Operating Voltage	12~27V
	Average power consumption	4W
	Debugging software support	Windows 7, Windows 10 and above (win10 and above driver-free)

This document and all related documents are subject to the final interpretation of TAROT. The details are subject to change without notice.



VIII. Protocol of the Gimbal and Flight Control

The Gimbal camera supports the use of serial protocol control, through the protocol control, you can achieve control of the Gimbal and the camera, as well as the Gimbal state, attitude angle real-time feedback, easy to integrate and combine with other modules, such as connected to the flight control, or the use of data transmission control, etc.

Serial protocol content is not explained here, you can dock according to the instructions. Please contact our sales staff for a Gimbal control agreement.

IX. Troubleshooting

Jelly phenomenon	<p>1:Check the shock ball installation for offset</p> <p>2:Gimbal camera installation fixed whether there is loose</p> <p>3:Whether the shock ball is broken, please replace the shock ball regularly</p>
Gimbal Point axis offset	<p>Check Sensor Information through the debugging software to check if the Gimbal has a resting 4-6 seconds self-test time before powering up</p>
Video file cannot be opened	<p>Whether the Gimbal recording process has a complete execution of the Operation to close the video, the video file will be lost if the Gimbal is directly powered off before the video is properly closed.</p>
TCA and TGA software does not work properly	<p>1:T10X-Pro has no power supply or the power supply voltage is lower than 12V and fails to start working normally.</p> <p>2:Some lite systems lack the corresponding USB serial port driver, please install the driver in the package.</p>
HDMI screen does not come out	<p>Check the wiring status between the Gimbal and the HDMI display/HDMI picture transfer device, supporting HDMI version 1.4</p>