SIYI

E3
PROPULSION SYSTEM USER MANUAL

SIYI Technology (Shenzhen) Co., Ltd.

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SIYI

Thank you for purchasing SIYI products.

E3 is an integrated propulsion system independently developed by SIYI Technology, specifically designed for light industrial drones with a single-axis thrust of 0.5-1kg. Combining powerful thrust, precise control, and high reliability, it utilizes FOC vector control and dual-throttle redundancy. Featuring a modular split design, conformal coating sealing process, intelligent data monitoring, fault storage functions, and an IPX5 protection rating, it is the ideal choice for light industrial propulsion systems.

To ensure a good product experience, please read this user manual carefully before assembly and flight. This manual can help you resolve most usage inquiries. You can also visit the official SIYI Technology website (www.siyi.biz), call the official after-sales service center, or send an email to support@siyi.biz to consult SIYI engineers directly regarding product knowledge or to provide feedback.

Contact Us: SIYI Official Website *(https://siyi.biz/en)*

SIYI User Group - Facebook	
Facebook	
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Revision History

Version	Date	Description
1.0	Feb.2026	Initial release
2.0	Jun. 2026	Added UniGCS open-source flight controller configuration and precautions
2.1	Jun. 2026	Modify the leveling method

Contents

READ TIPS

Symbols and Icons

Please pay more attention to content indicated with the following marks:

 **DANGER** Dangerous operations that are highly likely to cause personal injury.

 **WARNING** Operations that may result in personal injury.

 **Note** Be careful to avoid unnecessary property damage caused by improper operations.

 **Prohibited**  **Mandatory**  **Mark**

Safety

The E3 propulsion system is designed and manufactured for professional application scenarios. Operators must possess the corresponding basic knowledge and skills; please use it with caution. SIYI Technology assumes no responsibility for any unnecessary product damage, financial loss, or personal injury caused by non-standard or irresponsible operation. Minors must be supervised by professionals when using this product. SIYI products are designed for commercial scenarios and are strictly prohibited for military purposes. Unauthorized disassembly or modification of this product is prohibited without SIYI Technology's permission.

Storage, Transportation, and Recycling

When your SIYI products are idle, being transported for fieldwork, or have reached the end of their service life, please note the following:

 Danger

Idle SIYI products should be kept out of reach of children. Avoid placing SIYI products in environments that are excessively hot (above 60°C) or excessively cold (below -20°C).

Note

Avoid placing SIYI products in humid or dusty environments. When carrying or transporting SIYI products, avoid vibrations or impacts that may damage the components.

1. Product Introduction

1.1 Product Features

High-Efficiency Power

The maximum recommended thrust per axis is 1kg, at which the propulsion efficiency is 9.45g/W. The maximum thrust per axis reaches 2.2kg, providing ample power redundancy and high system efficiency. This ensures effortless flight under load, longer operational endurance, and enhanced operational efficiency.

Modular Design

With a split propulsion system design, users only need to mount the motor on the drone arm, eliminating concerns about small or thin arm tubes on light frames. The ESC can be mounted in any position. This highly customizable, ready-to-use design allows for quick assembly and disassembly.

ESC (Electronic Speed Controller)

Equipped with SIYI's self-developed FOC ESC, it provides precise control and rapid response. The fail-safe protection functions have undergone extensive experimental testing, ensuring safety, reliability, and high stability. It supports data storage, real-time monitoring of system operational status, and records operating data to facilitate issue tracking and analysis. The PCB utilizes a conformal coating waterproof process, providing an IPX5 protection rating, ensuring long-term stable operation fearlessly in rainy conditions.

Motor

The motor utilizes high-quality bearings and high-performance magnetic steel to ensure corrosion resistance, extend service life, and guarantee long-term stable operation. The centrifugal cooling structure employs excellent aerodynamic simulation design, featuring high airflow, low noise, and outstanding heat dissipation. The enameled wire of the motor winding has a temperature resistance of up to 200°C, significantly enhancing motor reliability.

Propeller

The propellers feature a large pitch and excellent aerodynamic design. Made of carbon fiber-nylon composite materials, they provide higher thrust while maintaining efficiency. They are corrosion-resistant, easy to maintain, and capable of withstanding harsh operational environments.

PWM & CAN Dual Throttle Redundancy

The dual-throttle design allows flexible selection of control responses and logic. Real-time adjustment and rapid response improve throttle control data transmission stability and system anti-interference capabilities. The PWM and CAN throttle dual-redundancy ensures that if one signal is lost during operation, the switch occurs without any change in flight attitude, greatly improving the system's fault tolerance and safety.

Fault Storage & Real-Time Analysis

The ESC features built-in data storage. Using the CAN communication protocol paired with the SIYI CAN LINK module, users can perform firmware upgrades, historical data queries, fault storage data analysis, and ESC parameter adjustments. When paired with a flight controller supporting the CAN protocol (such as SIYI N7), real-time data telemetry can be achieved to monitor the propulsion system's status and prevent potential risks.

Comprehensive ESC Protection Functions

Whether during power-on self-test or the operational phase, the ESC promptly detects system anomalies through preset detection mechanisms, ensuring equipment and personnel safety.

· Power-on Self-Test: Over/under-voltage protection, phase loss protection, op-amp anomaly protection, MOS short-circuit protection, throttle loss/non-zero protection.

· Operational Protection: Stall protection, throttle loss warning, over-current warning.

High Efficiency & Reliability

The system has passed over a hundred tests, including continuous load aging for over 1,000 hours in harsh laboratory environments, and strict outdoor flight aging for over 200 hours.

Open Source & Commercial Ecosystems

Upholding SIYI Technology's excellent tradition in the intelligent robotics sector, the system embraces both inclusive open-source systems and trusted commercial systems, injecting powerful vitality into building a sustainable industry ecosystem!

(1) SIYI Ecosystem: Use the PC software to view data waveforms, upgrade firmware, modify configurations, and trace fault data.

(2) Open Source Ecosystem: Open-source firmware support (ArduPilot, PX4); Open-source communication protocol support (DroneCAN).

1.2 Product Overview

1.3 Technical Specifications

Overall

Max Thrust	2.2 kg / axis
Recommended Takeoff Weight	0.5 - 1 kg / axis
Recommended Battery	6S LiPo
Cable Lengths	Power Cable: 500mm Signal Cable: 550mm Motor Phase Cable: 600mm
Protection Rating	IPX5
Motor Mounting Holes	M3*4@Φ25mm
Total Weight (excl. prop & connectors)	166g±2g

ESC Specification

Model	40A FOC
PWM Voltage Input	3.3 / 5V
PWM Pulse Width	1050 ~ 1950 μs
PWM Operating Frequency	50 ~ 500 Hz
Max Operating Voltage	28V
Continuous Current	17A (With good heat dissipation)
Max Current	50A (Instantaneous)

Communication Protocol	CAN
Firmware Upgrade	Supported
Digital Throttle	CAN Throttle

Motor Specifications

KV	350 KV
Stator Size	Φ35 * 10 mm
Slots/Poles	12N14P
Weight	120g±1g

Propeller Specifications

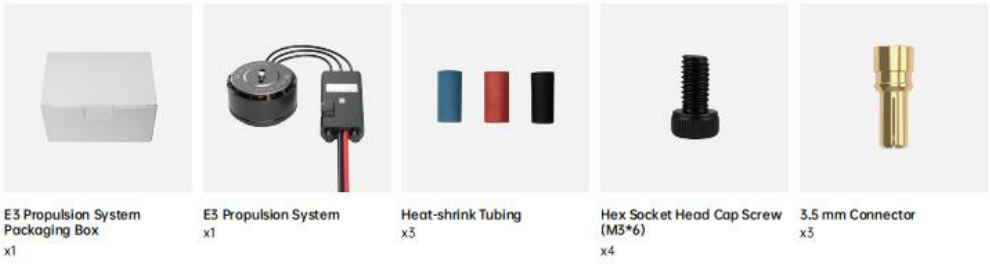
Diameter * Pitch	15.5 * 5.8 inches
Weight	26.5g±0.5g

1.4 Performance Data

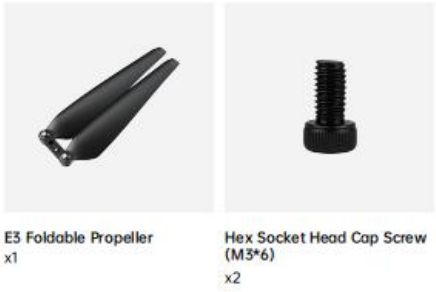
E3 Thrust Data							
Voltage(V)	Propeller	Throttle(%)	Current(A)	Thrust(KG)	RPM	Power Input(W)	Efficiency(G/W)
24	15558	20	0.28	0.10	1318	5.19	15.26
		25	0.44	0.16	1660	9.56	15.81
		30	0.68	0.25	1992	14.51	15.18
		35	1.02	0.35	2317	22.52	14.23
		40	1.46	0.46	2635	32.46	13.27
		45	2.00	0.59	2948	44.72	12.38
		50	2.65	0.73	3256	59.56	11.45
		55	3.41	0.86	3559	79.12	10.57
		60	4.25	1.00	3853	99.69	9.83
		65	5.32	1.17	4141	124.84	9.19
		70	6.57	1.33	4425	151.46	8.47
		75	8.08	1.50	4701	192.86	7.81
		80	9.48	1.66	4975	230.48	7.34
		85	11.64	1.91	5230	274.94	6.91
		90	13.82	2.12	5498	333.33	6.45
		95	15.87	2.30	5737	358.91	6.12
		100	16.03	2.32	5753	356.39	6.09

1.5 Packing List

Propulsion System Bundle: 1x E3 Motor, 1x E3 ESC
Accessories: 3x Heat shrink tubes, 3x 3.5mm bullet connectors, 4x M3*6 inner hexagon screws



Propellers: 1x 15558 Folding Propeller (CW or CCW), 2x M3*6 inner hexagon screws



1.6 Protection Functions, LED & Buzzer Definitions

The SIYI propulsion system uses both LED indicators and a buzzer to define different operational statuses

Status	Exception Info	Buzzer	LED Indicator	Recommended Action
Self-Test	Over-voltage, Under-voltage	None	Yellow flash (1 short: Over, 2 short: Under)	Check power supply
	Op-Amp Anomaly	None	Yellow flash (2 long, 3 short)	Contact Tech Support
	MOS Short Circuit	None	Yellow flash (2 long, 2 short)	Contact Tech Support
	Motor Phase Loss	None	Yellow flash (2 long, 1 short)	Check if motor rotation is stuck
	Throttle Loss	1 Short Beep	Yellow flash (1 long)	Check if throttle cable is damaged; verify signal output
	Throttle Not Zero	1 Short Beep	Yellow flash (1 long)	Check throttle travel on FC/Radio
Running	Throttle Loss	1 Short Beep	Yellow flash (1 long)	Cable loose/damaged, or no signal output
	Stall Protection	None	Yellow flash (1 long, 4 short)	Check for debris in the motor
	MOS/Capacitor Over-Temp	None	Yellow flash (1 long 2 short / 1 long 3 short)	Check if operating within recommended payload range
	Full Throttle (100%)	None	Solid yellow until non-full throttle state, then reverts to normal color	Not within the recommended thrust range; reverts to normal color once out of full throttle.
	Over Current	None	Yellow flash (2 long)	Check if operating within recommended payload range
Firmware	No Firmware	None	White solid	Connect to UniGCS to upgrade firmware
	Upgrade Failed	None	White solid	Ensure system works properly and cables are connected, then retry
	Upgrading	None	White flash	Upgrading in progress; reverts to normal after success

Note

Red, green, and blue are the normal LED colors, which can be customized by the user.

The propulsion system navigation lights can also be turned off.

Even if the navigation lights are turned off, the yellow LED will still flash in the event of a fault or abnormality.

2. Assembly Preparation

2.1 Soldering Power Connectors

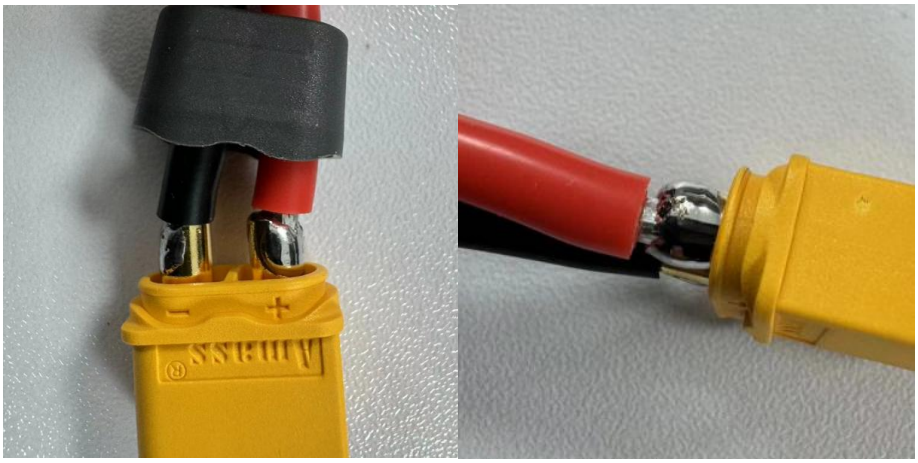
Soldering the power connector is necessary for the propulsion system to function properly.

Tools Required:

- Soldering iron
- Solder (ensure sufficient quantity)
- Connector (Amass XT60 or higher grade recommended).

Steps:

1. Identify the positive (Red) and negative (Black) wires of the propulsion system power cable.
2. Use the soldering iron to solder the positive wire to the positive terminal of the connector, and the negative wire to the negative terminal.



Note

Ensure the solder joints are fully and securely soldered without cold/false soldering to maximize flight safety.

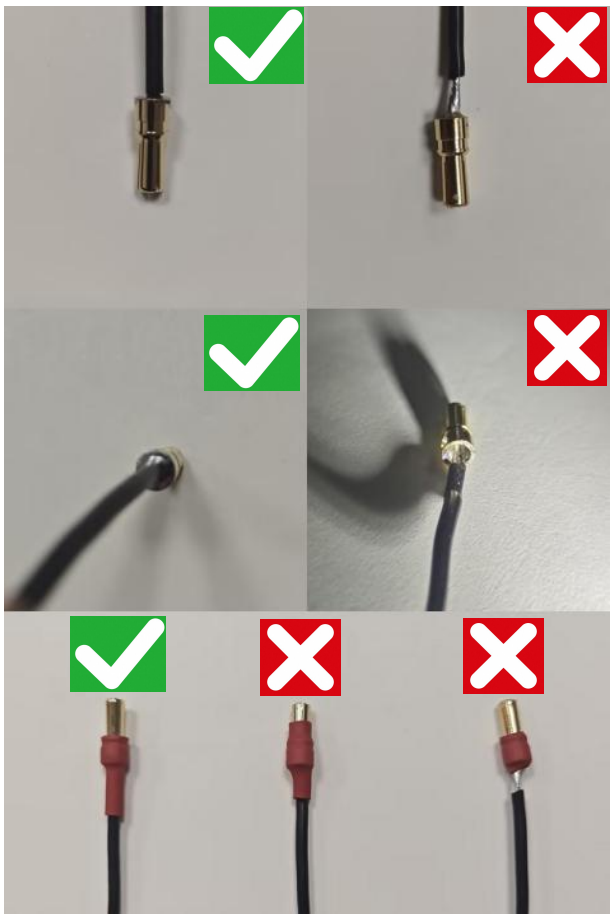
2.2 Soldering Three-Phase Wire Connectors

Tools Required: Soldering iron, Solder.

- Soldering iron
- Solder.

Steps:

1. Prepare the 3.5mm gold-plated bullet connectors and the three-color heat shrink tubes.
2. Solder the 3.5mm connectors to the tinned ends of the motor phase wires. Trim the tinned wire ends if they are too long for the connector socket to ensure the heat shrink tube can properly cover the silicone wire insulation later.
3. Install the three-color heat shrink tubes in the order of the motor phase wires to facilitate determining motor rotation direction later.



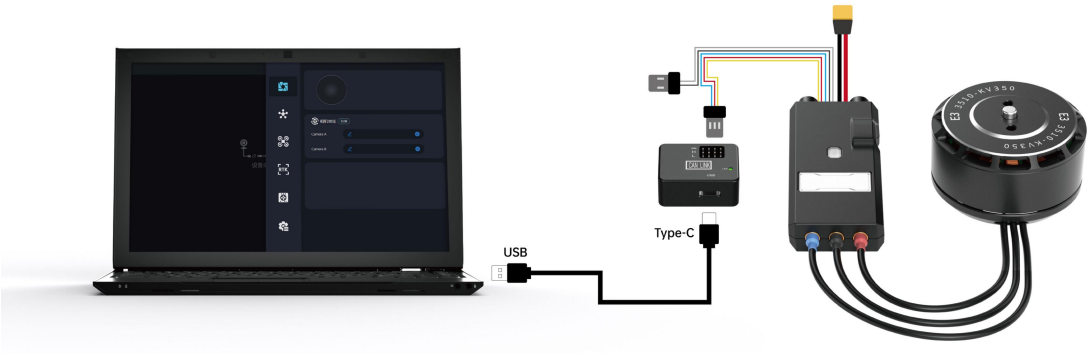
2.3 Parameter Configuration

SIYI UniGCS software allows users to customize the propulsion system's LED colors, Throttle IDs,
and CAN throttle settings.

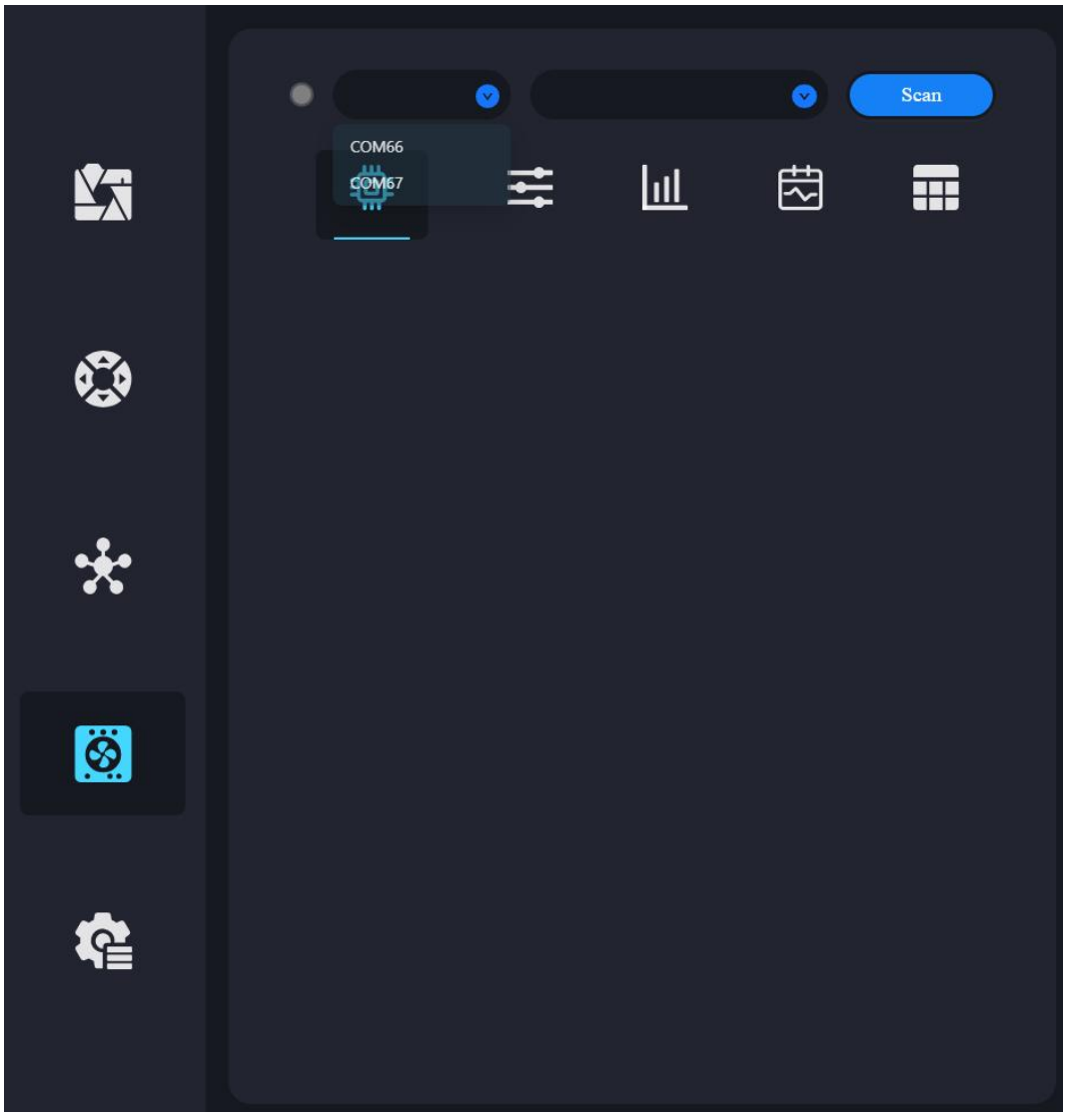
Tools Required:

- SIYI UniGCS (Windows version)
- SIYI CAN Link module
- Windows PC.

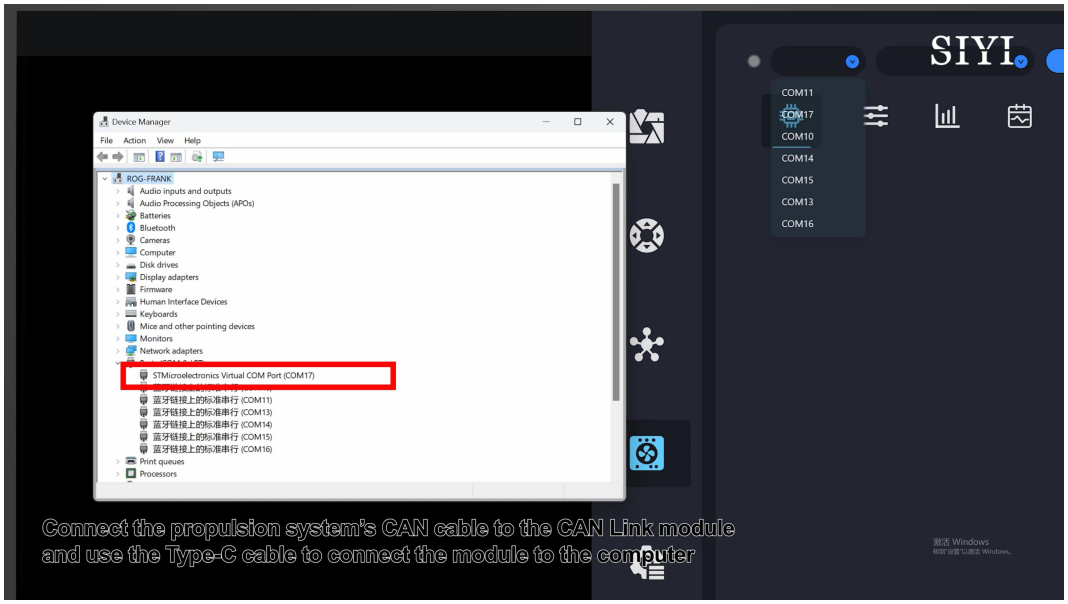
Steps:

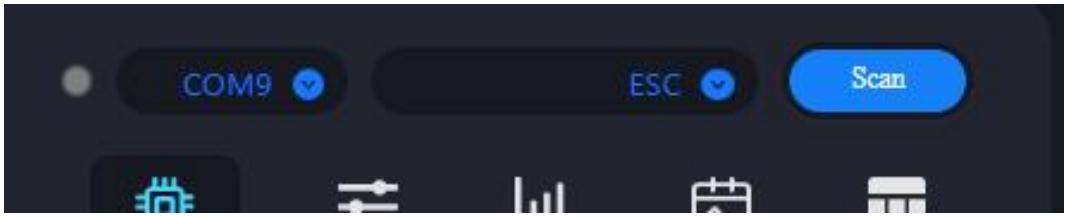


1. Connect the motor, ESC, CAN Link, and PC via USB, and power on the propulsion system.
2. Run SIYI UniGCS and enter the ESC settings menu.

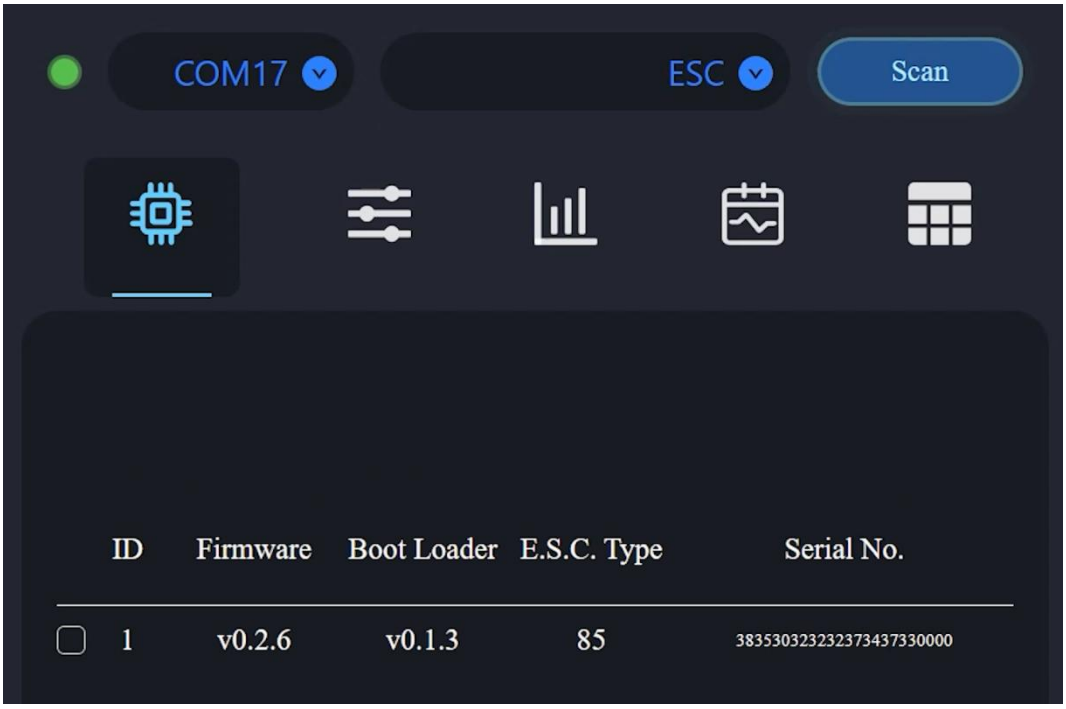


3. Select the corresponding COM port and device type (ESC), then click "Scan".



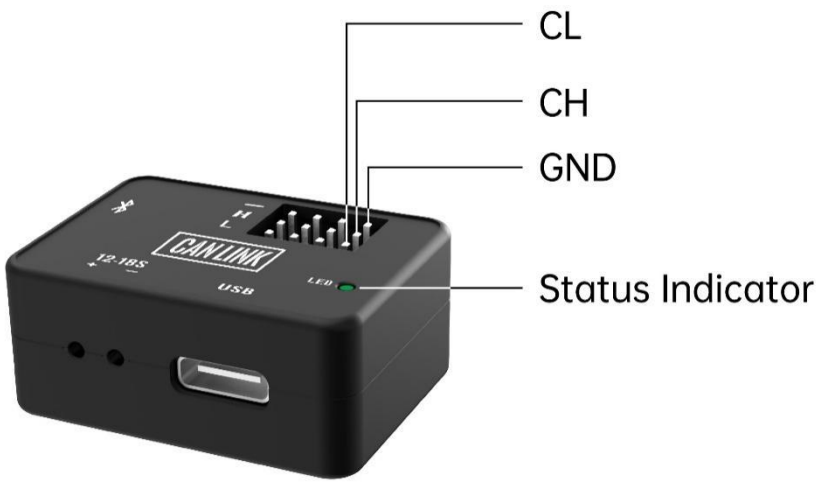


4. If the propulsion system is successfully recognized, the connection is established.



Note

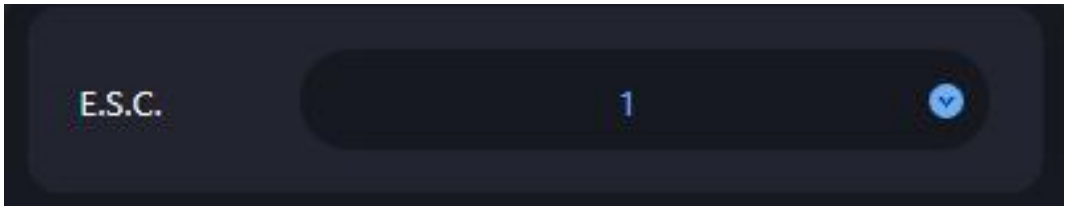
Before configuration, ensure the propulsion system is functioning correctly, and pay special attention to the CAN interface pin definitions to avoid reverse connection.



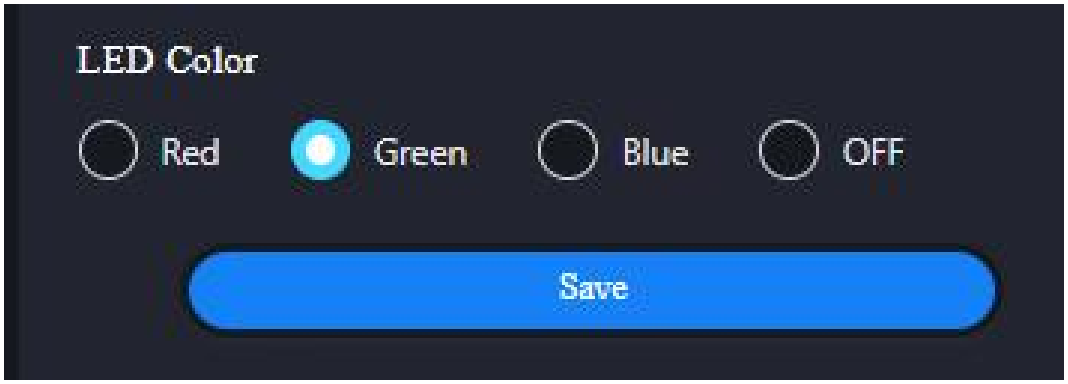
2.3.1 LED Color

The propulsion system's LED color is an important visual reference during flight.
Steps:

1. Select the target ESC ID.



2. Set the desired LED color (Red/Green/Blue/Off) and save.



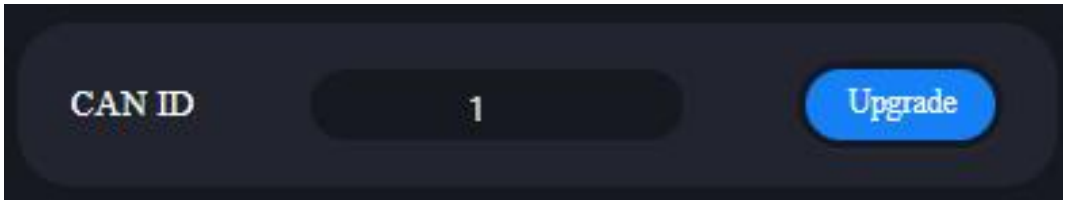
3. If the ESC LED changes accordingly, the setup is successful.

Note

Before ESC configuration, please close any other serial port devices to ensure the propulsion system is successfully recognized.

2.3.2 CAN ID

Setting the CAN ID is necessary when using CAN communication.

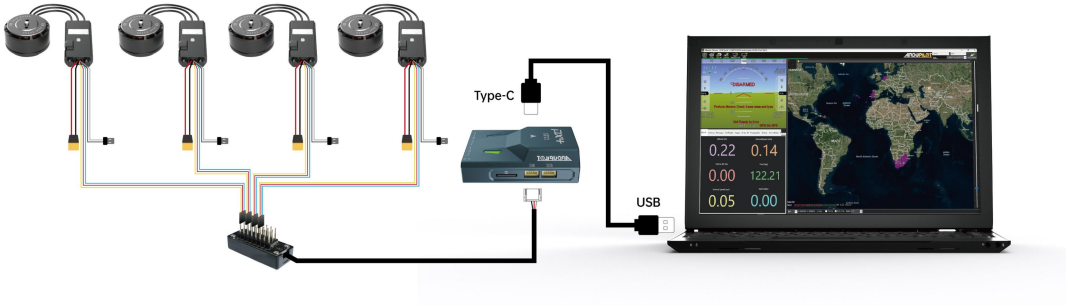


Note

The system automatically assigns a power ID at the factory. If CAN functions are not used, skipping CAN ID setup will not affect other product functions.

2.4 CAN Throttle

The CAN throttle is a digital throttle that enables finer and more accurate operation.

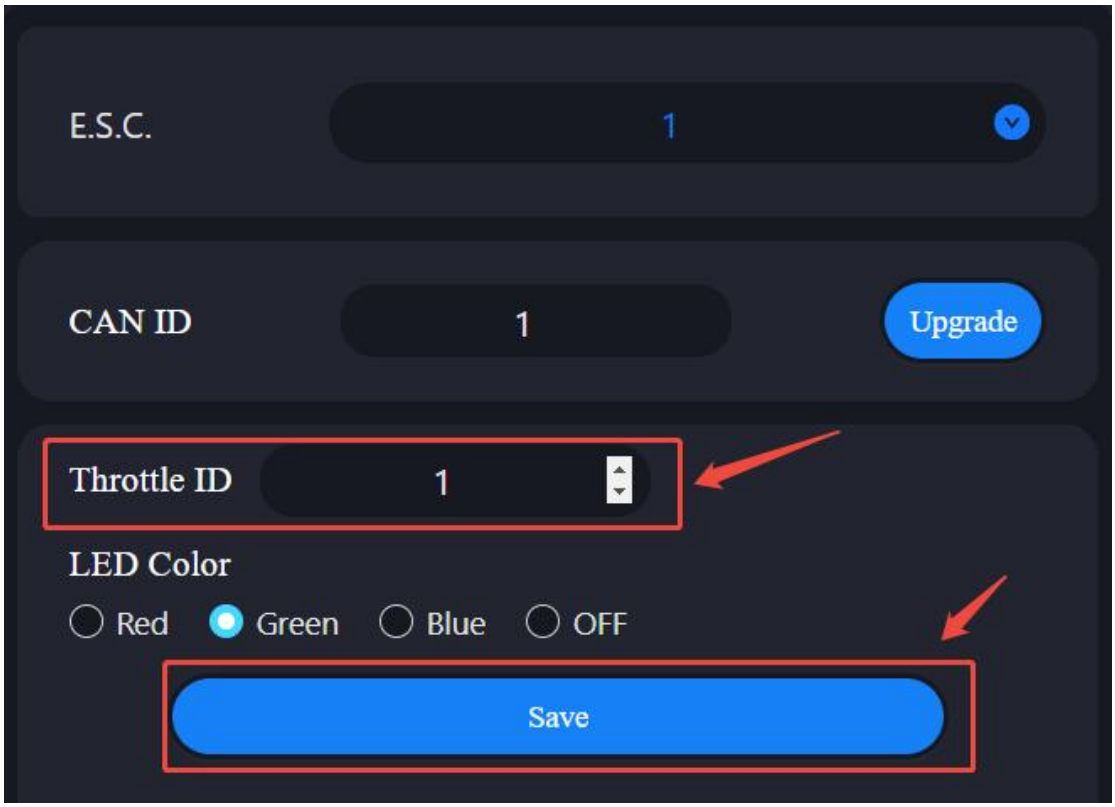


Note

The E3 propulsion system prioritizes PWM throttle by default. CAN throttle is only used when no PWM signal is present. If you are not using CAN throttle, no setup is required.

2.4.1 Setting CAN Throttle via SIYI UniGCS

Please refer to Chapter 2.2 of this manual to connect the devices, then run the SIYI UniGCS software and enter the ESC settings menu. Select the target ESC, set its Throttle ID, and save.

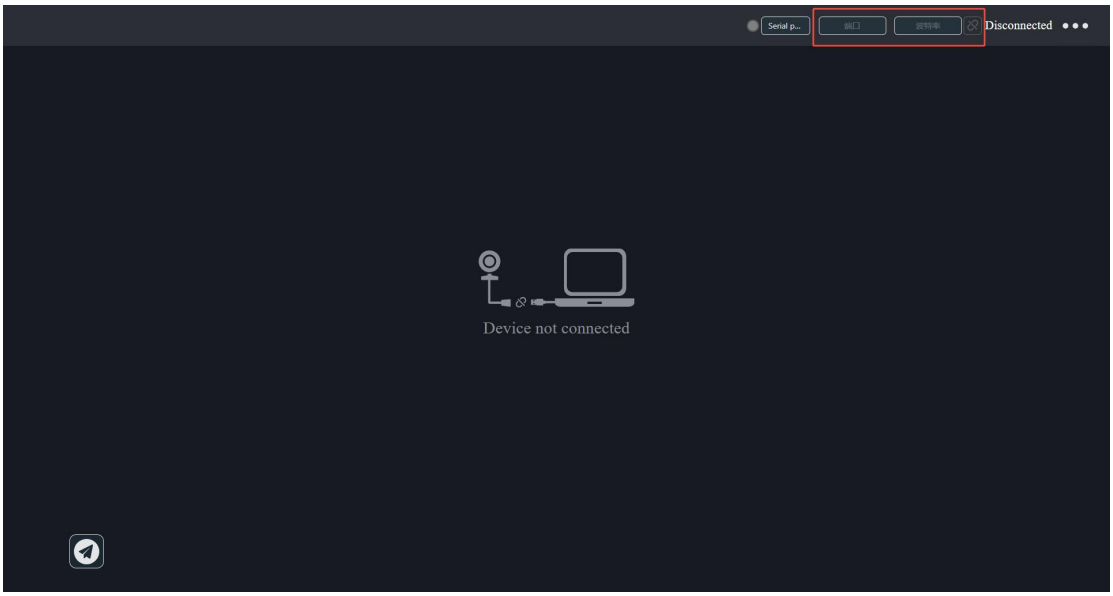


2.4.2 Configuring Flight Controller CAN via SIYI UniGCS (ArduPilot)

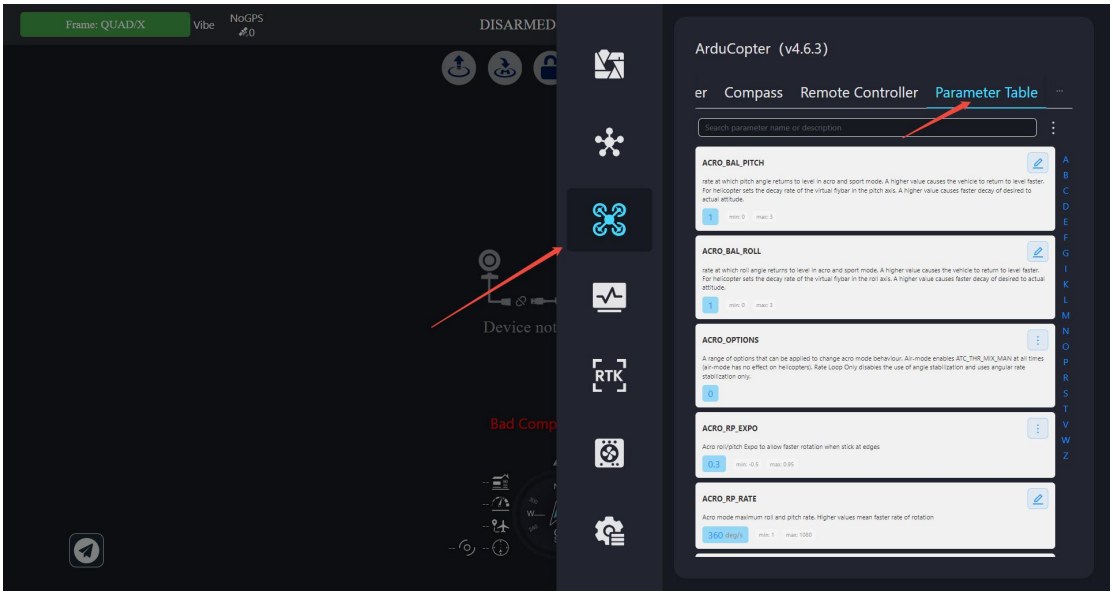
ArduPilot supports configuring the E3 propulsion system via the DroneCAN protocol using either UniGCS or Mission Planner.

Steps:

1. Launch UniGCS, select the correct COM port (115200 baud), and connect.

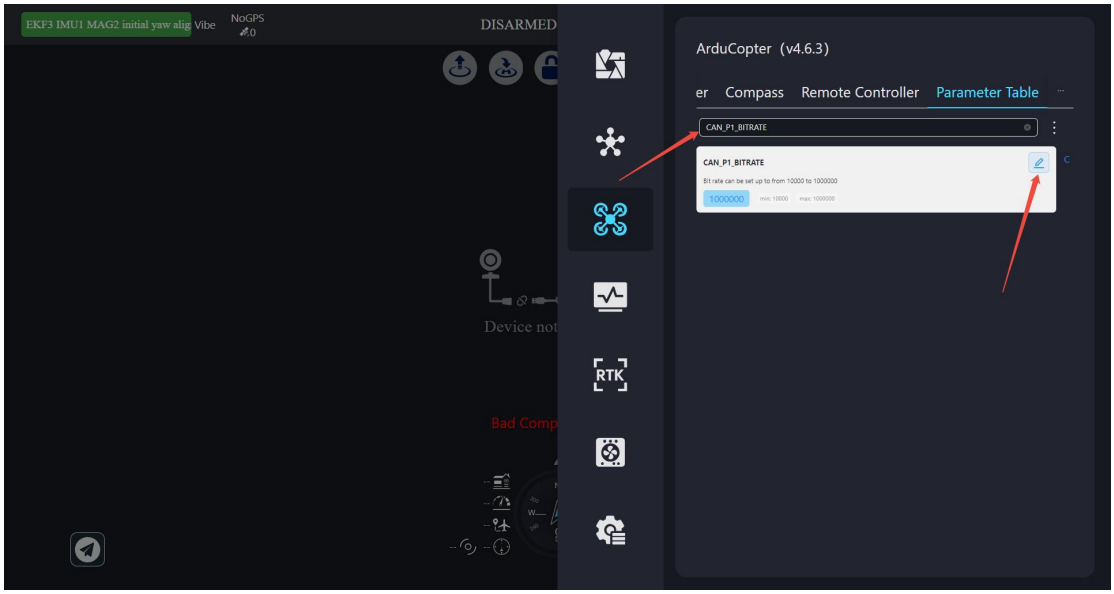


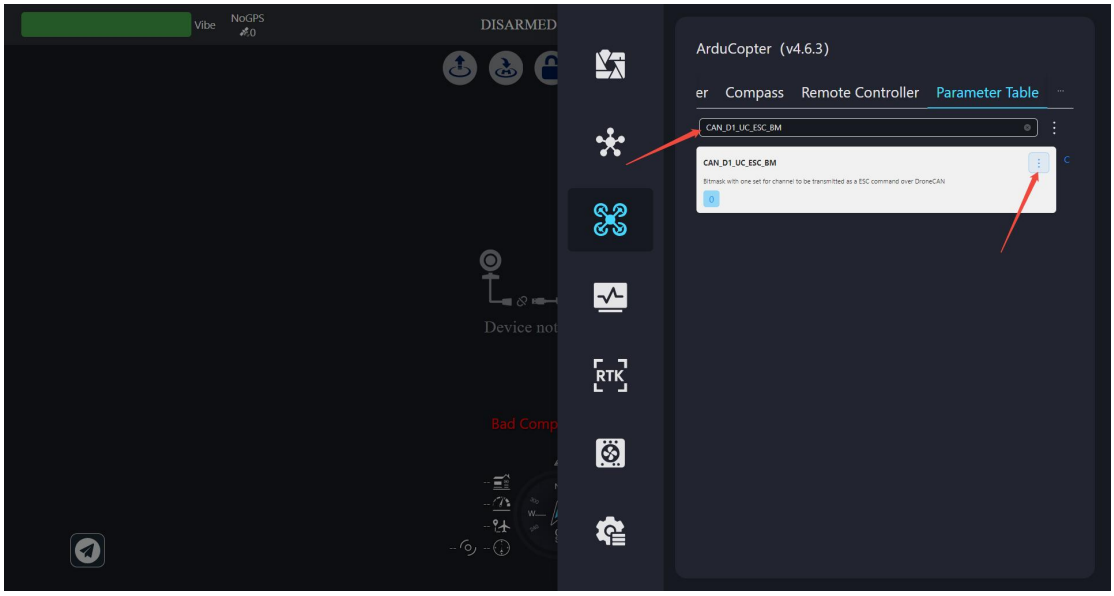
2. Click the Parameter Table in the top right corner.

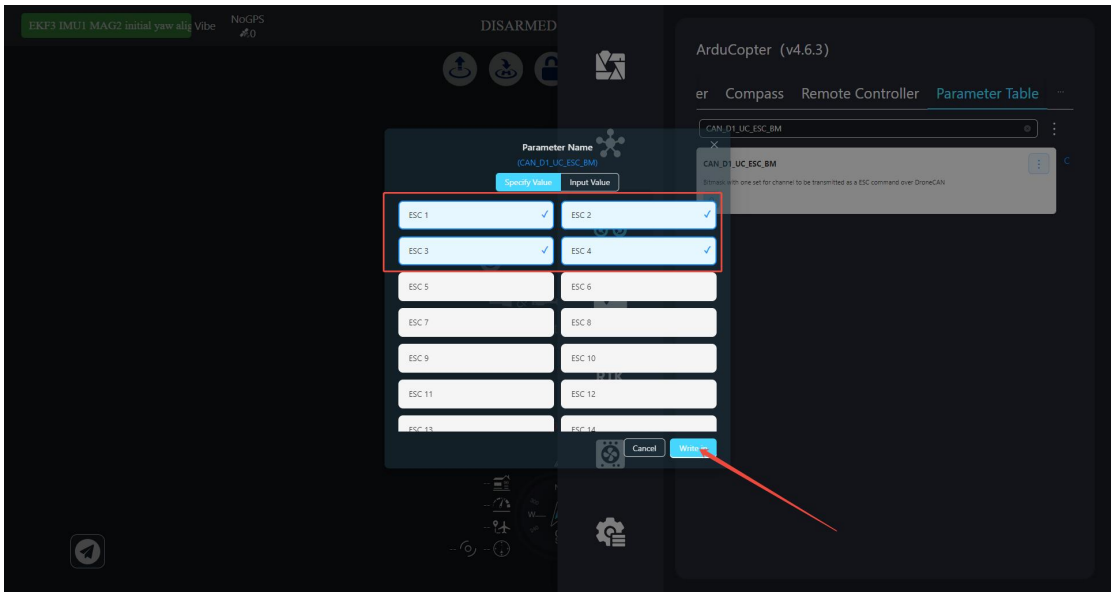


3. Configure CAN_P1_DRIVER = 1 and CAN_D1_PROTOCOL = 1. Reboot the FC.

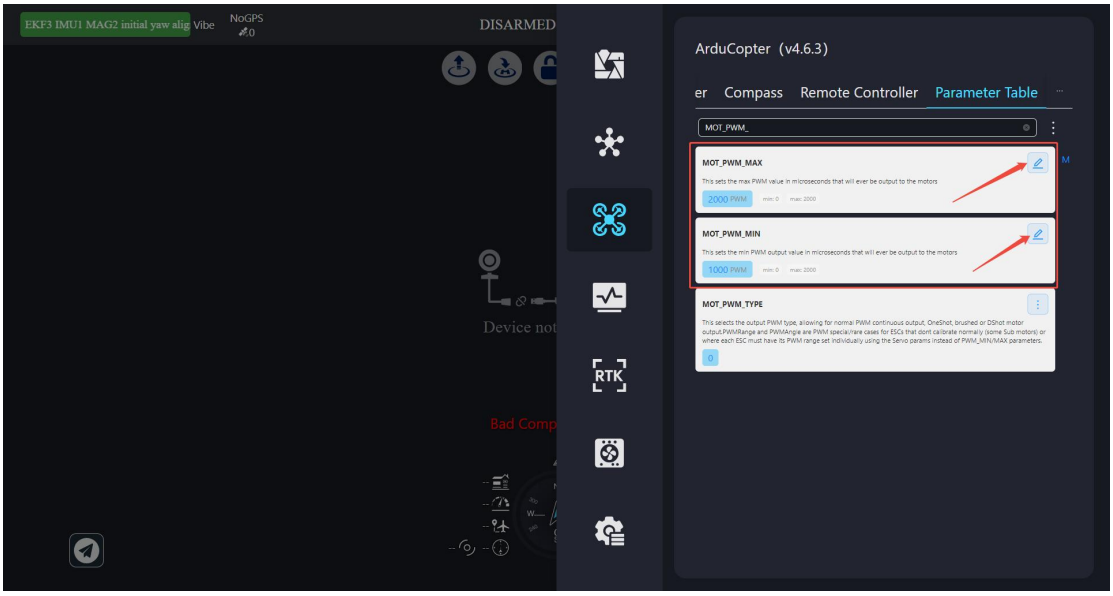
4. Configure CAN_P1_BITRATE = 1000000. Check the boxes for CAN_D1_UC_ESC_BM according to the number and IDs of your ESCs.



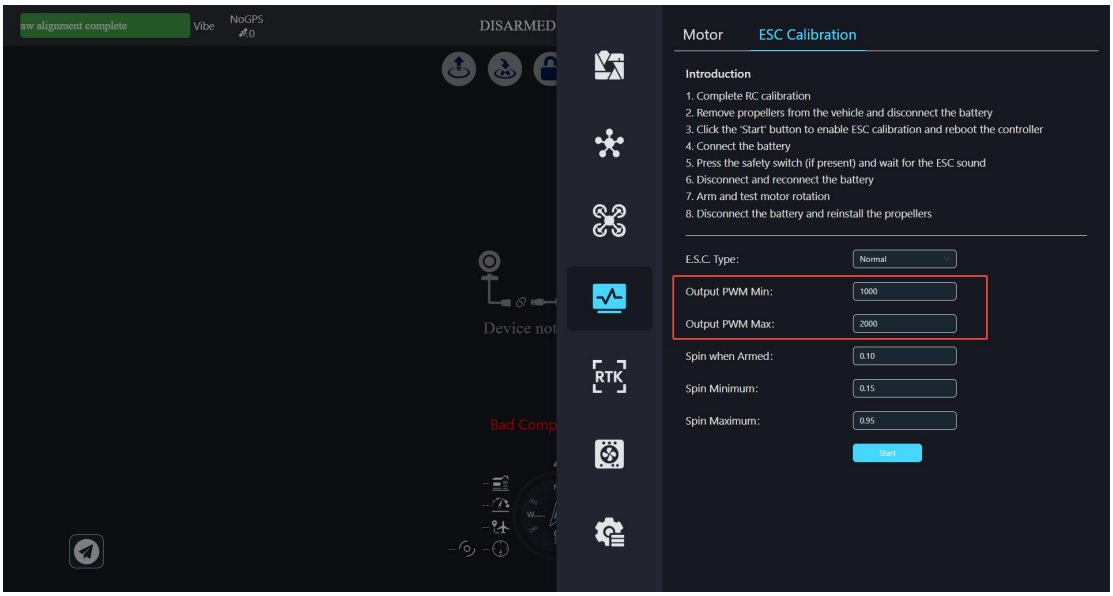




5. Configure MOT_PWM_MAX to 1950 and MOT_PWM_MIN to 1050.



(or set these values in the ESC Calibration interface).

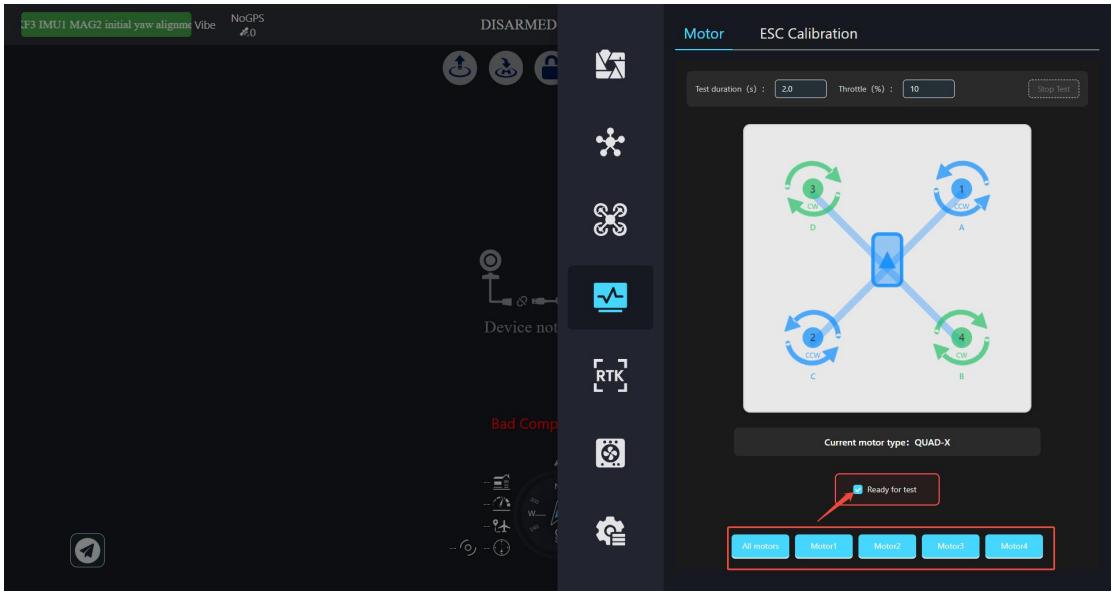


Warning

Do NOT install propellers when configuring FC throttle parameters. Motors may spin briefly when parameters are written, which is normal.

ESC Test

Navigate to the ESC testing interface and select the target motor based on its assigned number.



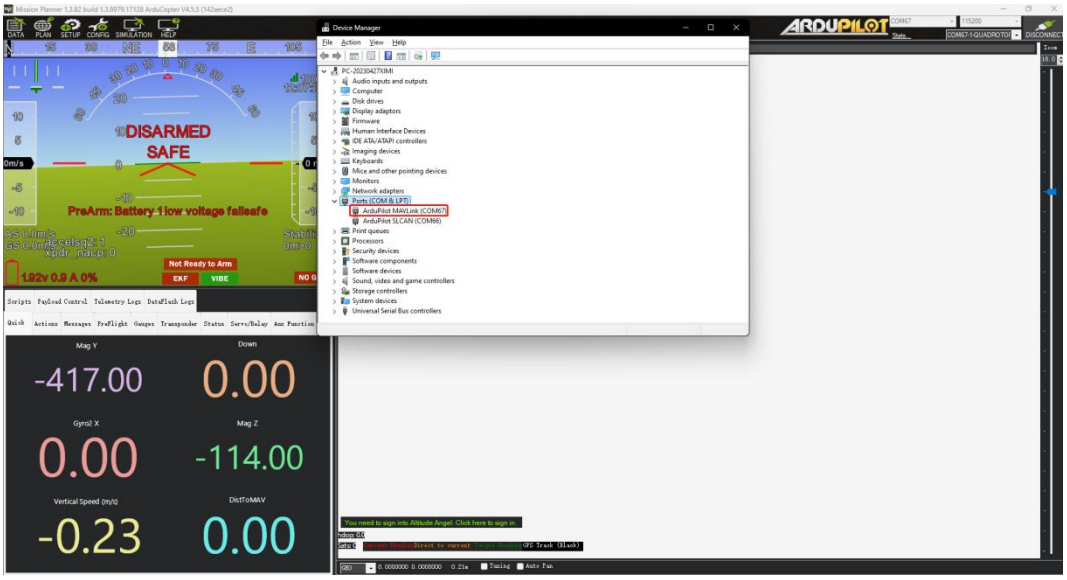
2.4.3 Setting CAN Throttle via Mission Planner (ArduPilot)

The ArduPilot flight controller supports the configuration of the E3 propulsion system

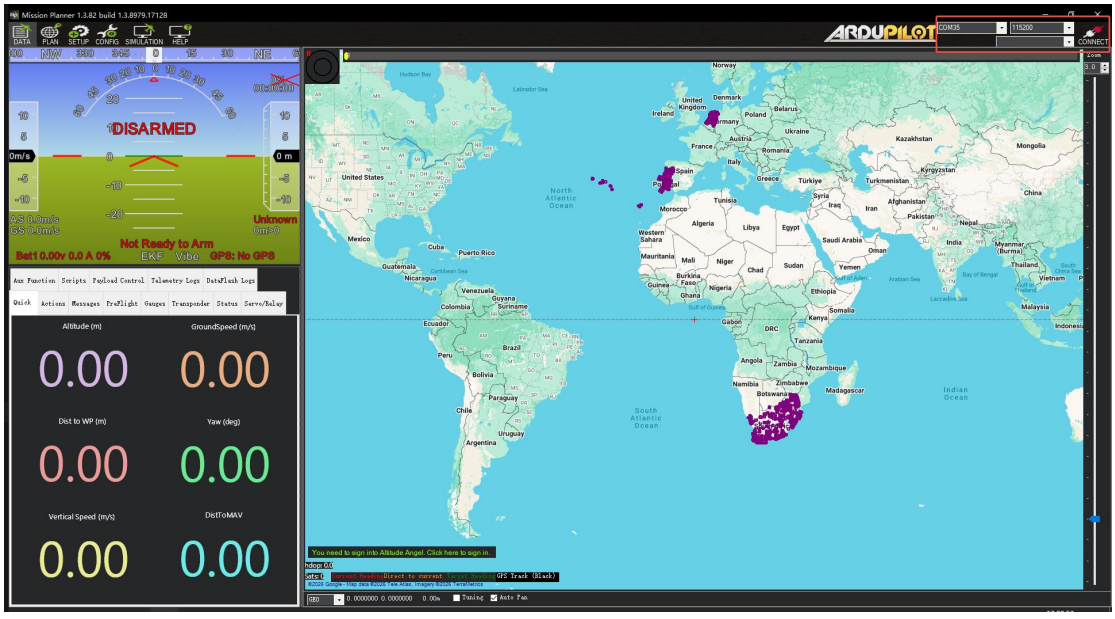
via the DroneCAN protocol.

Steps:

1. Launch Mission Planner, find the corresponding COM port in Device Manager.

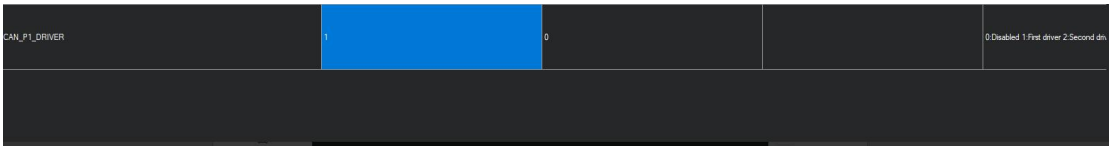


2. Select the COM port and 115200 baud rate.



3. Search for CAN_P1_DRIVER and set to 1.

4. Set CAN_D1_PROTOCOL = 1 (DroneCAN). Reboot the FC.



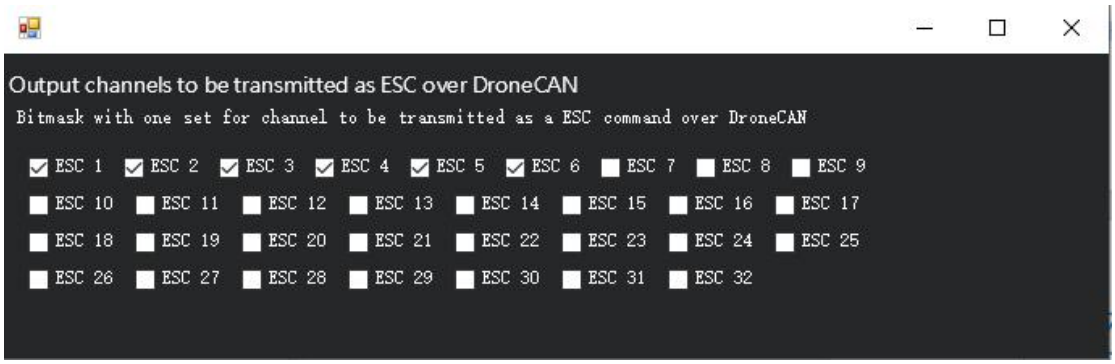
5. Set CAN_P1_BITRATE = 1000000,Configure the CAN interface protocol to DroneCAN.

6. After successful configuration, reboot the flight controller. The CAN_P1_BITRATE and CAN_D1_UC_ESC_BM parameters will now become available.

CAN_D1_PROTOCOL	1	1		0:Disabled 1:DroneCAN	Enabling this option starts selected protocol that will use this virtual driver
CAN_D1_UC_ESC_BM	0	0			Bitmask with one set for channel to be transmitted as a ESC command over DroneCAN
CAN_D1_UC_ESC_OF	0	0		0 18	Offset for ESC numbering in DroneCAN ESC RawCommand messages. This allows for more efficient packing of ESC command ESC RawCommand will be sent with the first 4 slots filled. This can be used for more efficient usage of CAN bandwidth
CAN_D1_UC_NODE	10	10		1 250	DroneCAN node should be set implicitly
CAN_D1_UC_NTF_RT	20	20	Hz	1 200	Maximum transmit rate for Notify State Message
CAN_D1_UC_OPTION	0	0			Option flags
CAN_D1_UC_POOL	16384	16384		1024 16384	Amount of memory in bytes to allocate for the DroneCAN memory pool. More memory is needed for higher CAN bus loads
CAN_D1_UC_SRV_BM	0	0			Bitmask with one set for channel to be transmitted as a servo command over DroneCAN
CAN_D1_UC_SRV_RT	50	50	Hz	1 200	Maximum transmit rate for servo outputs
CAN_D2_PROTOCOL	1	1		0:Disabled 1:DroneCAN	Enabling this option starts selected protocol that will use this virtual driver
CAN_LOGLEVEL	0	0		0 4 0:Log None	Loglevel for recording initialisation and debug information from CAN Interface
CAN_P1_BITRATE	1000000	1000000		10000 1000000	Bit rate can be set up to from 10000 to 1000000
CAN_P1_DRIVER	1	0		0:Disabled 1:First driver	Enabling this option enables use of CAN buses.

7. Configure CAN_P1_BITRATE to 1000000.

8. Check the appropriate boxes for CAN_D1_UC_ESC_BM according to the quantity and IDs of your ESCs. The figure below illustrates a setup using 6 ESCs with IDs configured as 1, 2, 3, 4, 5, and 6.



9. Set MOT_PWM_MAX to 1950 and MOT_PWM_MIN to 1050.

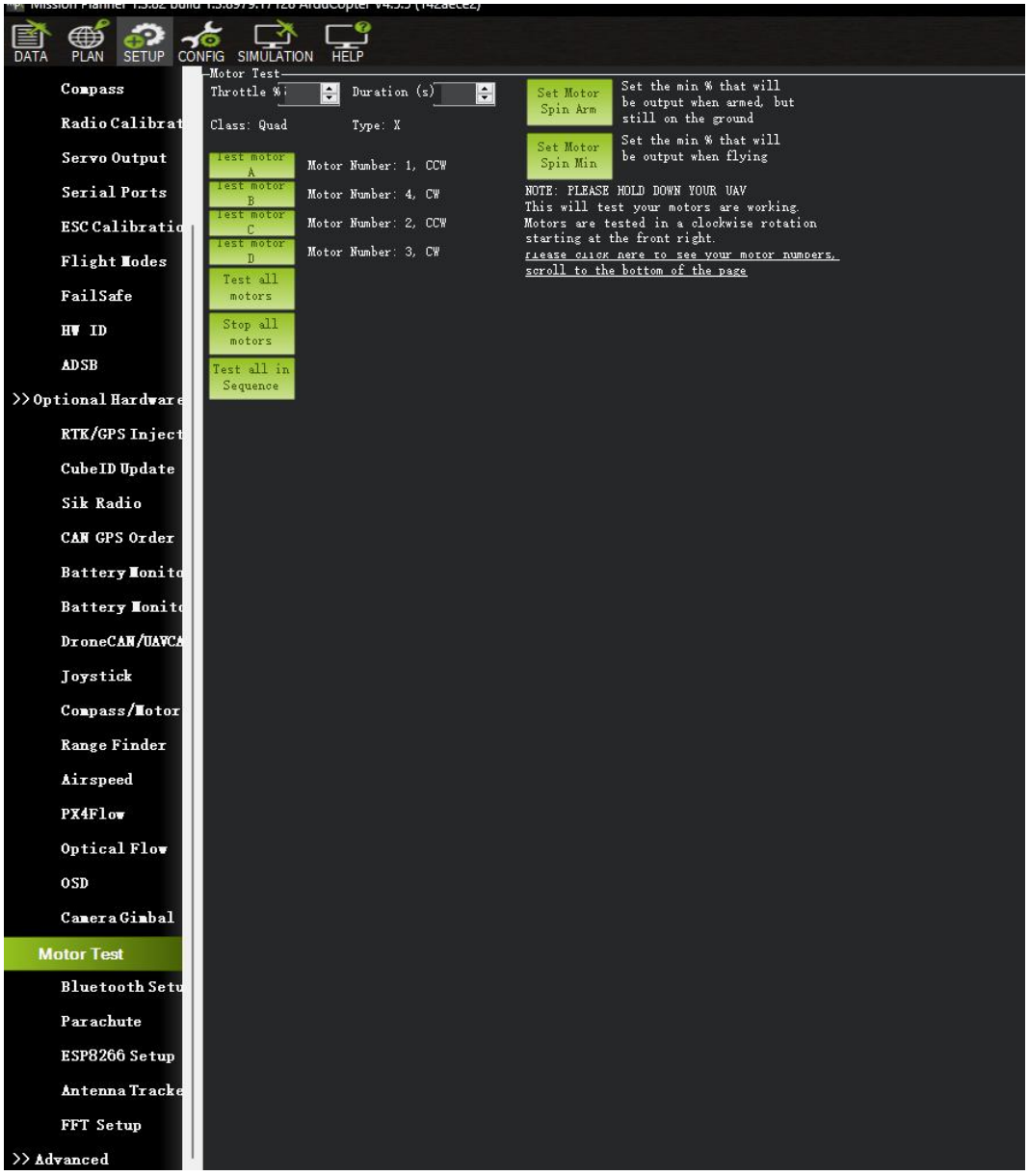
Name	Value	Default	Units	Options
MOT_PWM_MAX	1950	2000	PWM	0 2000
MOT_PWM_MIN	1050	1000	PWM	0 2000

Warning

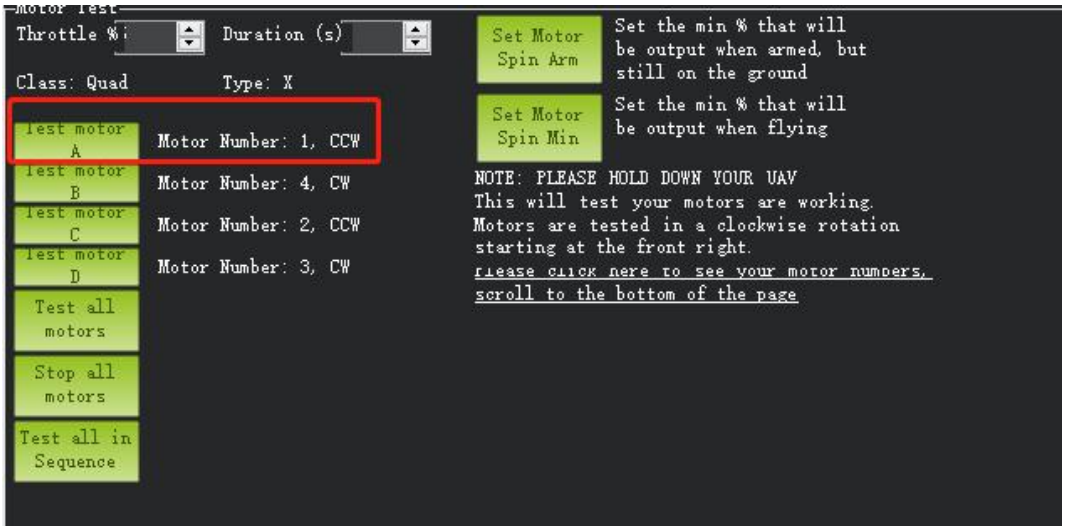
Do NOT install propellers when configuring the MOT_PWM_MAX / MOT_PWM_MIN parameters. It is normal for the motor to briefly spin up when the correct parameters are written.

ESC Testing

1. In the motor test interface, you can configure the throttle percentage and the duration of the throttle action. Once configured, select the target motor based on its ID number.



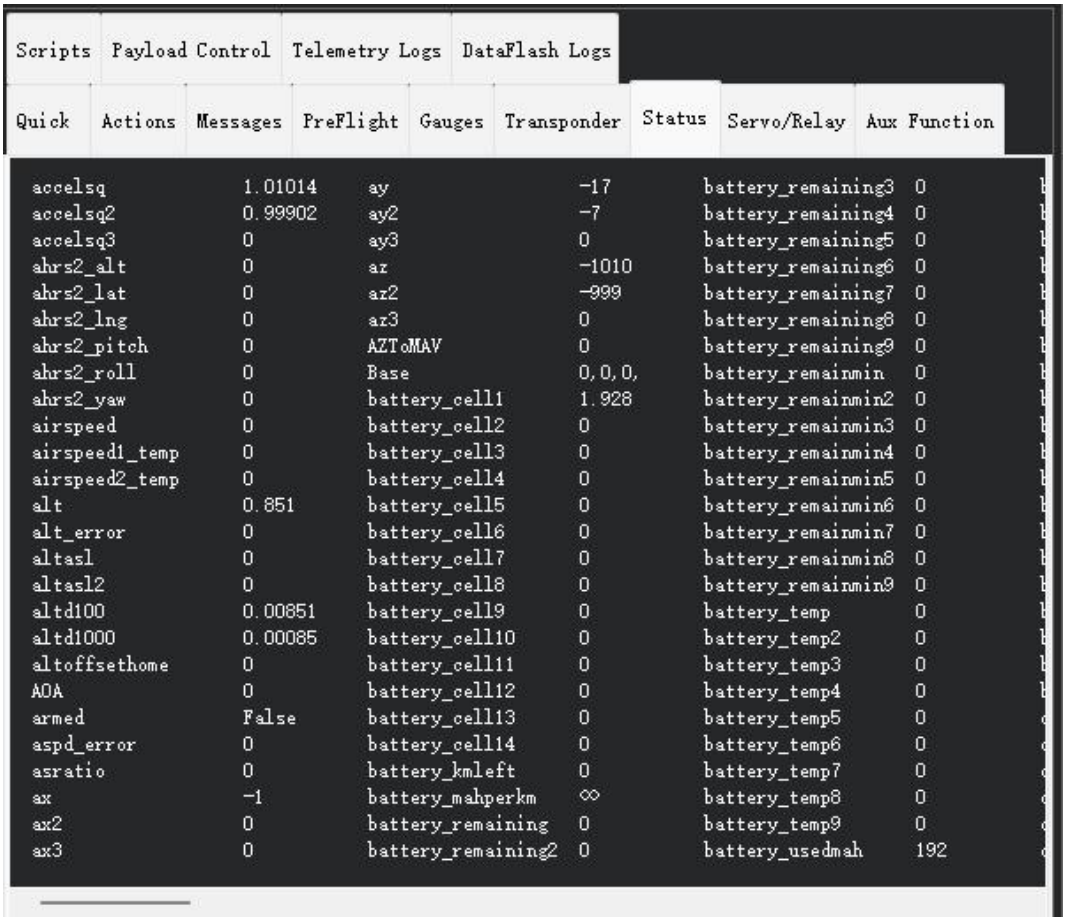
2. For example, to test motor No. 1, click ‘Test motor A'.



3. In the status bar, you can observe ESC 1's data under this throttle action, including:

- Voltage (esc1_volt)
- Current (esc1_curr)
- RPM (esc1_rpm)
- Temperature (esc1_temp)

and other related data.



2.4.4 Setting CAN Throttle via QGroundControl (PX4)

PX4 supports UAVCAN communication with the E3 propulsion system.

Parameter Configuration:

-UAVCAN_BITRATE: 1000000

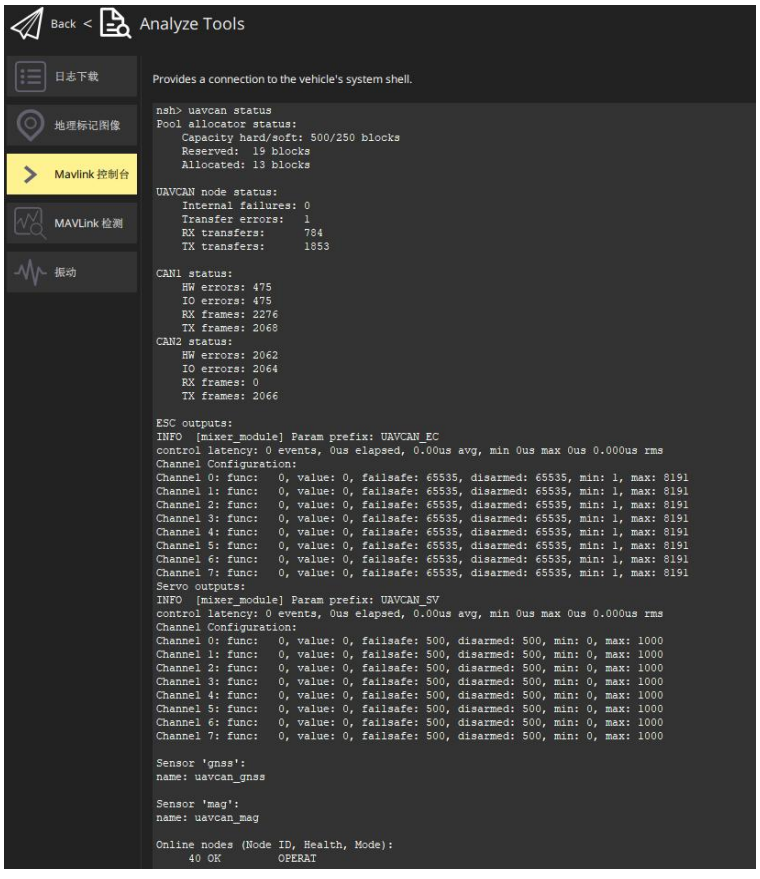
- UAVCAN_ENABLE: Sensors and Actuators (ESCs) Automatic Config

UAVCAN_BITRATE	1000000 bit/s	UAVCAN CAN bus bitrate
UAVCAN_ENABLE	Sensors and Actuators (ESCs	UAVCAN mode
UAVCAN_ESC_IDLT	Enabled	UAVCAN ESC will spin at idle throttle when armed, even if the mixer outputs zero setpoints

Set SYS_CTRL_ALLOC to Enabled to enable the CAN dynamic ID allocation function. The PX4 CAN dynamic ID allocation feature requires an SD card. Failure to insert an SD card will prevent PX4 from dynamically allocating CAN node IDs to CAN devices.

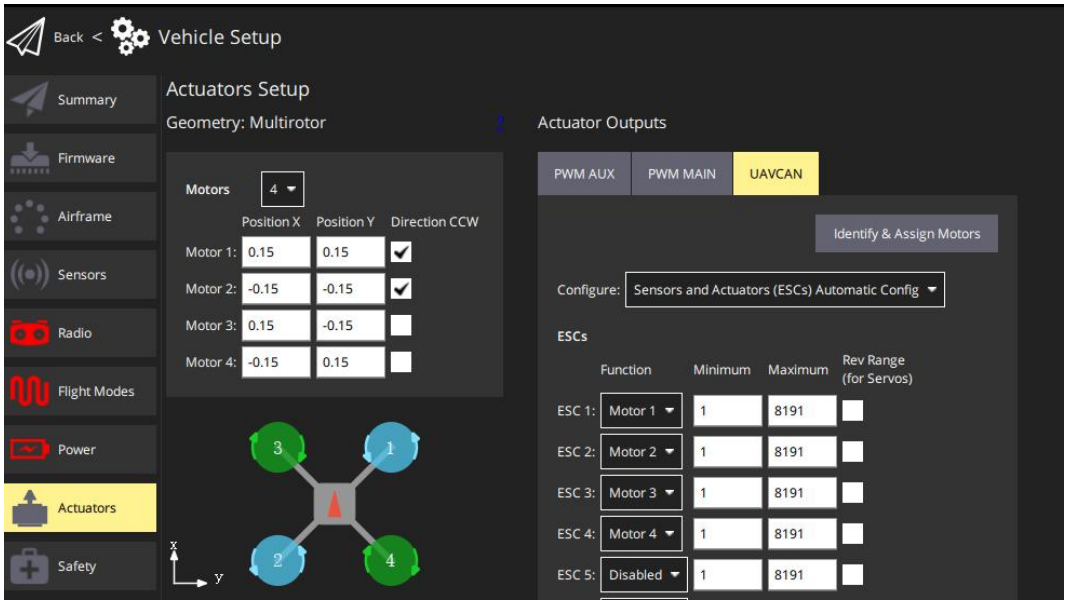
SYS_CTRL_ALLOC	Enabled	Enable Dynamic Control Allocation

After configuring the above parameters, reboot PX4. In the MAVLink Console, enter uavcan status to view the CAN port status information and the devices connected to the CAN port.

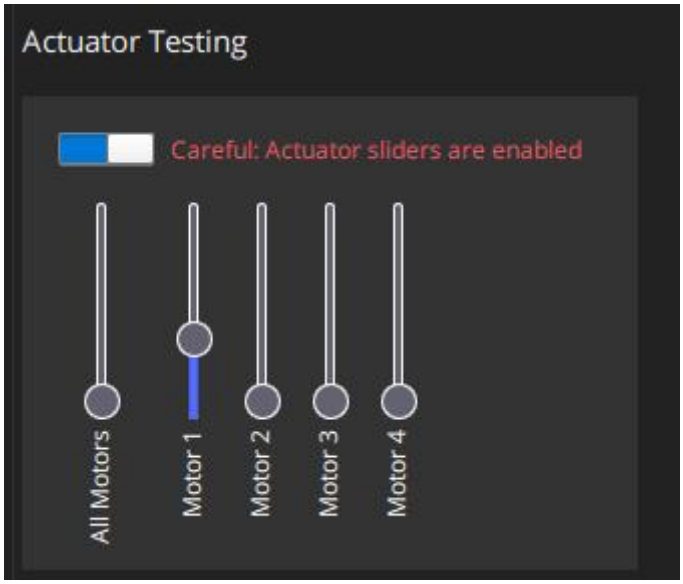


ESC Testing

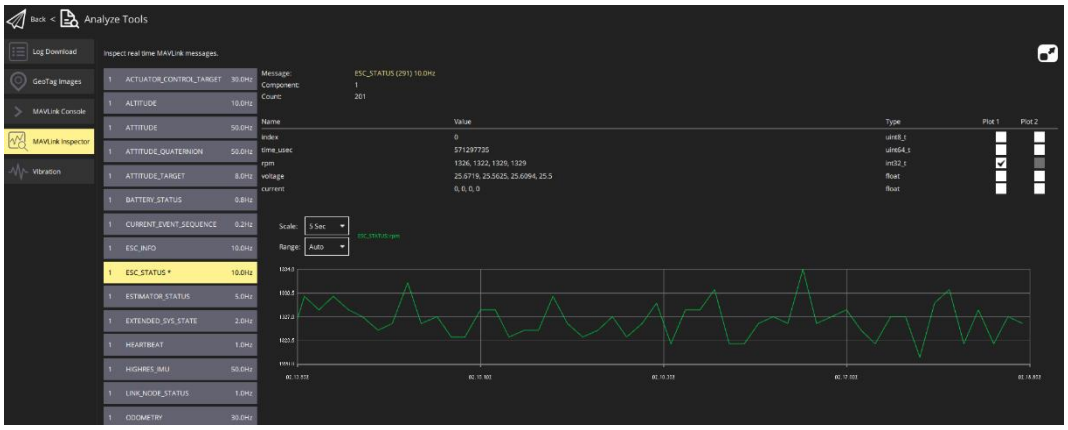
1. In the Actuator Outputs section, set the mapping between the ESCs and the motors, and configure the maximum and minimum throttle values. In the Geometry: Multirotor section, configure the rotation directions of the motors and their positions relative to the center point.



2. Toggle the switch in the Actuator Testing section to enable testing, and drag the slider of the target motor to adjust its throttle.



3. Check the MAVLink messages. The ESC_STATUS message contains information such as the ESC's RPM, voltage, and current. Check the plot box to view the curves of these data changing over time.



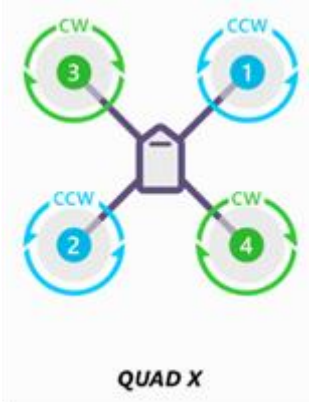
3. Installation

3.1 Propulsion System Assembly

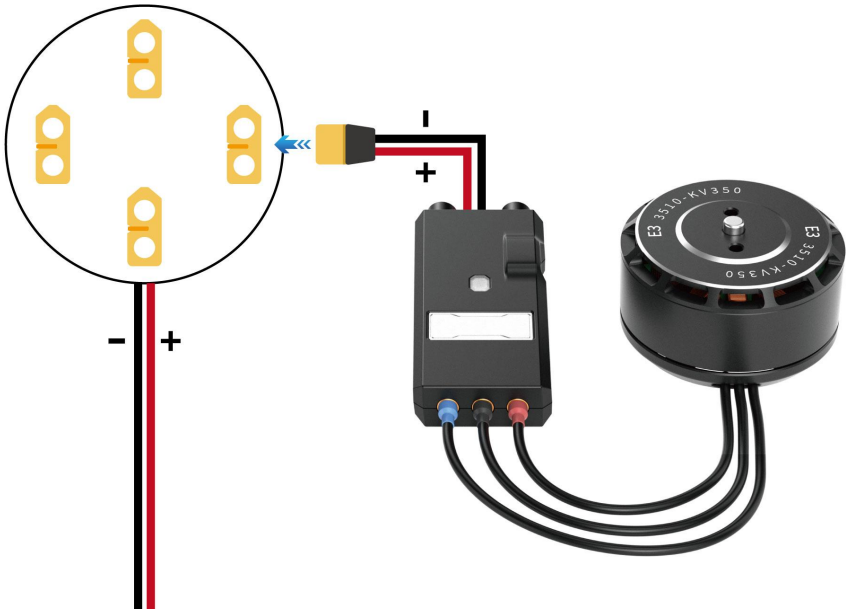
3.1.1 Matching Throttle ID and Motor Rotation

Mainstream flight control systems on the market typically define specific throttle IDs and motor rotation directions for particular frame types. When installing the propulsion system, it is essential to carefully consult the flight control system's user manual to match the throttle IDs and motor rotation directions accordingly.

Taking the N7 flight controller (ArduPilot firmware) paired with the E3 propulsion system as an example:



You can make the motor rotate in different directions by selecting the appropriate wiring order for the three motor phase cables based on the rotation direction (CW or CCW) illustrated by the flight controller. If the actual rotation direction is inconsistent with the required direction, swapping any two of the three motor phase cables will change the motor's rotation direction.



Note

If your SIYI propulsion system is to be used in conjunction with a commercial flight controller, please ensure you thoroughly review sections of the flight control system's user manual related to throttle IDs and motor rotation directions to avoid safety risks caused by improper use. If necessary, please consult the original manufacturer's technical support.

3.1.2 Mounting Motors and ESCs

Once the throttle ID and motor rotation direction are confirmed, you can begin mounting the motor onto the corresponding arm motor base. Ensure the connection between the motor and the motor base is secure. If the screws provided in the package are shorter than the thickness of the motor base, users must provide their own suitable screws to secure the motor. The standard for selecting screws is: after passing through the motor base, the threaded portion protruding from the mounting hole should be ≥ 2.5mm and ≤ 3.5mm. This ensures a reliable connection without damaging the motor coils.

Steps:

1. Mount the motor onto the motor base.

2. Route the three motor phase cables through the carbon tube of the arm. Check if there are any sharp edges where the motor phase cables pass. If so, polish the sharp edges or wrap them with flexible materials to prevent damaging the motor phase cables.

3. The mounting position of the ESC should be comprehensively considered, taking into account factors such as heat dissipation, electromagnetic interference, and wiring convenience. Heat dissipation requires special attention, as excellent heat dissipation is crucial for the long-term reliable operation of the equipment.

3.2 Leveling

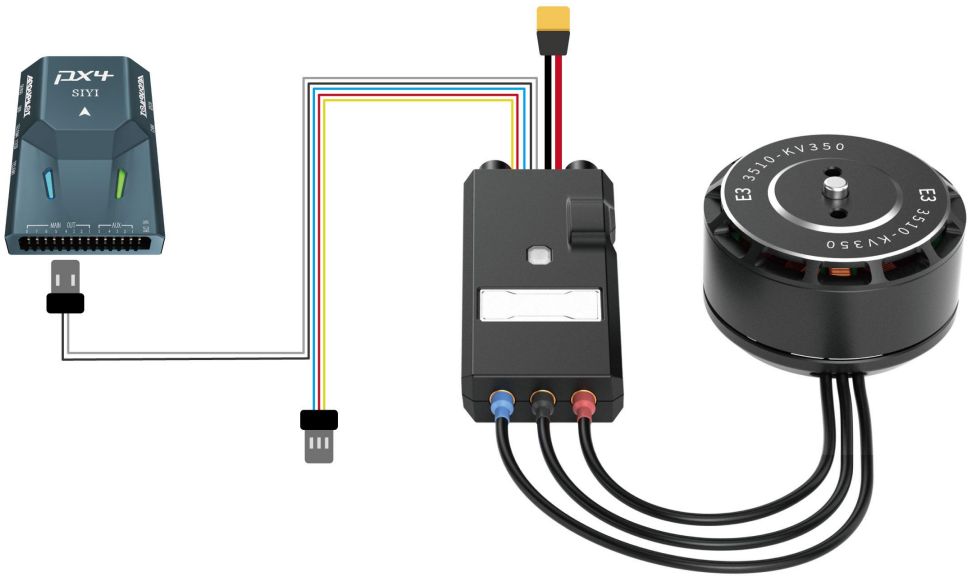
Next, use a bubble level to calibrate the leveling of the installed motor or motor base. The reference plane for calibration should be the flight controller mounting surface or the top surface of the flight controller (if the flight controller is installed and its surface is suitable). Calibrate the motor or motor base so that it is level with the reference plane. During measurement, the bubble level should be positioned horizontally perpendicular to the axis of the drone arm.

3.3 Securing the Motor

After confirming the installation and leveling, securely tighten the connections between the motor and the motor base, as well as between the motor base and the carbon tube of the arm, to ensure a stable installation.

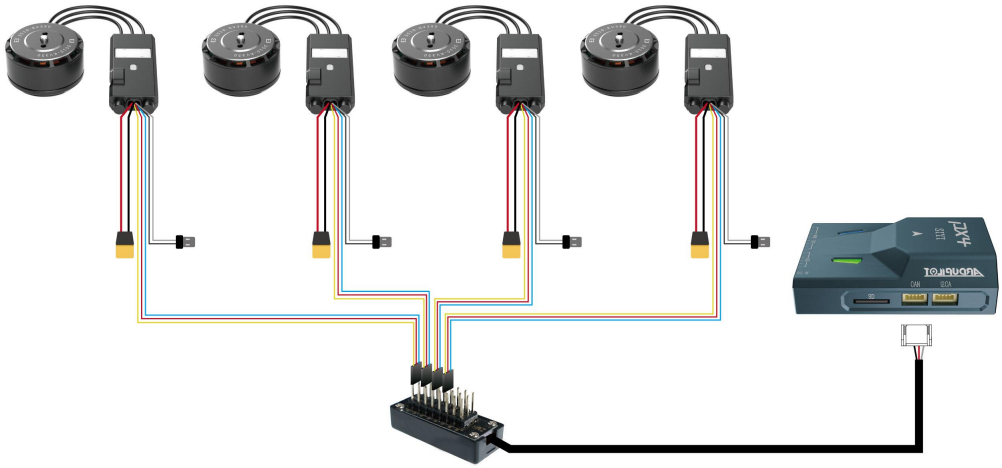
3.4 Wiring and Routing

3.4.1 PWM Throttle Cable



Connect the PWM signal cable to the corresponding throttle output channel pins on the flight controller.

3.4.2 CAN Signal Cable (if using CAN throttle or dual throttles)

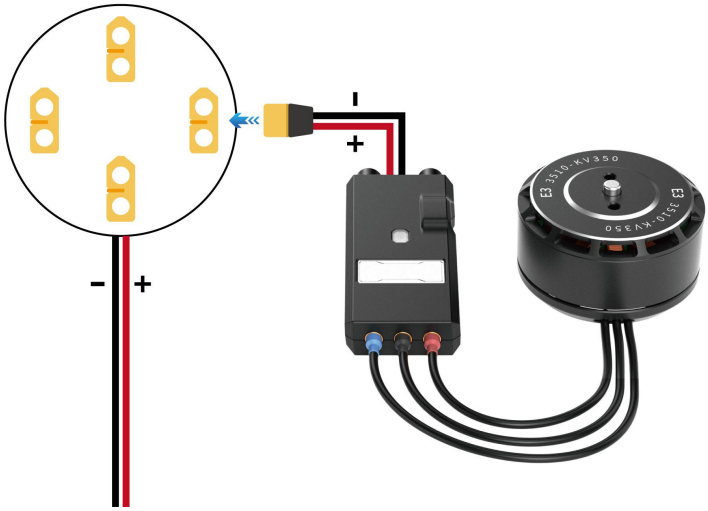


If using CAN throttle, connect the CAN signal cable to the CAN Hub module and route it to the flight controller's CAN port as a bus.

Note

If CAN throttle is not used, no configuration is required.

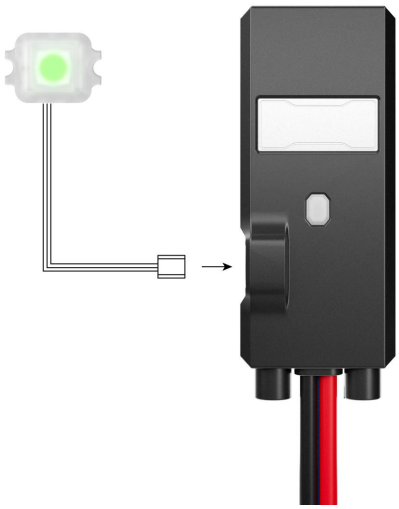
3.4.3 Power Cable



Connect the main power cable to the power supply interface on the Power Distribution Board (PDB).

3.4.4 External LED Connection (Optional Accessory)

If you wish to use an external LED light, simply plug it into the designated external LED port. Please insert or remove it only when the power is disconnected.



3.5 Debugging and Checking

Before debugging begins, please strictly follow the steps below in sequence:

1. **Note** Ensure that the propulsion system is wired correctly to avoid safety risks caused by misconnections or missing connections!
2. **Warning** Be absolutely certain that no propellers are installed on the propulsion system to prevent safety hazards during the debugging process!
3. **Note** Power on the system and confirm that the communication between the Ground Control Station (GCS) and the flight controller is normal!

3.5.1 Throttle Channels

Use the GCS software to send signals to each throttle channel of the flight controller one by one. This verifies whether the operational status of each throttle ID in the propulsion system matches the flight control system's default layout.

3.5.2 Motor Rotation (Do NOT Install Propellers)

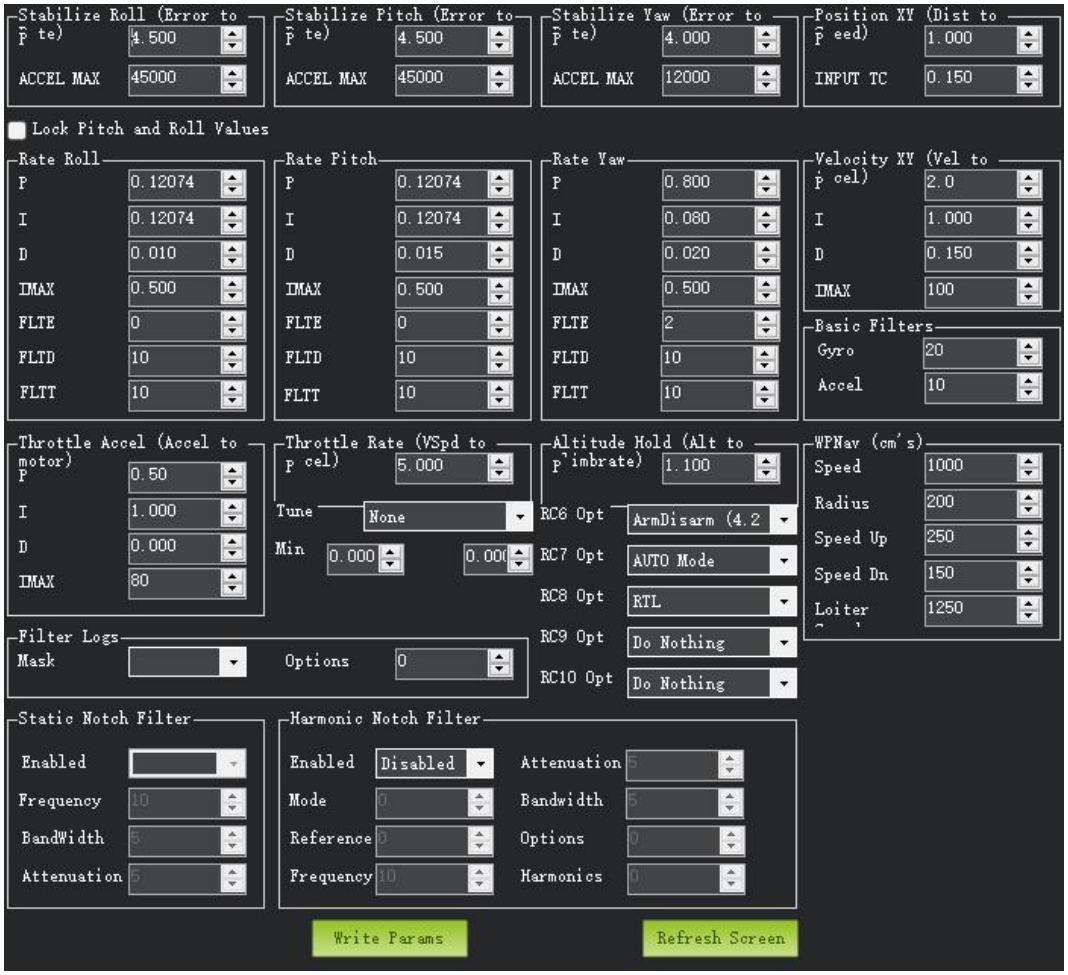
Activate each motor individually via the GCS software to verify whether the rotation direction of each motor in the propulsion system is consistent with the flight control system's default layout.

Warning Be absolutely certain that no propellers are installed on the propulsion system to prevent safety hazards during the debugging process!

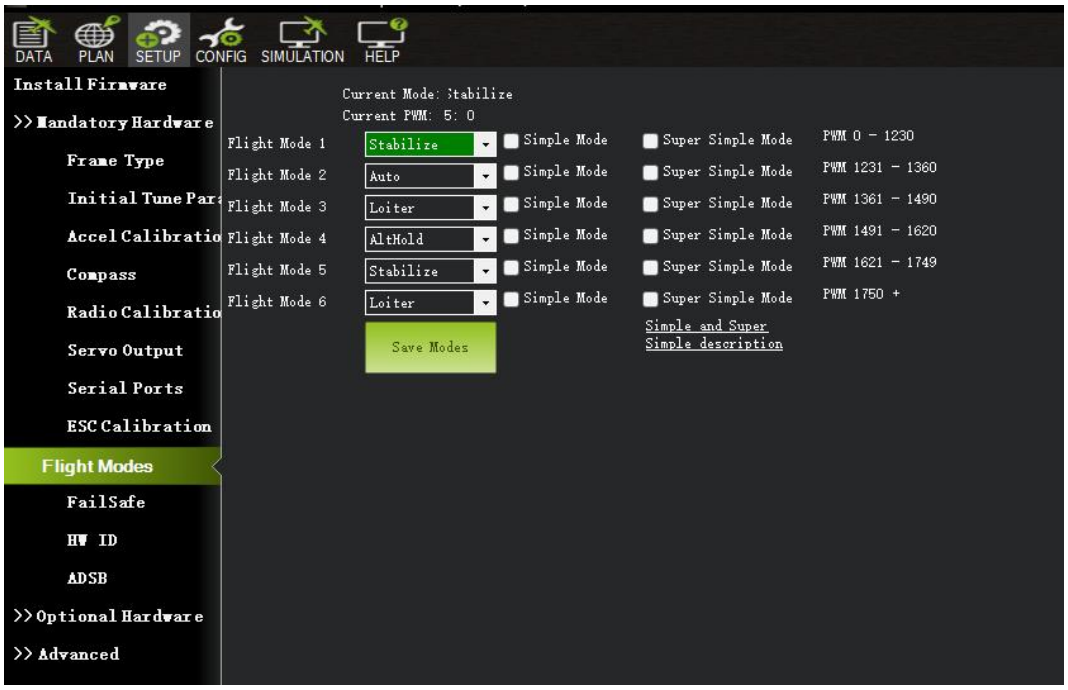
3.5.3 Flight Controller Parameters

Checking flight controller parameters is of great significance for ensuring drone flight safety, enhancing flight stability and precision, enabling fault diagnosis and troubleshooting, as well as evaluating and optimizing performance. Therefore, before and during flight, flight controller parameters should be regularly checked and adjusted to ensure the normal flight of the drone and the successful completion of missions.
It is recommended to pay special attention to the following parameters:

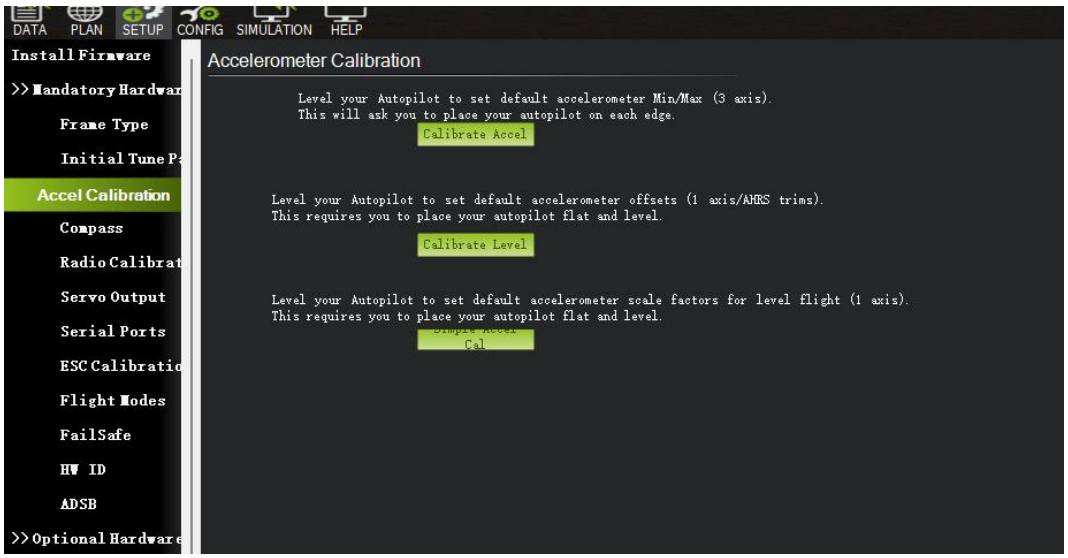
· PID (Proportional, Integral, Derivative control parameters)



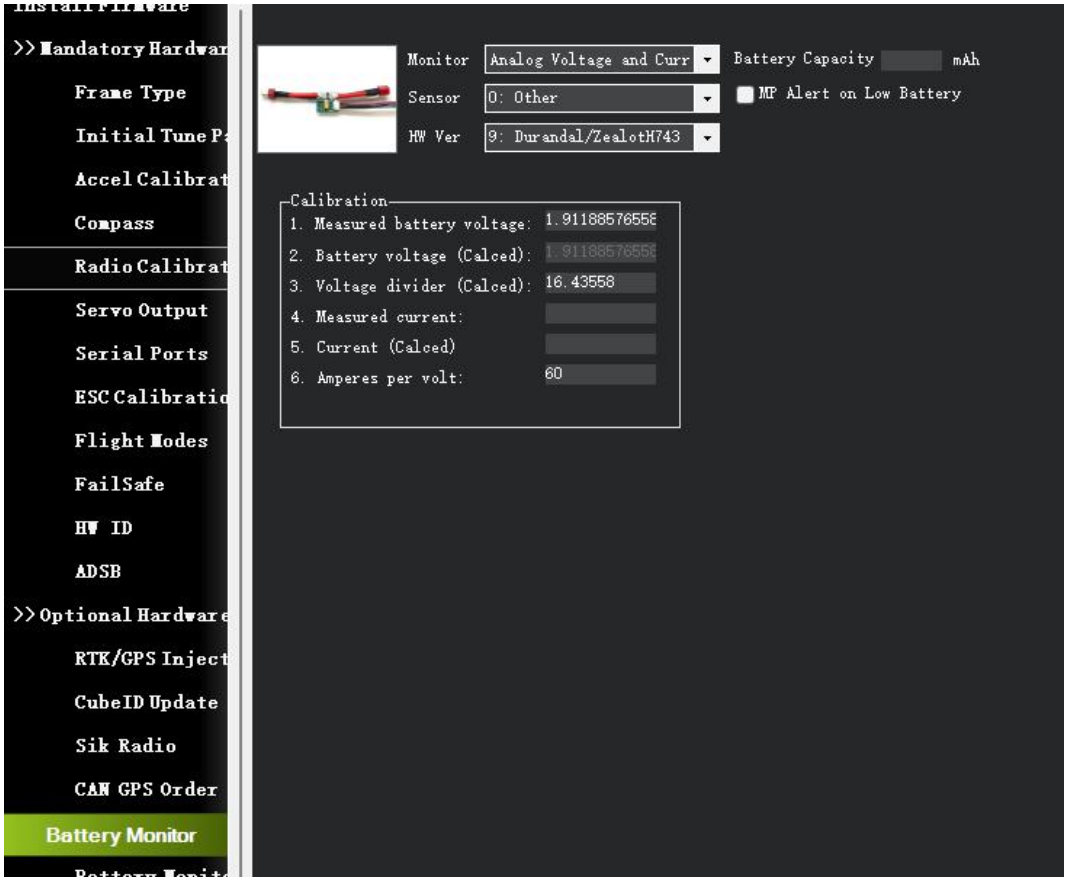
· Flight mode configuration



· Gyroscope and accelerometer calibration status



· Voltage and current monitoring settings



Note

Based on the drone's actual flight performance and the recommendations of the flight control software, we should adjust the PID parameters appropriately. To verify the adjustment effects, it is recommended to conduct a small-scale flight test and carefully observe the flight stability and response speed of the drone. On this basis, gradually fine-tune the parameters until the drone reaches its optimal flight state.

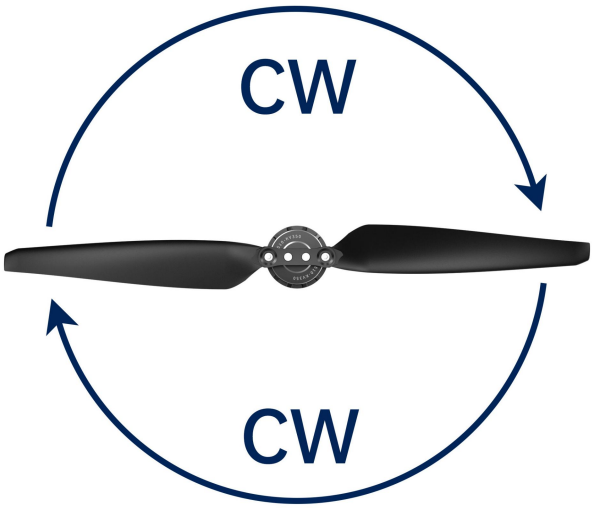
3.6 Installing Propellers

Warning Installing the propellers is the absolute final step before flight testing. Before installing the propellers, please strictly ensure that the motor rotation direction and all preceding steps have been completed correctly, to avoid testing accidents that could result in personal injury and property damage.

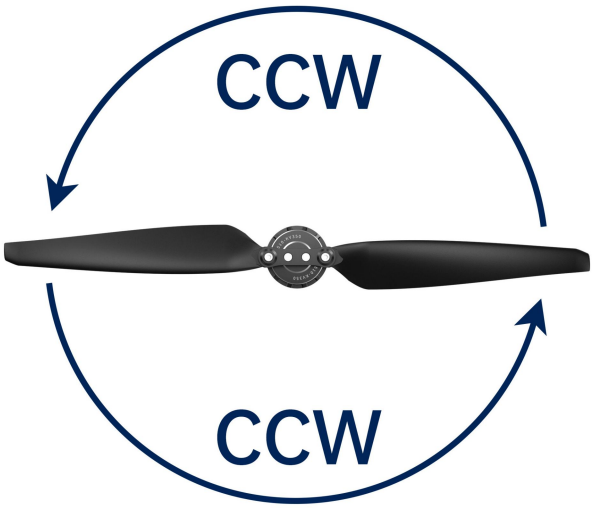
3.6.1 Matching Motor Rotation

Note

The CW and CCW rotation of the propellers must perfectly match the CW and CCW rotation of the motors. If a motor rotates incorrectly, simply swap the connection order of any two of the three motor phase cables.



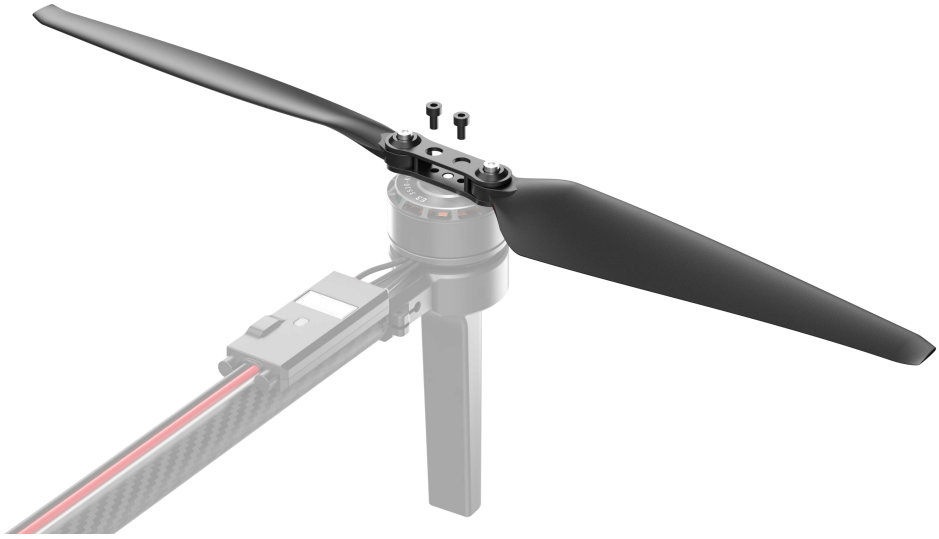
CW



CCW

3.6.2 Securing the Propellers

Use M3*6 screws to fasten the propellers by aligning them directly with the propeller and motor mounting holes.



4. Flight Testing

Warning

Before arming for takeoff and during flight, it is necessary to conduct a series of basic checks on the drone to ensure flight safety and improve testing efficiency and success rates.

Note

This chapter only provides testing guidance related to the propulsion system. For flight testing guidance regarding other components, please refer to their respective user manuals.

4.1 Pre-Flight Checks

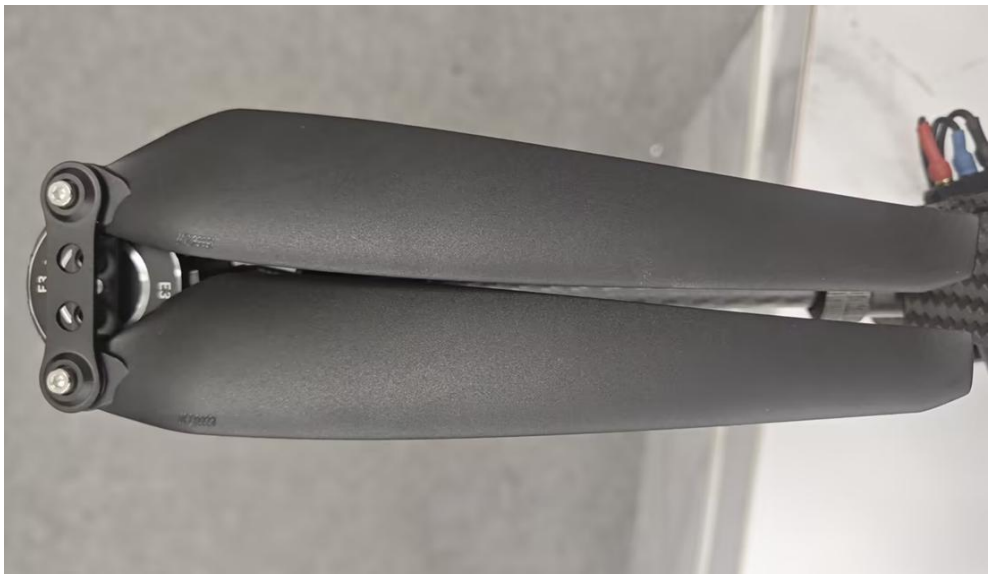
Note

A pre-flight check should be conducted before every power-on.

4.1.1 Checking the Propellers

Note

Ensure the propellers are installed correctly, securely tightened, and free of damage.



Note

If using folding propellers, unfold the blades manually at this time to prevent unnecessary vibrations during takeoff.

4.1.2 Checking the Propulsion Assembly

Note

Ensure the motors and wiring are securely mounted and connected.

Note

Manually rotate the motors to check for any binding or jamming.

4.2 Flight Testing

4.2.1 Ground Test

Note

Place the drone on a flat, open surface and power it on. Then, arm the drone and slowly increase the throttle. Carefully observe the drone's feedback to ensure all motors and propellers are operating normally.

4.2.2 Low-Altitude Hover Test

The low-altitude hover test is conducted to check the drone's stability and control response.
Hover the drone at an altitude of one to two meters and observe its hovering stability. Perform small-scale tests of translations in all directions (forward, backward, left, right) and rotation (yaw) controls to ensure the drone can execute these maneuvers stably.

4.2.3 Basic Maneuver Test

Increase the flight altitude and perform simple forward, backward, left/right translation, and rotation maneuvers. Observe the drone's response feedback and stability to confirm the responsiveness and stability of the propulsion system.

4.3 Post-Flight Checks

 **Note**

After every flight, it is recommended to conduct necessary checks on the drone to promptly detect any flight anomalies and safety hazards.

4.3.1 Checking Propellers and Motors

 **Note**

Check whether the propellers are loose or damaged, and inspect the motors for looseness, jamming, or abnormal overheating.

4.3.2 Recording and Analyzing Flight Data

Analyzing flight data helps identify flight anomalies and deficiencies, enabling the prompt formulation of countermeasures and enhancing flight testing efficiency.

It is recommended to focus on the following flight test data:

- Flight Time
- Power Consumption
- Flight Modes
- Anomalies

5. Troubleshooting

The SIYI tuning software supports real-time monitoring of the propulsion system's vibration, temperature, current, voltage, and other information, thereby assisting in quickly locating and troubleshooting issues, improving maintenance efficiency, and ensuring operational safety.

Note

Warning

Before troubleshooting, the propellers must be removed to avoid risks to personal safety.

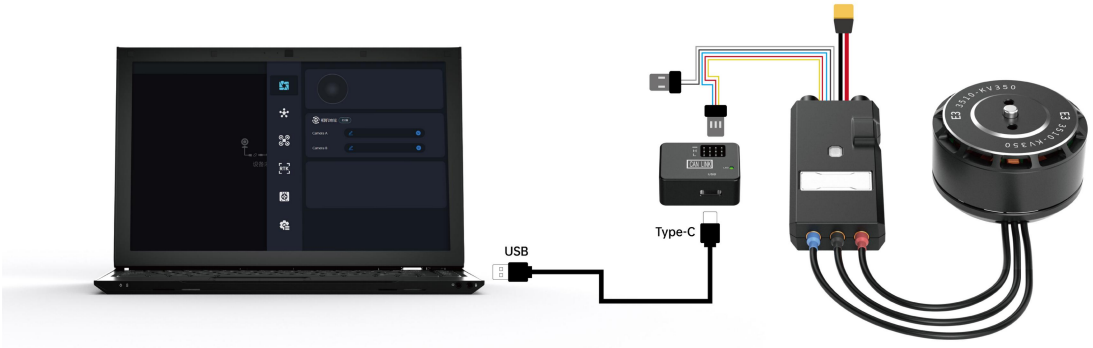
Please confirm the flight data to prevent incorrect data analysis and the inability to accurately determine the root cause of the problem.

5.1 Real-Time Operation Data

Tools Required

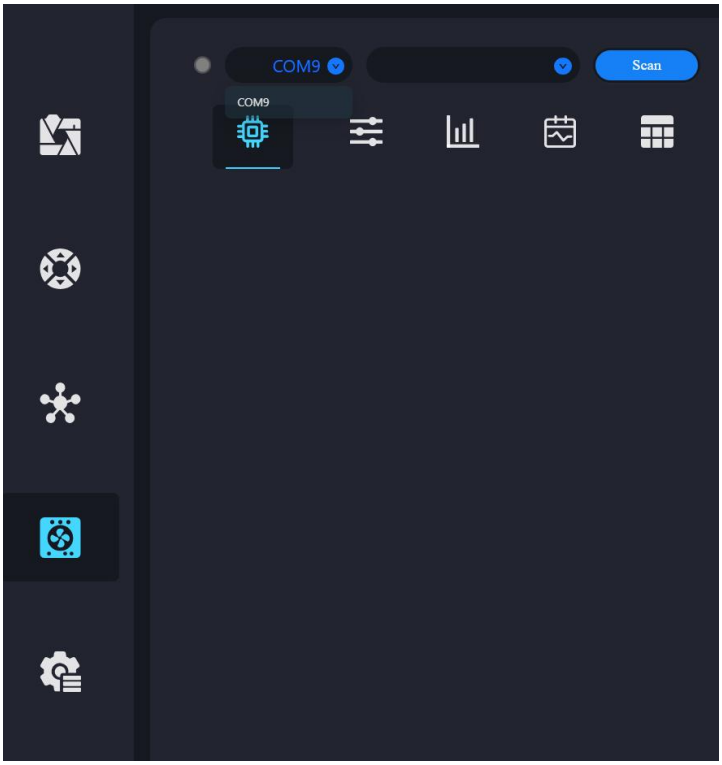
- SIYI UniGCS software (Windows version)
- SIYI CAN Link module
- Windows PC

Steps:

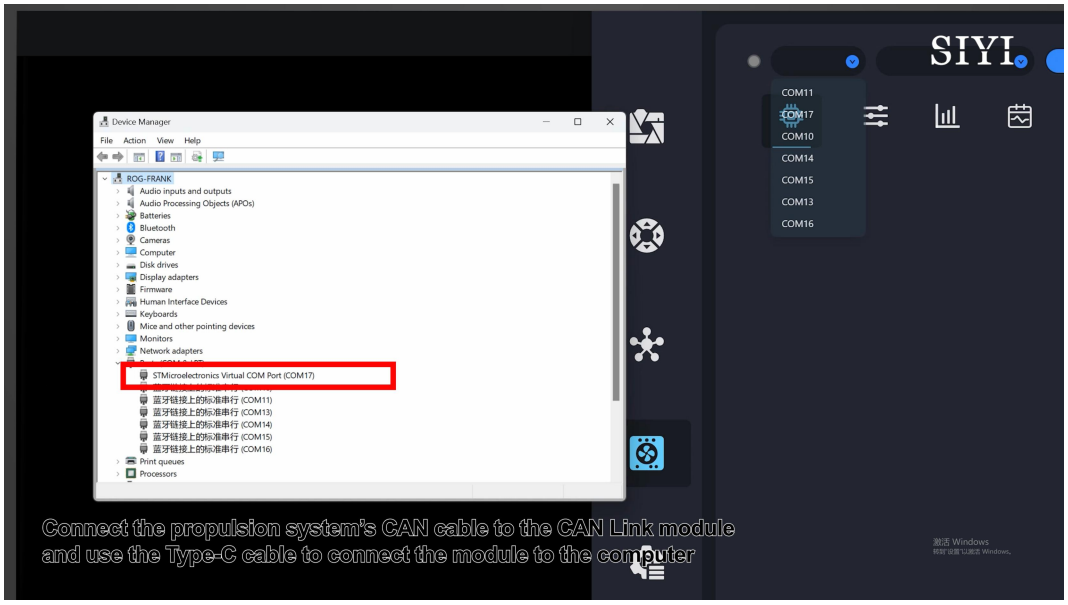


1. Please refer to the figure above to connect the propulsion system, SIYI CAN Link module, and the Windows device.
2. Run the SIYI Ground Control Station (GCS) software and enter the ESC settings

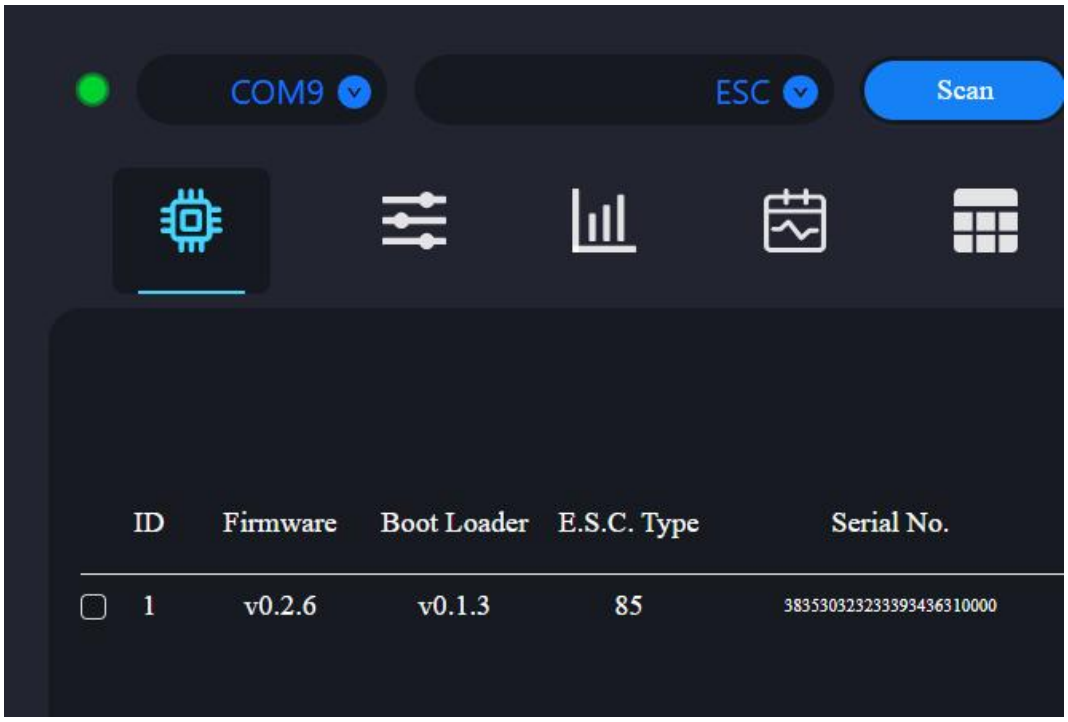
menu.



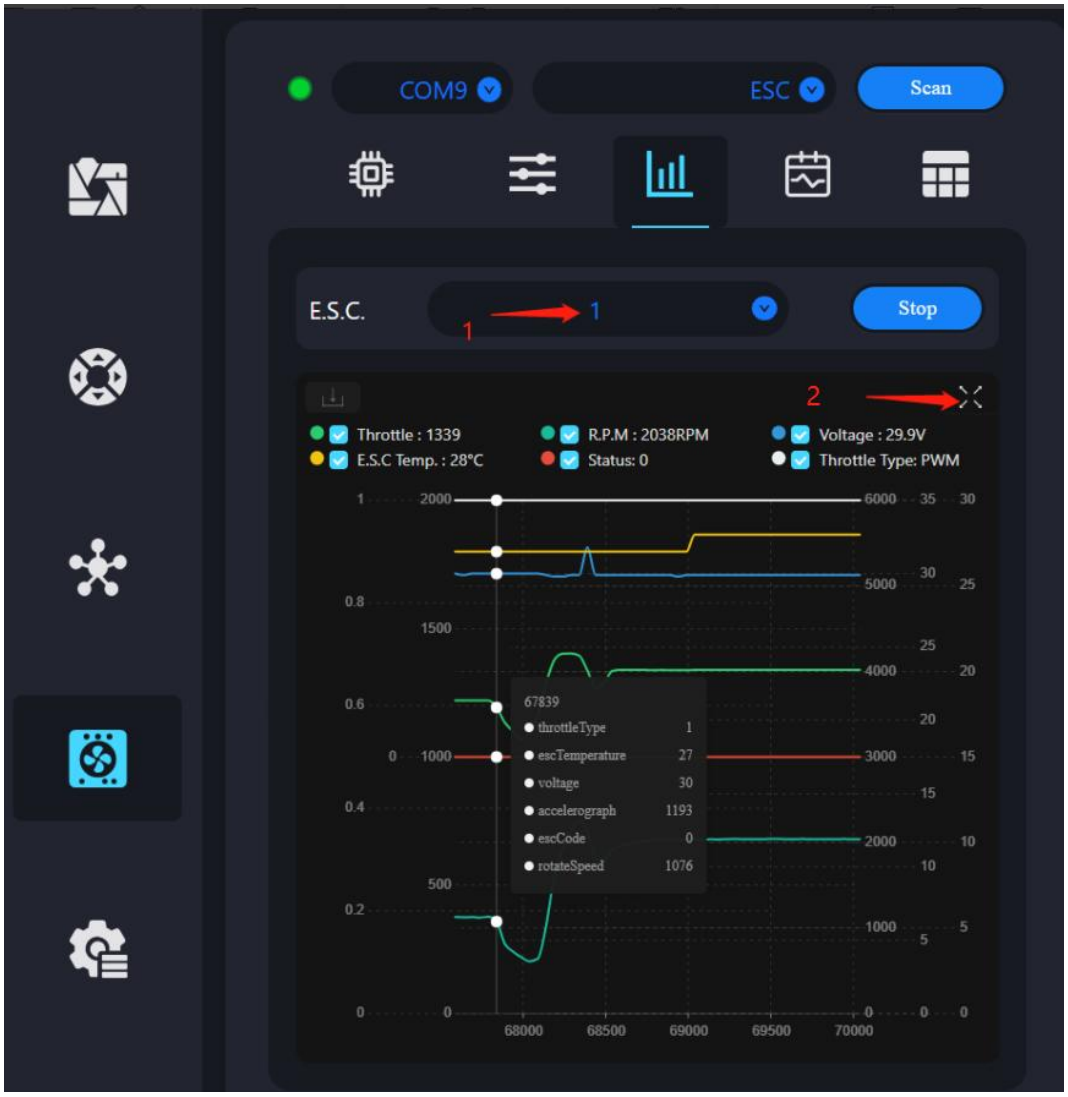
3. Select the corresponding COM port and device type (ESC), then click "Scan".



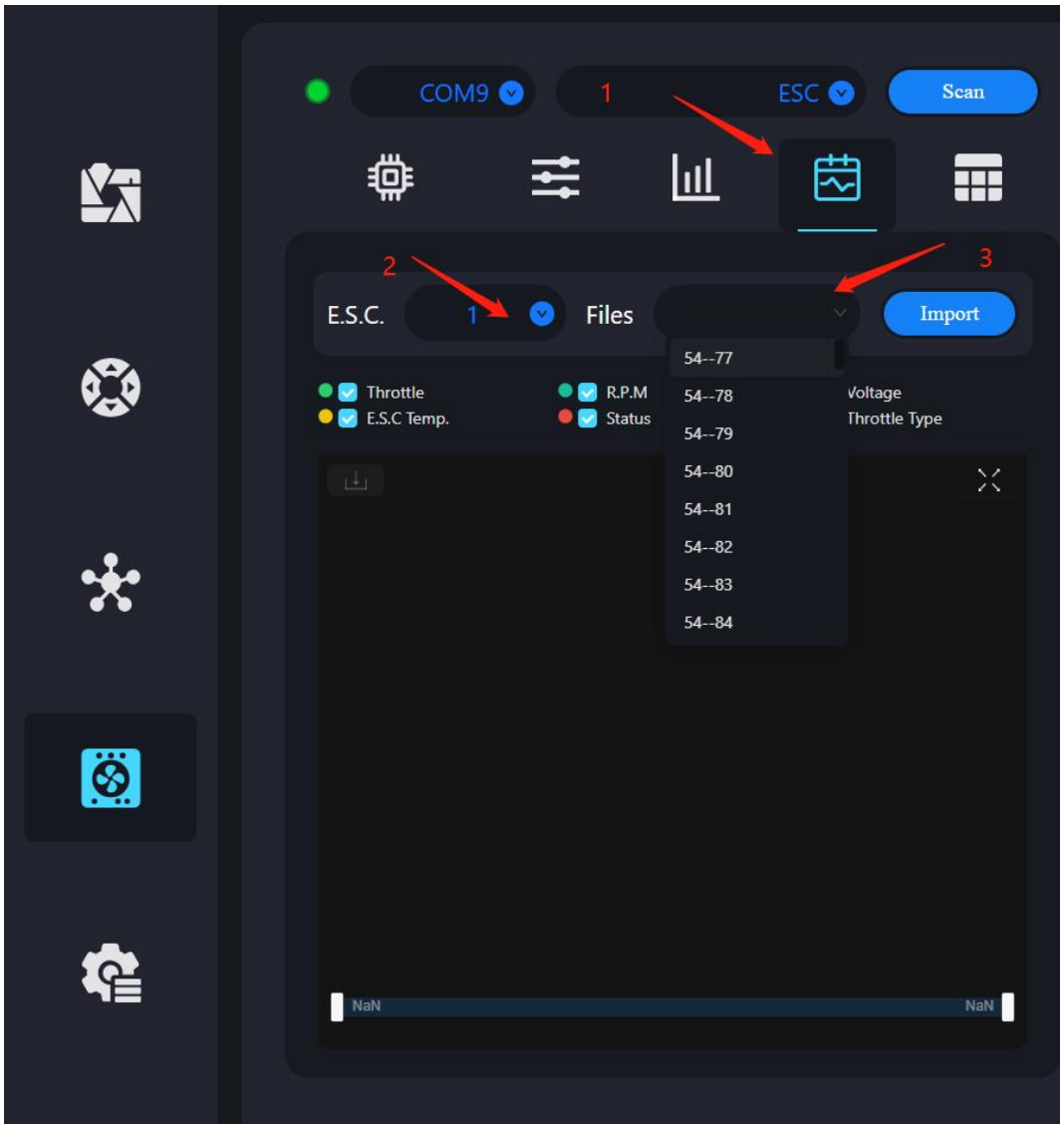
4. If the propulsion system is successfully recognized, the connection is established.



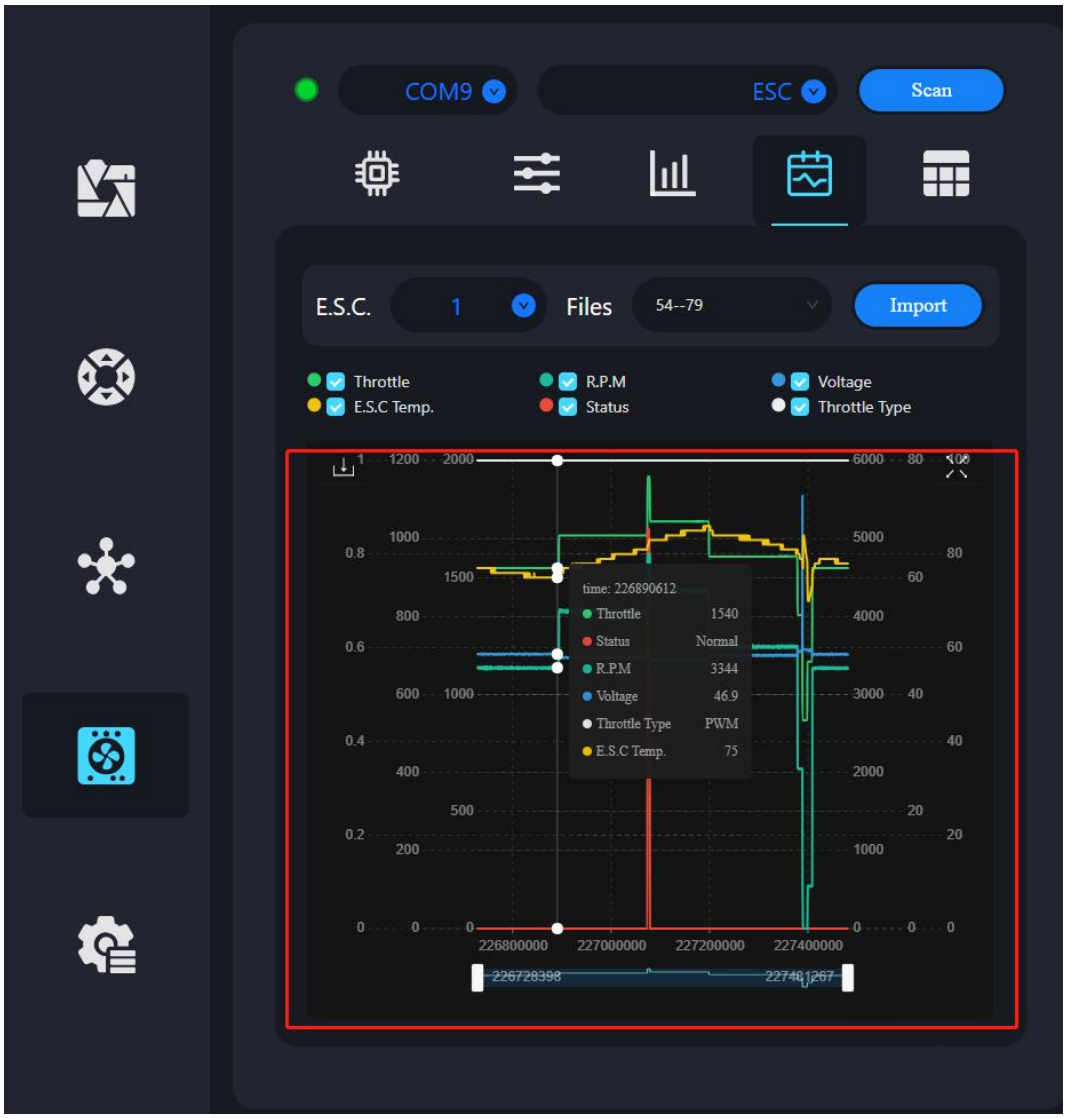
5. After selecting the corresponding ESC ID, the system will display a series of parameters, including throttle status, RPM, voltage, ESC temperature, ESC status, and throttle type. In addition, corresponding waveforms will be displayed in real-time for monitoring and analysis.



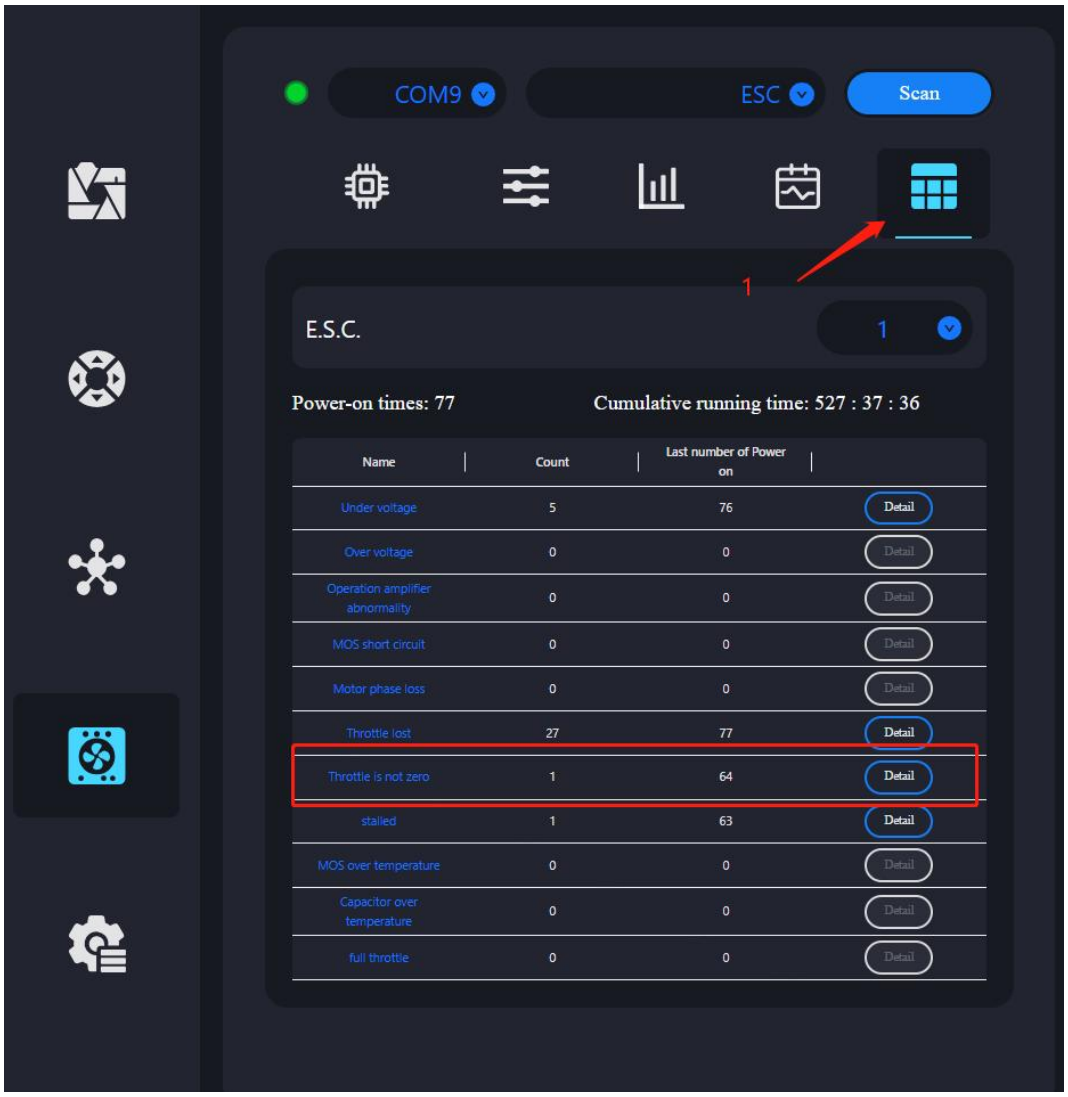
5.2 Historical Operation Data



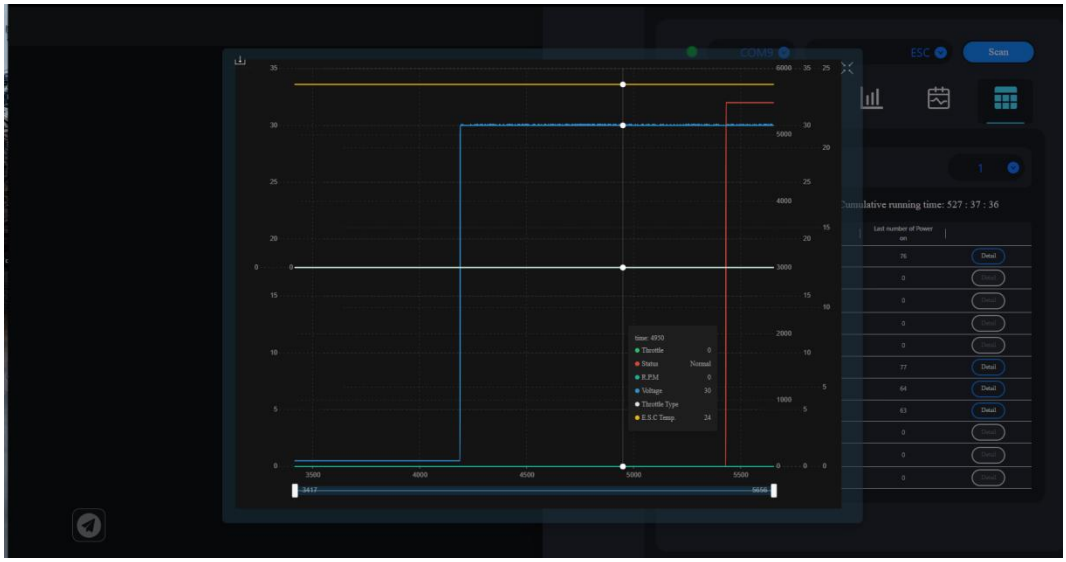
Users can check relevant information via the ESC ID. The prefix indicates the corresponding number of power-ons, and the suffix represents the file sequence number. Based on this naming convention, users can read the data content of the corresponding file.



5.3 Fault Storage Function



Users need to select the corresponding ESC ID to view based on actual requirements. When the user clicks the "Details" option, the system will display the time the anomaly occurred in the file and specific information regarding the anomaly point.



6. Firmware Upgrade

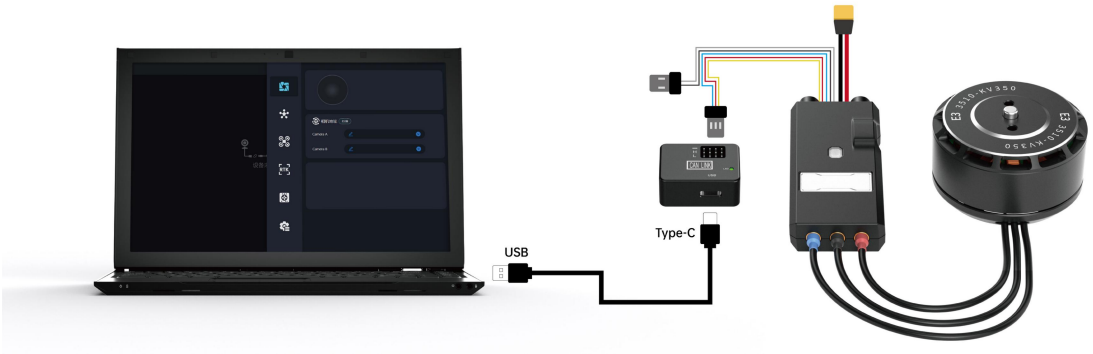
6.1 Upgrading via UniGCS Software

The SIYI GCS software allows users to upgrade the propulsion system's ESC firmware.

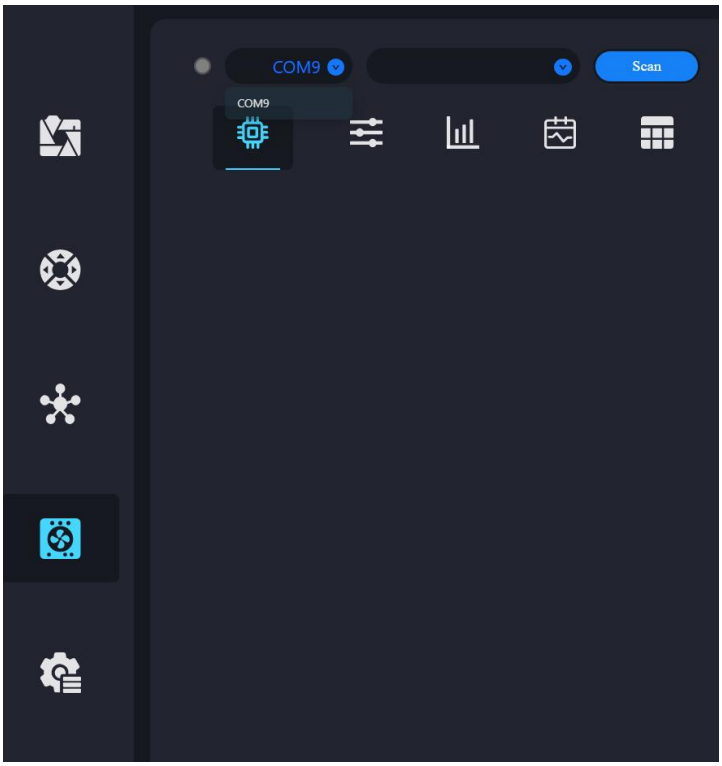
Tools Required

- SIYI UniGCS software (Windows version)
- SIYI CAN Link
- Windows PC

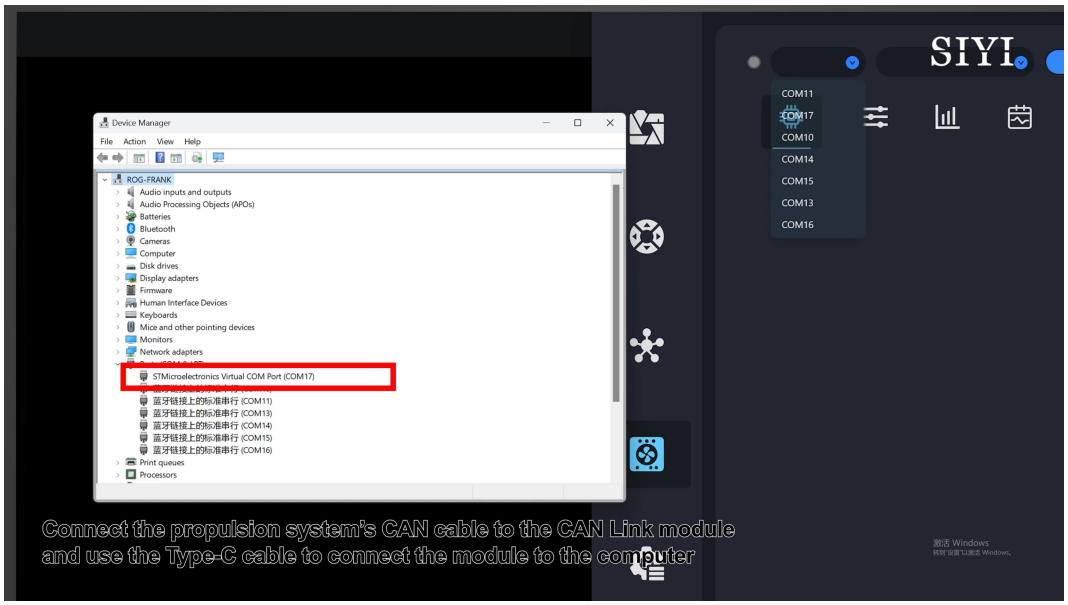
Steps:



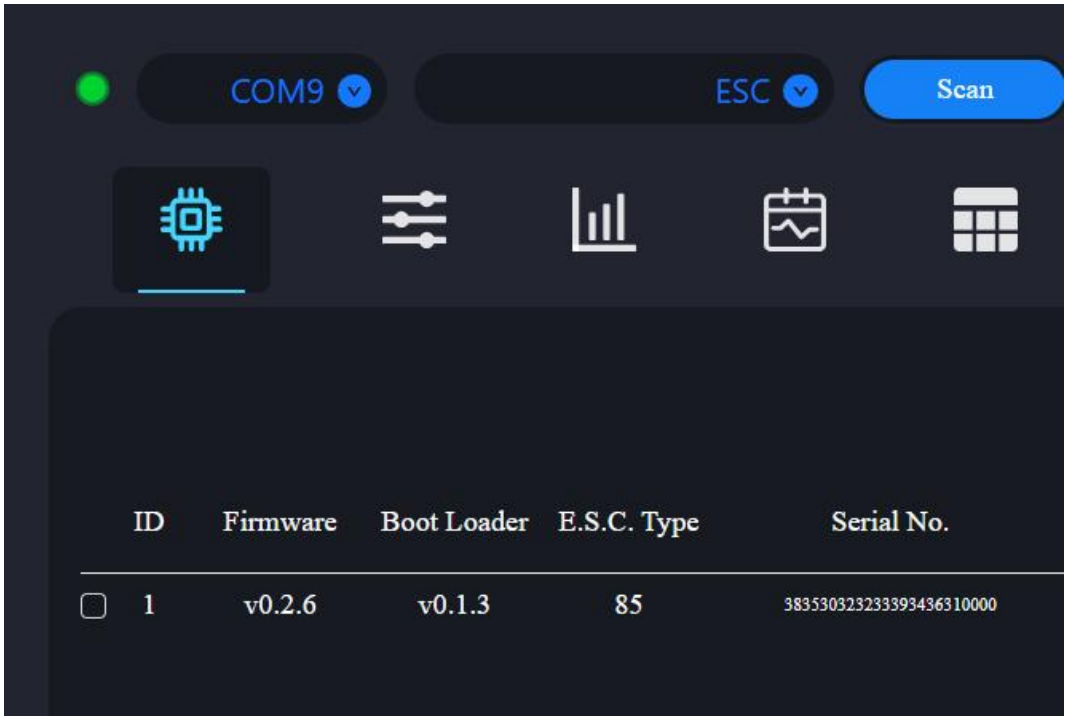
1. Please refer to the figure above to connect the propulsion system, SIYI CAN Link module, and the Windows device.
2. Launch the SIYI GCS software and enter the ESC settings menu.



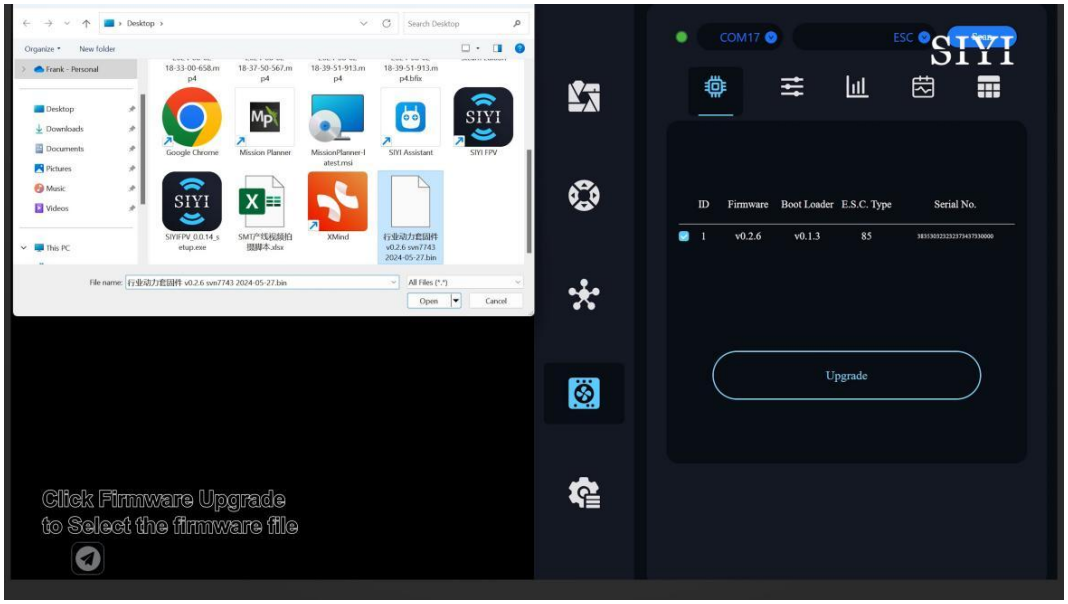
3. Select the corresponding COM port and device type (ESC), then click "Scan".



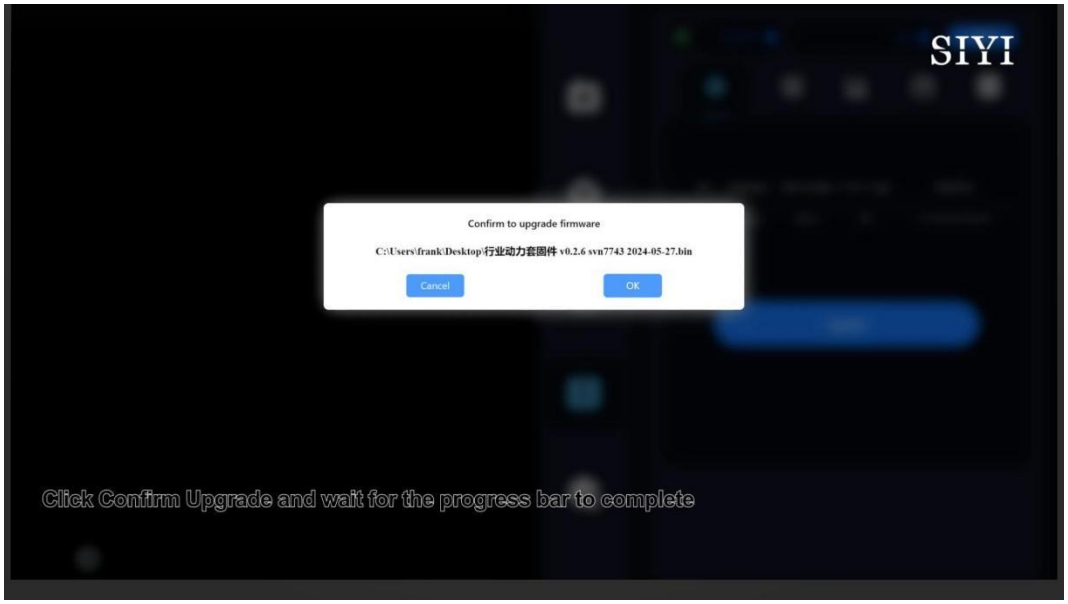
4. If the propulsion system is successfully recognized, the connection is established.

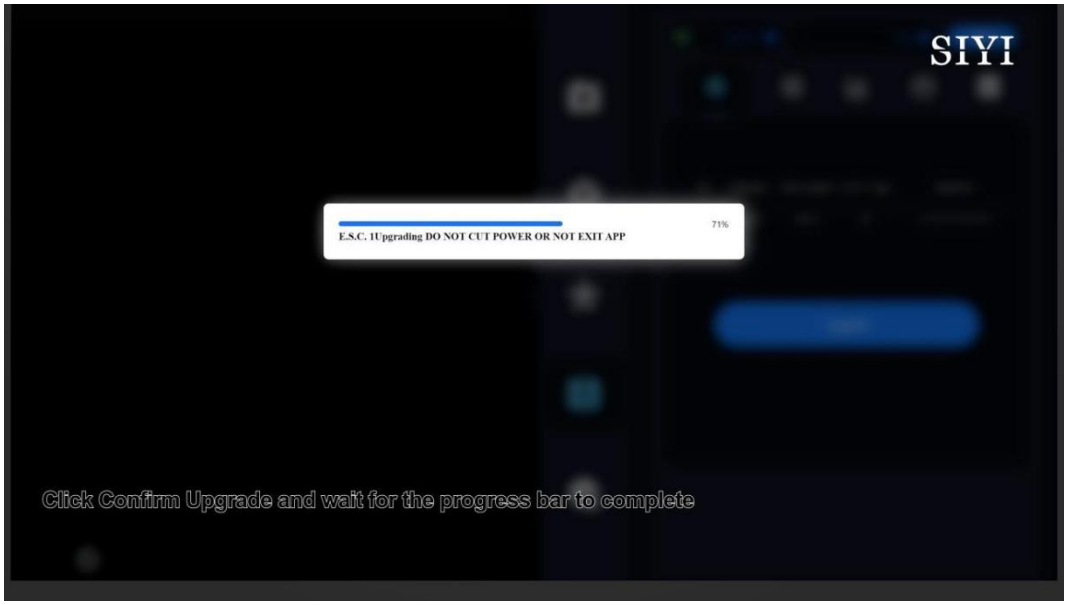


5. Click "Update Firmware" and select the firmware file.

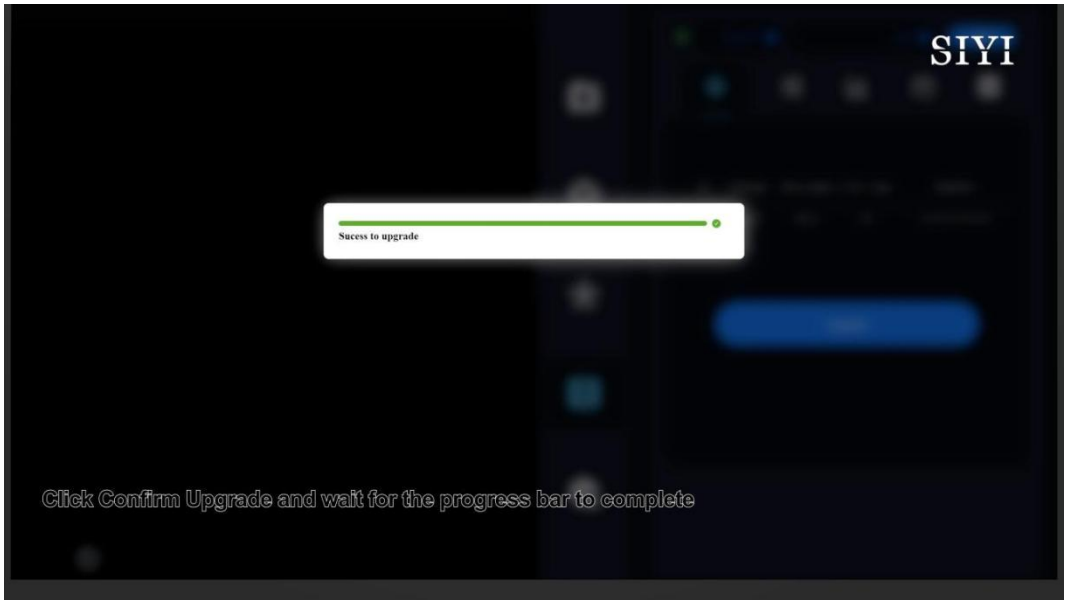


6. Click to confirm the upgrade, and wait for the update progress bar to complete.





7. Upgrade successful.

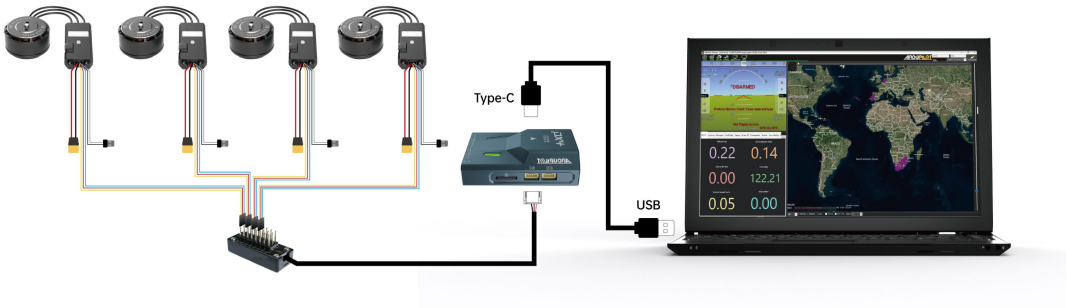


Note

Before upgrading the firmware, please ensure that the propulsion system is working properly, and pay special attention to the pin definition of the CAN interface to avoid a reverse connection. The upgrade status will be indicated by changes in the LED color. Upon completion of the upgrade, a beep will sound as a prompt, and the LED will simultaneously revert to its original color.

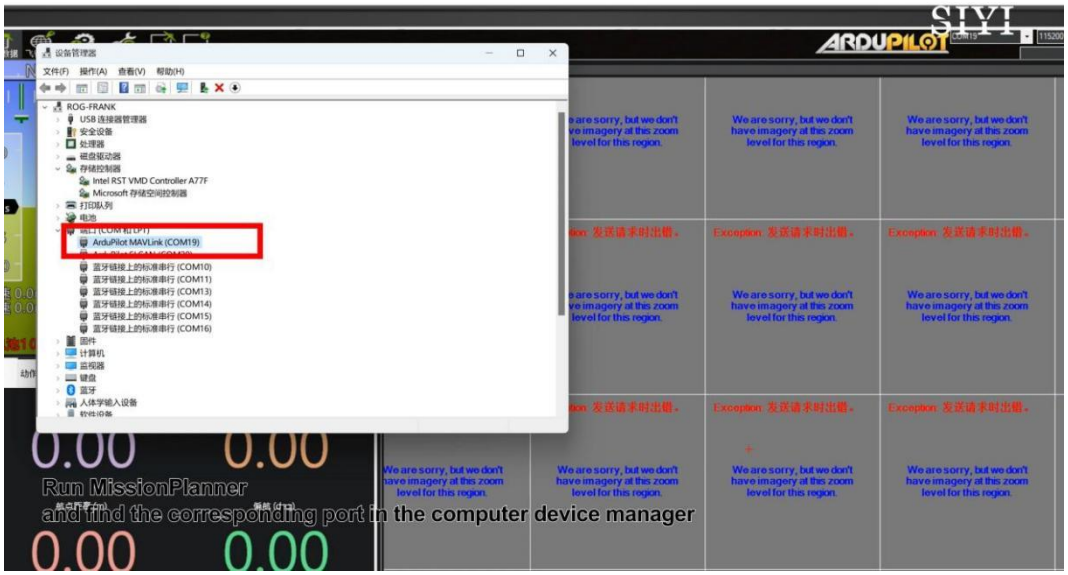
6.2 Upgrading via Mission Planner Software Using DroneCAN Protocol (ArduPilot)

The ArduPilot flight controller supports upgrading the SIYI propulsion system firmware via the DroneCAN protocol.

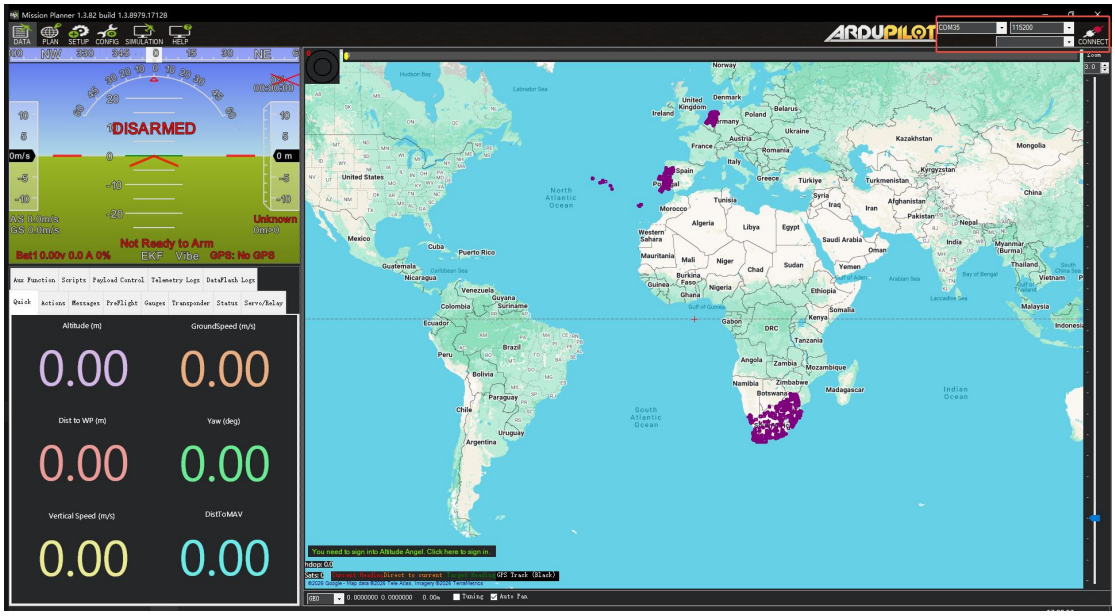


Steps:

1. Launch Mission Planner, and find the corresponding port in the PC's Device Manager.



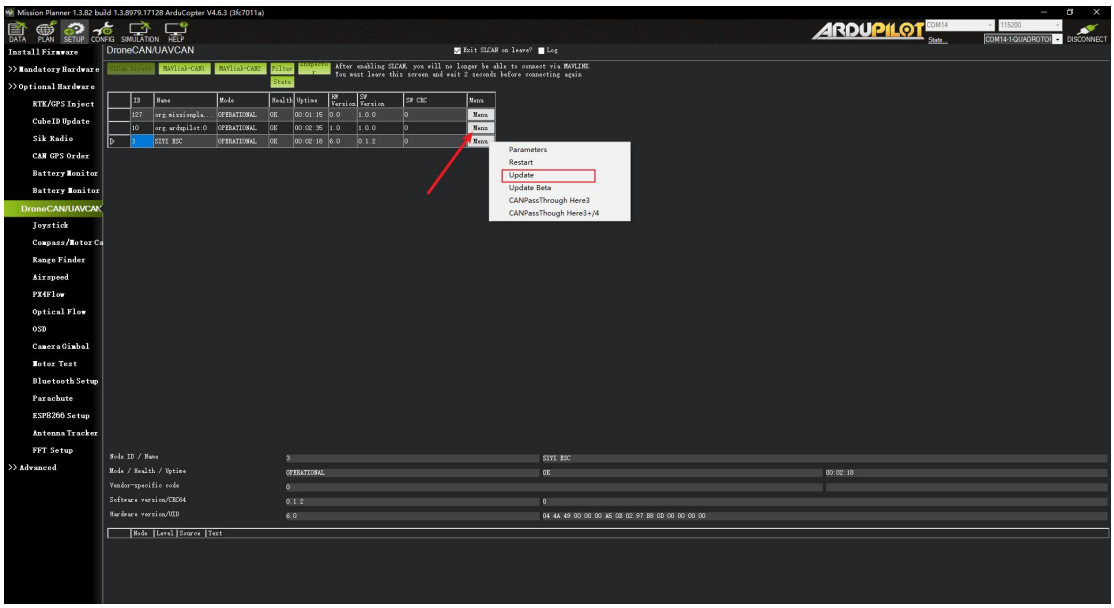
2. Select the corresponding COM port and 115200 baud rate.

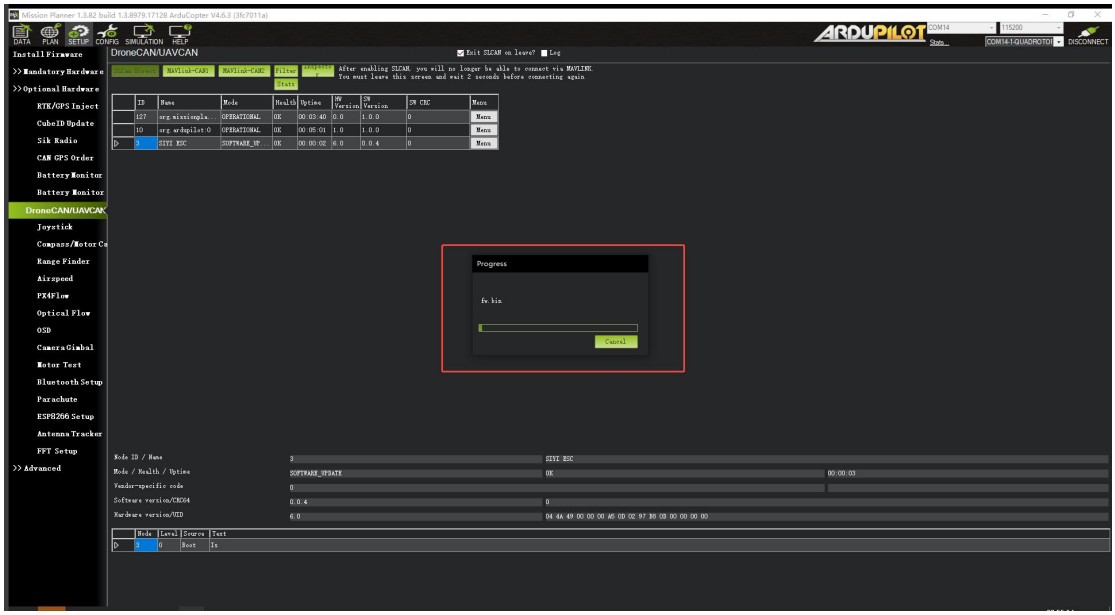


3. In the DroneCAN / UAVCAN section, click MAVlink-CAN1 to refresh the CAN devices.

4. The option named "SIYI ESC" is the SIYI propulsion system ESC.

5. The Update option can be found under Menu. Select the ESC firmware to proceed with the upgrade. During the upgrade process, the Mode will display as SOFTWARE_UPDATE along with a progress bar.





7. After-Sales and Warranty

Please visit SIYI Technology at https://www.siyi.biz/index.php?id=support for the latest after-sales and warranty information.