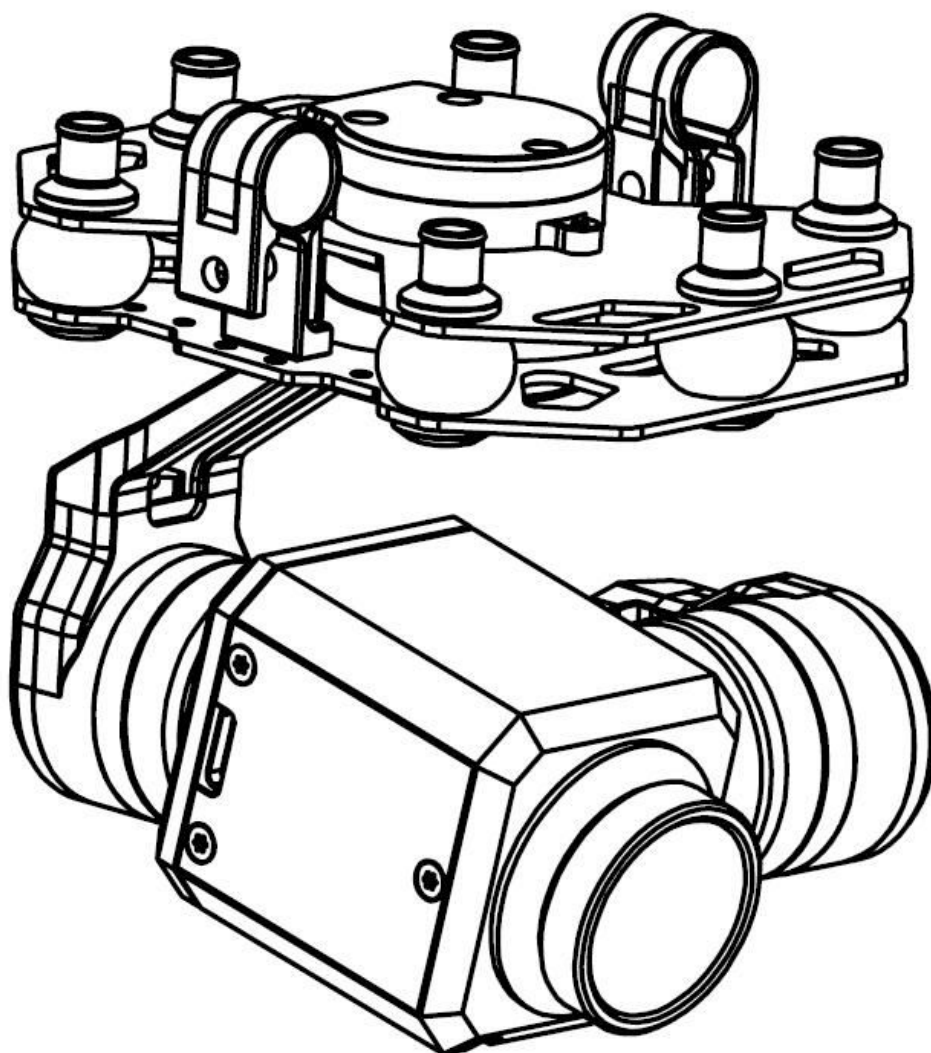


# **TAROT TL3T20**

## **Thermal Imaging Gimbal User Manual**



**2023.03.08 Revision V1.1**

## Content

|   |    |
|---|----|
| Warning and Disclaimer.....                                   | 1  |
| I . Product Introduction.....                                 | 2  |
| II . Product List.....  | 3  |
| III. Mounting & Configuration.....                            | 4  |
| 3.1 Mounted installation of gimbal.....                       | 4  |
| 3.2 Introduction of Gimbal Components.....                    | 5  |
| 3.3 Gimbal Controller Wiring Diagram and Instructions.....    | 6  |
| IV. Introduction of ZYX-Assistant Gimbal Tuning Software..... | 7  |
| 4.1 Installation of Tuning Software.....                      | 7  |
| 4.2 Connection of the Tuning Software.....                    | 7  |
| 4.3 Basic Setup of Tuning Software.....                       | 9  |
| 4.4 Channel Setting and Mapping for Tuning Software.....      | 10 |
| 4.5 Tools.....  | 12 |
| 4.6 Firmware Upgrade.....                                     | 13 |
| V . Frequently Asked Questions.....                           | 14 |
| VI. Product Specifications.....                               | 15 |
| VII. Port Description.....                                    | 16 |
| VIII. LED Indicator.....                                      | 17 |

## 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 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 TL3T20 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 TL3T20 is a delicate instrument. Please do not disassemble or assemble the TL3T20 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.

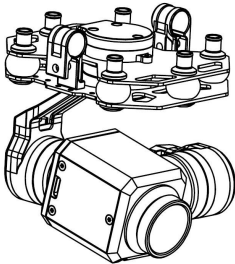
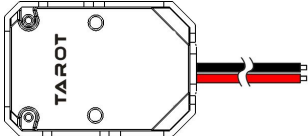

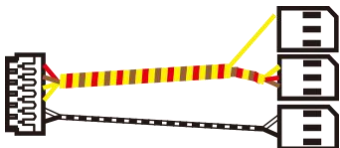
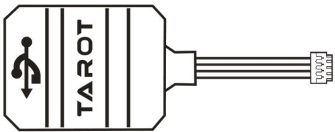
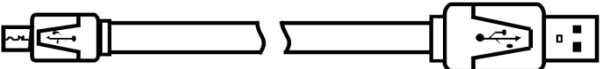
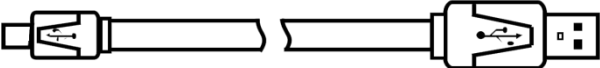
## I . Product Introduction

Tarot TL3T20 is a professional grade 3-axis thermal imaging Gimbal built by our company for the needs of many industries such as electric power inspection, fire fighting, etc. It has a built-in independent IMU to precisely control the attitude of the Gimbal, integrated Gimbal special servo drive module, supports pointing following and FPV first view two working modes, equipped with a professional grade 640 thermal imaging camera, can be Widely used in firefighting, forest security, public security monitoring, search and rescue, environmental law enforcement and other industries.

### Main Features:

- 1.The gimbal supports wide voltage 3-6S input;
- 2.Mechanical three-axis image stabilization,  $\pm 0.01^\circ$  image stabilization accuracy;
- 3.Aluminum alloy structure design, light and strong, good heat dissipation performance;
- 4.Highly optimized servo motor vector control algorithm;
- 5.Quick AV video output mode;
- 6.Rotation direction controllable angle (PAN):  $\pm 125^\circ$ ;
- 7.Pitch controllable angle (TILT):  $-120^\circ$  to  $+80^\circ$ ;
- 8.S-Bus/PWM receiver support;
- 9.Movement thermal imaging output resolution 640 \* 512;
- 10.Movement Tuning software (computer side) multi-mode optional;
- 11.Weight 278g

## II . Product List

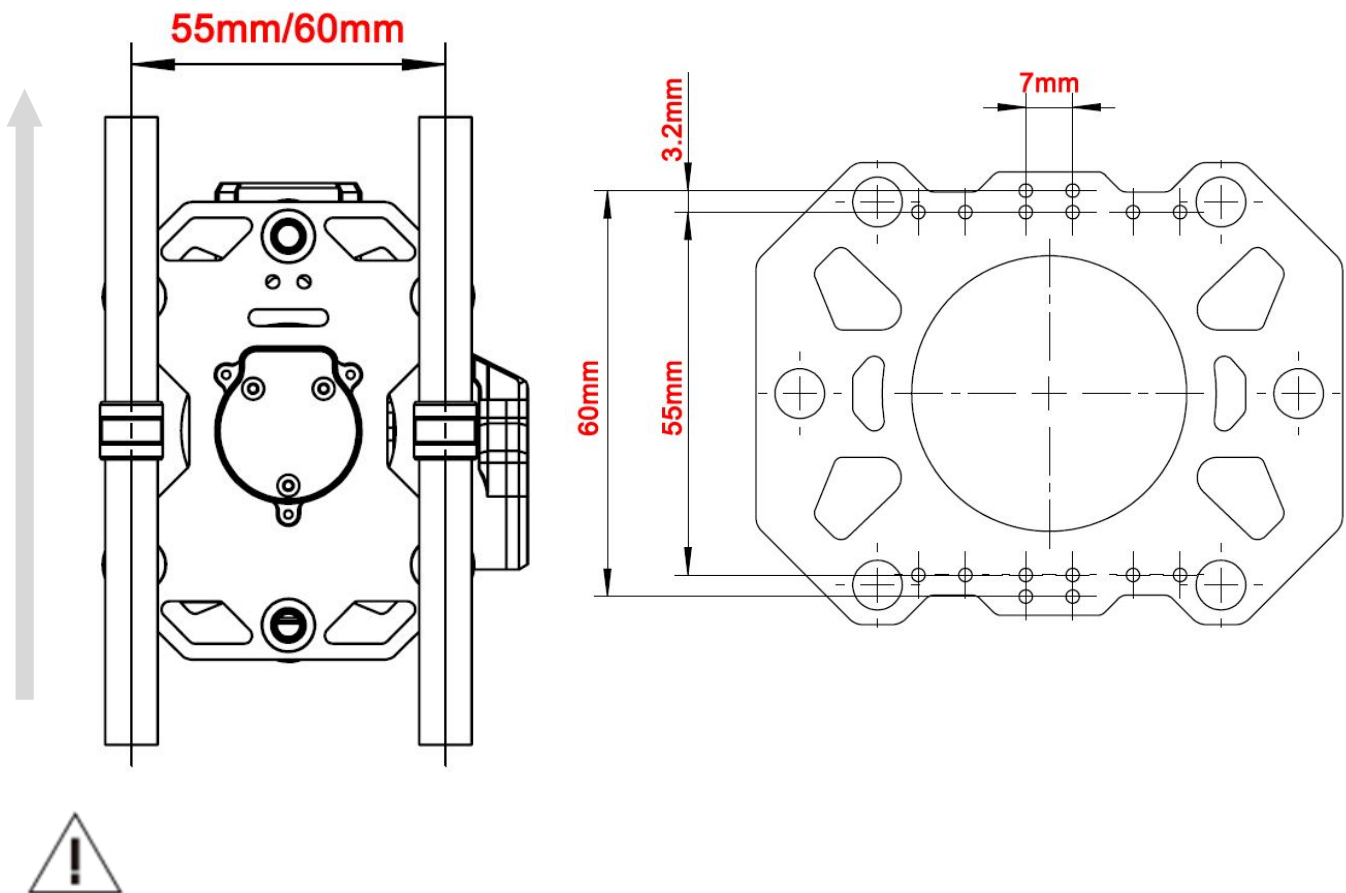
|   |  |
|---|--|
| Gimbal body × 1   |   |
| Gimbal Main Control Module (Power Supply) × 1   |    |
| Gimbal main control and Gimbal body connection cable × 1                                  |    |
| 5v output and receiver connection cable × 1   |   |
| Gimbal Debug Module × 1   |  |
| Gimbal Tuning Module<br>Connection Cable / Micro-USB × 1<br>(Not included, self-provided) |  |
| Thermal imaging movement<br>debug cable / Type-C × 1<br>(Not included, self-provided)     |  |

### III. Mounting & Configuration

#### 3.1 Mounted installation of gimbal

Customizable installation according to the hole size shown below, supports 2 types of mountings :

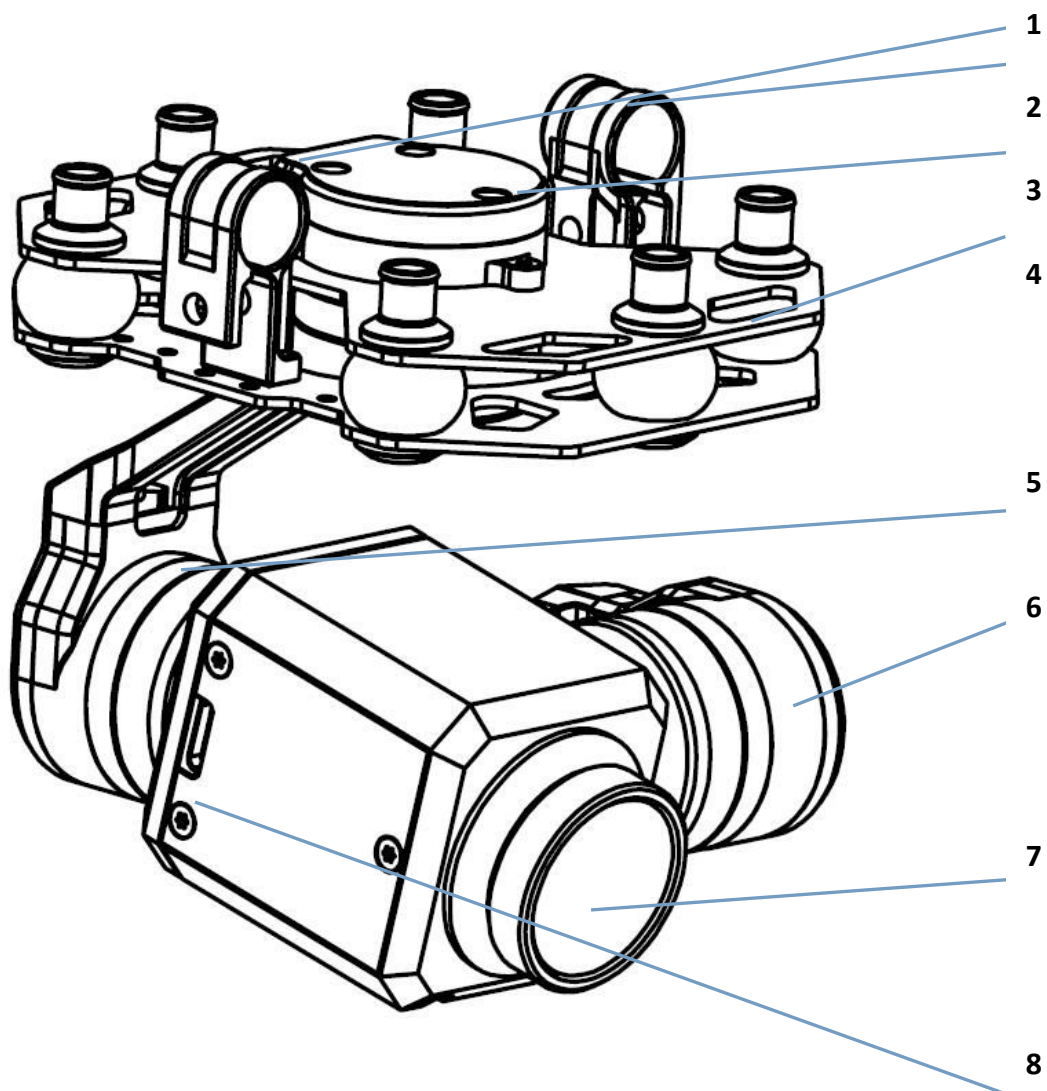
- 1 : Prepare Gimbal to mount carbon fiber tube ( $\Phi 10$ ), mounting distance support 55mm/60mm, can hang Gimbal directly on the carbon fiber tube quickly;
- 2 : Or add 4 M2 mounting holes to the vehicle, remove the Gimbal 2 suspension hooks and customize them with aluminum posts.



#### Cautions:

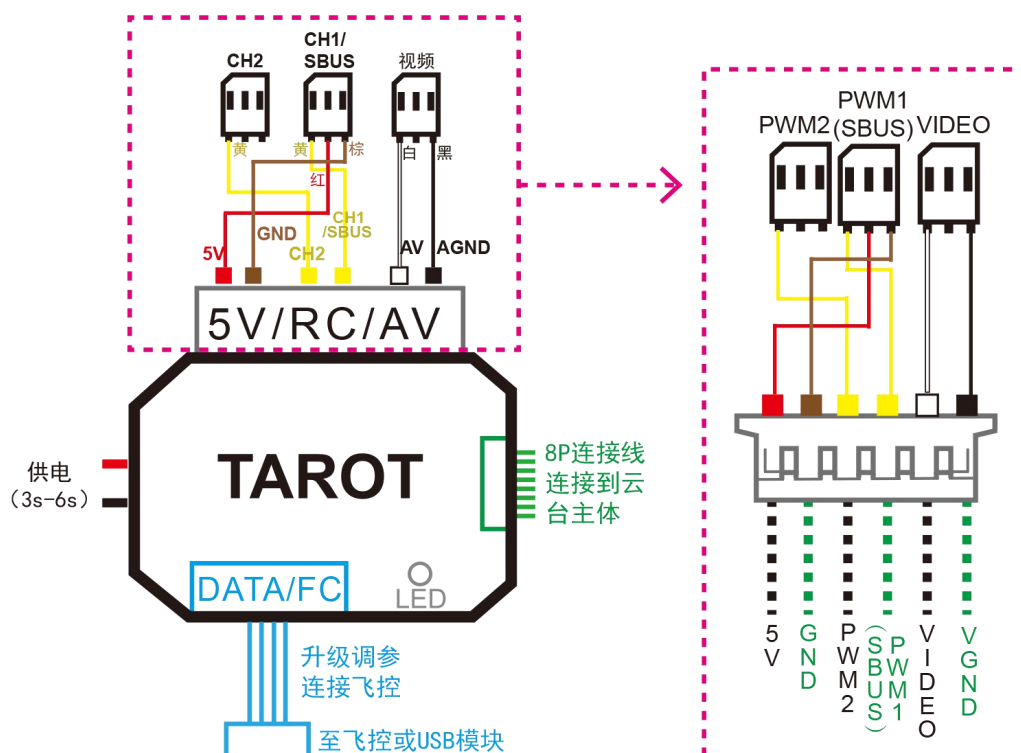
1. Please make sure there is enough space on the aircraft to ensure that the Gimbal camera does not touch the ground when going down vertically;
2. Please ensure that the Gimbal camera is installed in a horizontal position, firm and without looseness, to avoid abnormal vibration affecting the Gimbal 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 Introduction of Gimbal Components



|   |                        |   |                    |   |                                  |
|---|------------------------|---|--------------------|---|----------------------------------|
| 1 | Connection Controller  | 4 | Gimbal Shock Balls | 7 | Thermal Imaging Movement         |
| 2 | Gimbal Suspension Hook | 5 | Gimbal Roll Axis   | 8 | Movement Commissioning Interface |
| 3 | Gimbal Point Axis      | 6 | Gimbal Tilt Axis   |   |                                  |

### 3.3 Gimbal Controller Wiring Diagram and Instructions



|              |  |
|--------------|--|
| Power supply | <p>Power supply: 11V-26V (3-6S lithium battery)</p> <p><b>Too low or too high a voltage can cause damage to the Gimbal</b> , If using the same battery to power both the Gimbal camera and the aircraft, please ensure that the battery voltage meets the specifications of both the Gimbal camera and the aircraft</p>  |
| Receiver     | <p><b>Support PWM common receiver and SBUS two ways of input control</b></p> <p><b>1.PWM General Receiver</b> : Connect the Gimbal controller CH1/SBUS and CH2 channel lines to the corresponding desired channel interface of the PWM general receiver , Then set [Receiver Type] to "Normal Receiver" in the tuning software. The three functions of pitch/mode/pointing under [Channel Mapping] can be mapped to "Channel 1" and "Channel 2";</p> <p><b>2.SBUS Receiver</b> : Connect the Gimbal controller CH1/SBUS channel cable to the SBUS channel interface of the SBUS receiver , CH2 channel line should not be connected, and then set [receiver type] to "SBUS" in the tuning software, [channel mapping] under the three functions of pitch / mode / pointing mapping to the desired channel can be.</p> <p><b>Note:</b> If your receiver already has 5V power, please disconnect the 5V power from the CH1/SBUS channel line (red wire).</p> |



## IV. Introduction of ZYX-Assistant Gimbal Tuning Software

### 4.1 Installation of Tuning Software

①Please go to the official website to download the Tarot TL3T20 Tuning Software. Website: <http://www.tarotrc.com/>

②Run the driver installation software under the "USB Driver" folder. Follow the prompts to complete the driver installation.

32-bit system running : "CP210xVCPInstaller\_x86.exe"

64-bit system running : "CP210xVCPInstaller\_x64.exe"

③Connect to the computer via the Micro-USB cable to complete the final installation of the device driver.

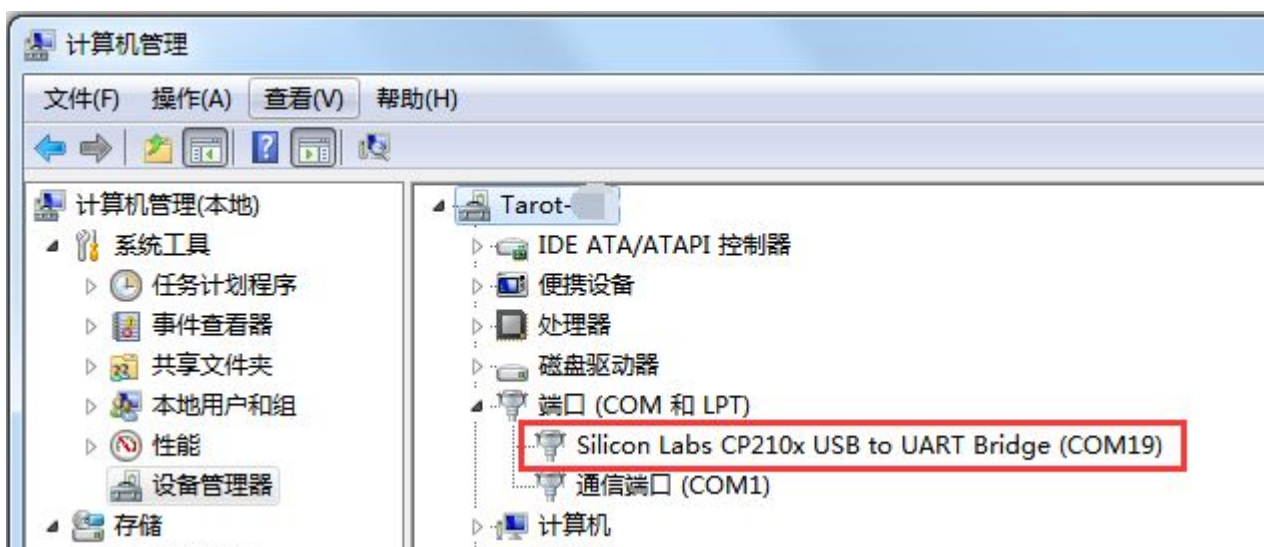
④Run the software "ZYX-Assistant.exe" for parameter setting and other operations.

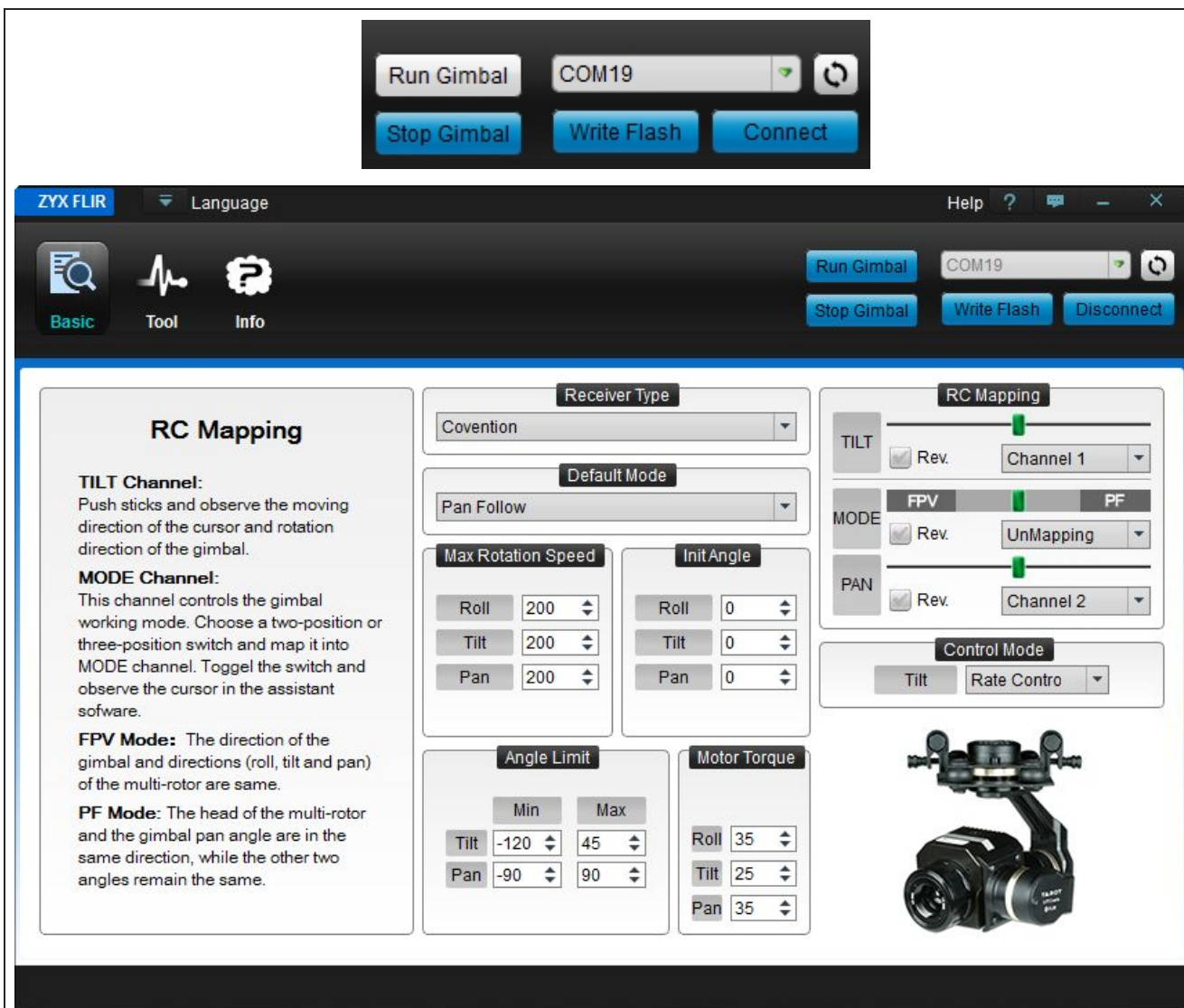
### 4.2 Connection of the Tuning Software

TL3T20 three-axis thermal imaging Gimbal, in flight, can stabilize the angle of roll, tilt, point in three directions, and output a stable thermal image.

By using ZYX-Assistant software, you can change the settings of the Gimbal control channels and set the corresponding Gimbal functions.

First connect your Gimbal to the [DATA/FC] port of the Gimbal Master Module via the [Gimbal Reference Module] and the [Micro-USB cable] to your PC , Then check Gimbal's real port number by "right-clicking" on [My Computer] - [Manage] - [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 the software "ZYX-Assistant.exe", click the Refresh button in the upper right corner and select the correct port number, click "Connect".





When the Gimbal connection is successful, the software will actively stop the Gimbal from spinning to protect your device.

Once you have set the relevant parameters, you can make your Gimbal work properly by clicking the "Run Gimbal" button. At this point, you can push and pull the rocker, toggle the switch to see if the Gimbal settings meet your requirements.

When you have finished setting the Gimbal parameters, click the "Cure Parameters" button to ensure that the parameters are cured in the Gimbal. When the Gimbal is next powered up, it will run with the saved parameters.

### 4.3 Basic Setup of Tuning Software

**1.Receiver not connected:**Gimbal mode is run by "default mode";

**2.Receiver is connected:**Gimbal mode is controlled by the receiver's "Mode" channel setting.

**FPV mode:**FPV mode, Gimbal is aligned with the three-axis orientation of the vehicle.

**Pan Follow mode :** Pan Follow mode, Gimbal Pan in line with the nose Pan.

The maximum rotation speed that Gimbal can achieve.

When you find that the Gimbal rotation speed is low when the remote control rocker is pushed and pulled to the maximum value, you can increase the value to increase the rotation speed.

Or, if the Gimbal rotates too fast when the joystick movement is small, you can reduce the value to slow down the rotation speed.

Rolling maximum speed input range:

0~200 (degree/sec)

Pitch maximum speed input range.

0~200 (degree/sec)

Pointing maximum speed input range.

0~200 (degree/sec)

**Note: After modifying the value, please hit the [Enter] key to upload the parameters and click "Write Flash".**

The screenshot shows the Tarot TL3T20 tuning software interface. It features several sections for configuring the gimbal. At the top, there's a 'Receiver Type' dropdown set to 'Covention'. Below it is the 'Default Mode' dropdown set to 'Pan Follow'. The 'Max Rotation Speed' section has three input fields for Roll, Tilt, and Pan, all set to 200. The 'InitAngle' section has three input fields for Roll, Tilt, and Pan, all set to 0. The 'Angle Limit' section has two columns, 'Min' and 'Max', with input fields for Tilt and Pan. The 'Motor Torque' section has three input fields for Roll, Tilt, and Pan, all set to 35. Arrows from the surrounding text boxes point to specific parts of the interface: one to the Receiver Type dropdown, one to the Max Rotation Speed section, one to the InitAngle section, one to the Angle Limit section, and one to the Motor Torque section.

Receiver connection method

**Covention:**Connect to CH1/SBUS and CH2 channels respectively with connecting cables;  
**SBUS:**Connect to the CH1/SBUS channel with the connection cable, making sure that the CH2 channel is not connected.

Initial angle in each direction after Gimbal power-up.Example: If you want the camera to stay at -45 degrees in pitch after Gimbal is powered up, you need to enter -45 in the corresponding item.

Roll angle range: -50°~50°

Pitch angle range: -120°~80°

Point angle range: -125°~125°

**Note: After modifying the value, please hit the [Enter] key to upload the parameters and click "Write Flash".**

Angular range of Gimbal rotation in pitch and pointing directions.

When the Gimbal is rotated to the angle limit setting by the remote control, the Gimbal will not continue to rotate until the rocker is pushed and pulled in reverse to bring the Gimbal back within the angle limit.

Pitch angle limit input range: -120°~80°

Point angle limit input range: -125°~+125°

**Note: After modifying the value, please hit the [Enter] key to upload the parameters and click "Write Flash".**

This parameter affects the response speed of the Gimbal; too small a parameter leads to poor Gimbal stability and too large a parameter leads to self-excited Gimbal oscillations.

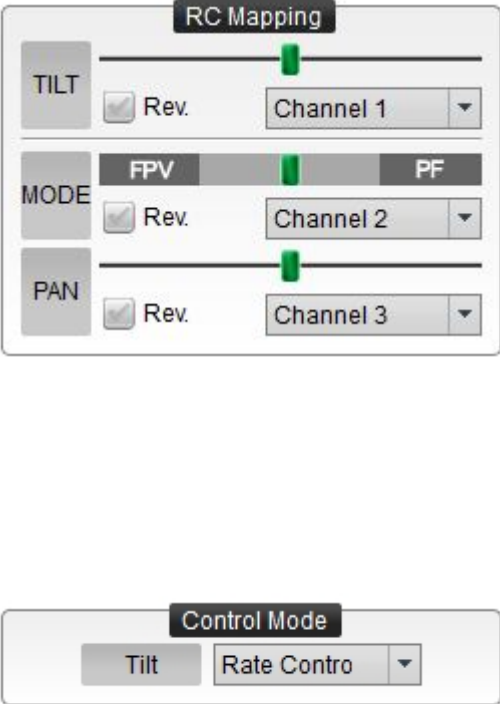
Adjustment method: If the Gimbal appears to be vibrating, please turn down the parameter slightly until the vibration disappears.

Input Range:0~200

**Note: After modifying the value, please hit the [Enter] key to upload the parameters and click "Write Flash".**

**Note: This parameter has been adjusted to a more appropriate value when the Gimbal is shipped, so please do not modify this parameter if there are no abnormalities in the Gimbal.**

## 4.4 Channel Setting and Mapping for Tuning Software



The screenshot shows the 'RC Mapping' and 'Control Mode' sections of the Tarot tuning software. The 'RC Mapping' section has three rows: 'TILT' with a 'Rev.' checkbox and 'Channel 1' dropdown; 'MODE' with a 'Rev.' checkbox and 'Channel 2' dropdown; and 'PAN' with a 'Rev.' checkbox and 'Channel 3' dropdown. Each row has a green slider bar. The 'Control Mode' section has a dropdown menu with 'Tilt' and 'Rate Contro' options.

**Tilt Channel:**  
Push the rocker and observe the direction of movement of the slider and the direction of rotation of the Gimbal.

**Mode Channel:**  
This channel controls the Gimbal mode, selecting a channel with a two- or three-position switch and mapping it to the "mode" channel.  
When the toggle switch is moved to the corresponding position, the slider will be located in the corresponding mode area.

**Point Channel:**  
Push the rocker and observe the direction of movement of the slider and the direction of rotation of the Gimbal.

Remote control of Gimbal rotation (only support pitch direction).  
Push the rocker and observe the direction of movement of the slider and the direction of rotation of the Gimbal.

**Rate Mode:** The remote control rocker position corresponds to the Gimbal's speed.

**Angle Mode:** The remote control rocker position corresponds to the angle of the Gimbal.

### ① Gimbal Mode Setting

Select a two- or three-digit switch as the mode switch control (default channel two) :

**Take a three-position switch as an example :**

Position 1: FPV mode (first-person view)

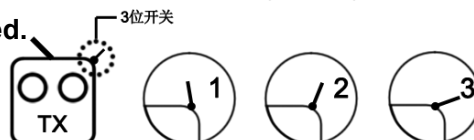
Gimbal roll, tilt and point angles follow the aircraft attitude changes; and when the remote control pointing rocker back to the center, Gimbal pointing will also automatically back to the center;

Position 2: No operation;

Position 3: Follow mode, point to follow mode

Gimbal roll and tilt angles remain the same, point follows the nose pointing change;

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



#### Note :

When the mode channel is not connected, the Gimbal will work in the default mode; if the mode channel is accidentally disconnected during use, the Gimbal will maintain the operating mode before disconnection;

When the Gimbal is powered on, if no receiver is connected, the Gimbal will work in the default mode.

### ② Gimbal Tilt Setting

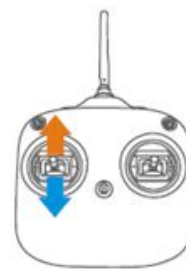
Select a rotary button switch or rocker for pitch axis control (default channel one) :

**Take the rocker as an example :**

Rocker up, Gimbal turns up corresponding to the tilt axis;

No operation in the center;

Rocker down, Gimbal turns down corresponding to the pitch axis.



### ③ Gimbal Point Setting

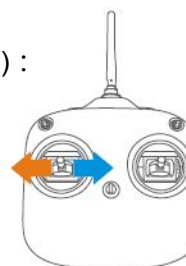
Select a rotary button switch or rocker for pointing axis control (default channel three) :

**Take the rocker as an example :**

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

No operation in the center;

Rocker to the right, Gimbal corresponding to the point axis to the right.

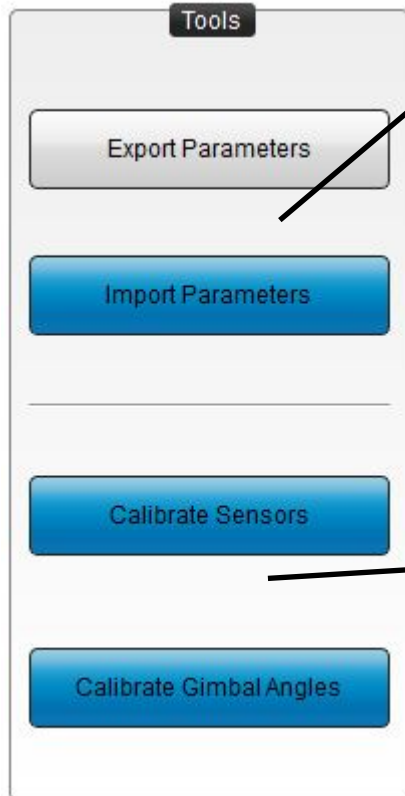


#### Cautions :

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.

## 4.5 Tools



Calibrate the sensor when the Gimbal angle is not horizontal or when you find that the output of the gyroscope is far from the zero value when the Gimbal is at rest.

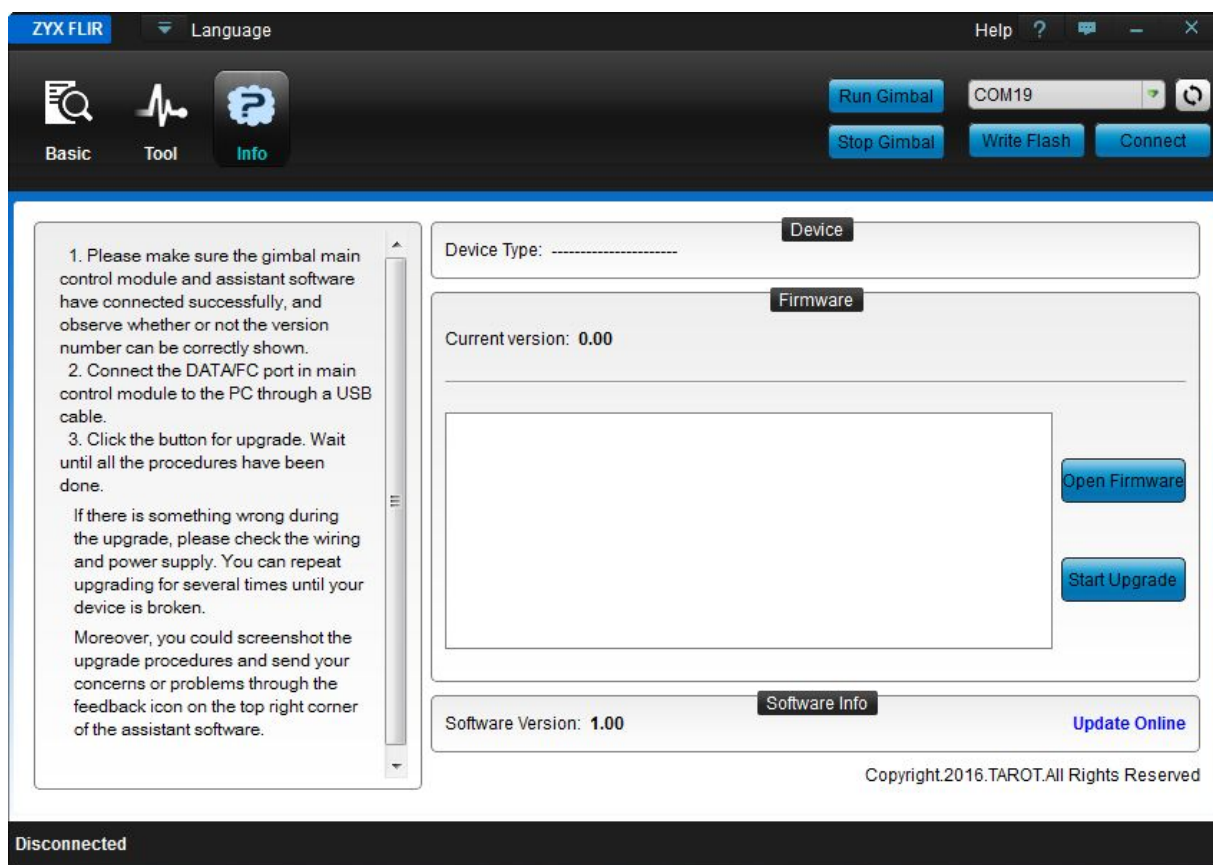
Calibration method: Place the Gimbal horizontally at rest (the level directly affects the calibration effect), then click the "Calibrate Sensor" button, when the bottom left corner of the software shows "Sensor calibration successful", calibration is complete..

**Note: Gimbal has been factory-tested rack calibration, no need to operate calibration in case of no problem**

Please keep the three axes of the Gimbal perpendicular to each other when calibrating the angle of the Gimbal, incorrect placement will affect the stable angle of the Gimbal after operation..



## 4.6 Firmware Upgrade



### Upgrade Steps :

1. Please download the latest version of Firmware Upgrade package from the official website (<http://www.tarotrc.com>).
2. Ensure that the Gimbal master module is successfully connected to the software.
3. Click the button "Open Firmware" to import the latest downloaded firmware file, click the button "Start Upgrade", the progress bar will reach 100% to be successful.

If you get an error during the upgrade process that you cannot upgrade, please check if the wiring is correct, the power supply is normal, and the driver installation is successful. As long as your device is not damaged, it is possible to repeat the upgrade several times.

## V. Frequently Asked Questions

| Question                       | Analysis   | Solutions   |
|--------------------------------|--|---|
| <b>Angle not horizontal</b>    | 1.Excessive sensor error;<br>2.The remote control does not return to zero;   | 1.Calibration Sensors;<br>2.Remote control back to zero;  |
| <b>Gimbal vibration</b>        | 1.Locking not fixed tight;<br>2.Motor torque is too high;  | 1.Tighten each fixing screw of Gimbal;<br>2.Slightly reduce the motor torque value;   |
| <b>Poor screen stability</b>   | 1.Excessive vibration of the aircraft;<br>2.Loose vibration damping ball;<br>3.Motor torque is too small;              | 1.Reduction of aircraft vibration;<br>2.Check and correct shock ball position;<br>3.Slightly increase the motor torque value; |
| <b>Fast flashing red light</b> | 1.Gimbal main control and Gimbal body connection line is loose;<br>2.Gimbal blocked rotation protection over 10 times; | 1.Check the connection cable and fix it tightly;<br>2.Check for resistance to Gimbal rotation, then reapply power;            |



## VI. Product Specifications

|                               | Projects   | Parameters   |
|-------------------------------|--|--|
| Function Indicators           | Video Output   | AV output PAL system<br><b>(Does not support internal recording)</b> |
|                               | Support Control Type (Gimbal)                          | PWM、S.Bus  |
| Gimbal Technical Indicators   | Input power  | 3S-6S Lipo (11V-26V)   |
|                               | Operating current                                      | 30mA ( @25V )<br>50mA ( @12V )                                       |
|                               | Blocking current                                       | 350mA ( @25V )<br>700mA ( @12V )                                     |
|                               | Working environment temperature                        | -20℃~+50℃  |
|                               | Weight   | 278g   |
|                               | Maximum external dimensions (length, width and height) | 96mm*80mm*99mm   |
|                               | Maximum speed  | Tilt : ±200°/S   |
|                               |  | Roll : ±200°/S   |
|                               |  | Point : ±200°/S  |
|                               | Controlled rotation range                              | Tilt : -120°~ +80°<br>Roll : -125°~ +125°                            |
|                               | Attitude control accuracy                              | ±0.02°   |
|                               | Assembled camera model                                 | 640 Thermal Imaging Camera   |
| Cameras Technology Indicators | Resolution   | 640*512  |
|                               | Focus  | 13mm F1.2  |
|                               | Focus type   | Athermalization  |
|                               | FOV  | 33°×26°  |
|                               | IFOV   | 0.95 mrad  |
|                               | Pixel Pitch  | 12μm   |
|                               | Frame Rate   | 50Hz   |
|                               | Response Spectra                                       | 8 ~ 14μm   |
|                               | NETD   | <a href="#">≤50mK@25℃ , F#1.0 ( ≤40mK optional )</a>                 |
|                               | TEC  | No   |
|                               | Brightness&Contrast Adjustment                         | Manual/Auto0/Auto1   |
|                               | Polarity   | Blackhot/whitehot  |
|                               | Palette  | Support  |
|                               | Reticle  | Display/disappear/move   |
|                               | Image Processing                                       | Shutterless I、NUC、Digital filtering/noise reduction、DDE              |
|                               | Image flip   | Right-left/Up-down/Diagonal  |
|                               | Camera Tuning interface                                | Type-c   |
|                               | Camera Tuning software                                 | PC (Win10 and above, drive-free)                                     |

## VII. Port Description

| Gimbal Main Control Port    |  |
|-----------------------------|--|
| PWR                         | Power port   |
| DATA/FC                     | Gimbal master tuner upgrade and flight control data input port |
| 5V/RC/AV                    | 5v Power Output, Receiver Input, Thermal Imaging AV Output     |
| Thermal imaging camera port |  |
| Type-c                      | Thermal imaging commissioning interface (PC side)              |

## VIII. LED Indicator

| Gimbal Main Control Indicator Status           |   |
|--|---|
| Red and blue lights flash twice                | Power-on self-test status   |
| Red and blue lights are always on              | Power-on self-test failure  |
| Blue light goes out                            | Flight control not connected  |
| Blue light is always on                        | Flight control is connected   |
| Blue light blinking                            | The flight control is connected properly and the flight control data is available |
| Red light flashing                             | 1. Line failure<br>2. Gimbal blocked rotation protection over 10 times            |
| Motor drive and sensor module indicator status |   |
| Blue light flashes once                        | Power-on self-test status   |
| Blue light is always on                        | Power-on self-test failure  |

