UAV Power System Testing **LY-Micro-Max**

User Manual

5.0

* LY-Micro-MAX refers to LY-Micro、LY-10KGF、LY-30KGF、LY-70KGF、LY-MAX thrust stand
* LY-MAX refers to the stand above 100KGF
* The User Manual is applicable to LY-Micro、LY-10KGF、LY-30KGF、LY-70KGF、LY-MAX thrust stand

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Content

Dear Client,

Thank you for choosing our products. Really appreciated it.

Established since 2017, we always believe that Expertise creates quality and insist on Customer First. Continuous investment in research and development, pursuit of precise attitude, and high efficient and excellent service enable us to continuously innovate and launch products that could satisfy our customers requirements.

This manual will guide you to use the LY-Micro-MAX UAV power system testing safely and efficiently. Before operating, please make sure to read this manual carefully and follow the instruction in the manual. Any questions, welcome to contact us at any time. We will listen carefully.

Thank you so much.

Best regards,

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I. Disclaimer

This statement applies to the licensee of WING FLYING (TIANJIN) TECHNOLOGY CO.,LTD., including users who purchase this product, authorized distributors, distributors and developers. Before using the LY-Micro-MAX UAV power test system, please read this statement and the Terms of use of the hardware equipment carefully. Once used, it is deemed to be the approval and acceptance of all contents of this statement and the Terms of use. Please strictly follow the user manual, and follow the professional guidance personnel of WING FLYING (TIANJIN) TECHNOLOGY CO.,LTD. when using it for the first time. Do not replace other versions of the software system by yourself to avoid unnecessary damage caused by compatibility differences.

When operating the LY-Micro-MAX UAV power test system, WING FLYING (TIANJIN) TECHNOLOGY CO.,LTD. will not be responsible for any loss caused by improper operation by the user. Please read the following terms carefully:

1. If the user does not adjust the parameter settings of the power system test stand according to the operation manual, resulting in poor testing results or product damage, WING FLYING will not be responsible.

2. The software provides update services, and users can choose the appropriate version according to their own need.

3. Users are limited to using own parameters. The manufacturer's parameters are calibrated by the factory, so users are not allowed to set them.

4. Due to unauthorized alteration or destruction of the internal system components of the power system test stand, resulting in errors in the data received by the software of the power system test stand, the Company shall not be responsible for, and shall have the right to be held accountable.

5.Before using the software, please read the User Manual carefully. Company shall not be responsible for any damage or other by not following the manual.

II. Precautions For Use

Before you are going to start your test, please pay attention to the safety. High-speed rotating propeller may cause a certain degree of injury and damage to personal property, so please pay attention to safety when testing. The company will not be responsible for product damage or personal risk caused by non-compliance with the manual.

1. LY-Micro-MAX thrust stand should be placed in a separate space. Before the Power test, the test stand should be fixed and ensure the safety of the surrounding environment. During the testing, no other people are allowed to enter without the permission of the operator, so as to avoid personal injury.

2. Please undergo the test within the measure range, and do not exceed the max test range.

3. Use the test stand in strictly accordance with the user manual. Do not violet the rules to avoid the electrical shock.

4. Do not get close to or touch the rotating motor or propeller to avoid being cut by the rotating propeller.

5. Before starting the actual test, please check if the propeller and motor are firmly assembled and the rotation direction is right.

6. Before use, please check weather all the parts are in good condition. If any parts are aging or damaged, please replace them with new.

7. The operator shall not operate under the condition of drinking, drug anesthesia, dizziness, fatigue, nausea or other poor physical or mental conditions so as to avoid injury.

8. When the software sends an alarm, the operation should be stopped immediately.

III. Product Introduction

(I) Components of the System

LY-Micro-MAX UAV Power System is composed of the **LY-Micro-MAX test stand**（including various sensors, acquisition cards, test stand accessories) and **MET-V6 test software.**

FIG 3-1-1 LY-30KGF thrust stand

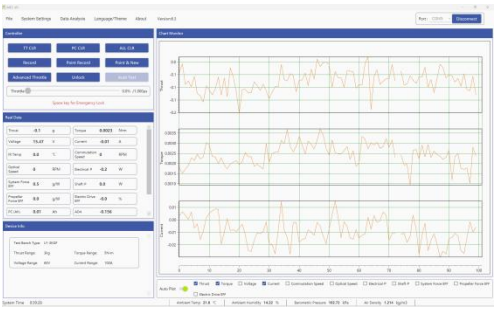

FIG 3-1-2 MET-V6 test software

* Test stand accessories include motor mount, supporting cables, power adapter, etc.

(II) Function Introduction

LY-Micro-MAX UAV Power Test System is a test system designed for small power development. It is equipped with sensors such as thrust, torque, voltage, current, temperature, speed, etc. It can realize the measurement of thrust, torque, voltage, current, temperature, speed and etc..

LY-Micro-MAX UAV Power Test System is equipped with the MET series test software. The MET test software is connected to the test stand to achieve the measurement and data analysis.

(III) The System Operation logic diagram

Here are the system operation logic diagram in the Fig 3-3-1.

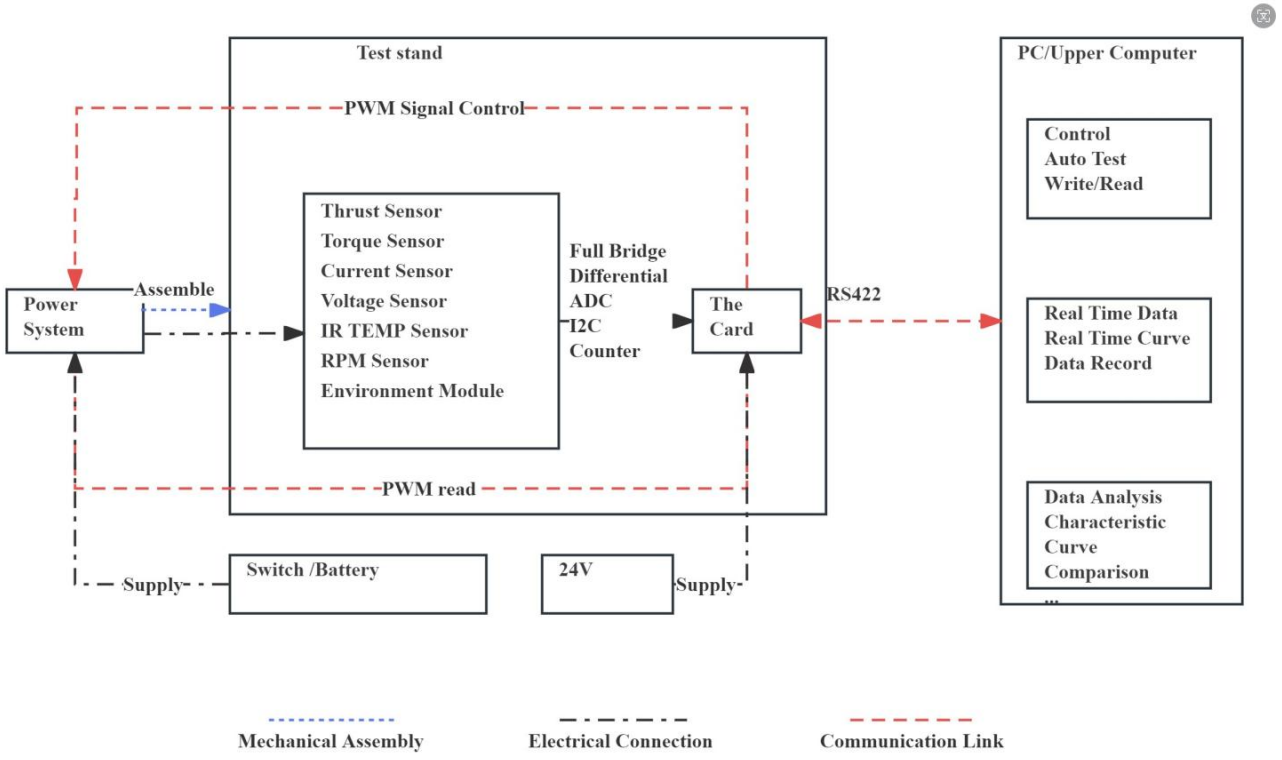

FIG 3-3-1 The system operation logic diagram

The figure clearly shows the logical control relationship between the test stand, the power system, the power supply, the upper computer and the operating mechanism of the test stand.

* The switch power supply, power system and computer in the system operation logic diagram are provided by the user.

* CAN communication customization is supported.

(IV) Ez-test100 Acquisition card introduction

1.The card: Acquisition card interface diagram

Ez-test100 acquisition card is developed by WING FLYING (TIANJIN) TECHNOLOGY CO.,LTD.. It can achieve thrust, torque, current, voltage, RPM, temperature and other multi-channel data acquisition. The conventional version of the Ez-test100 acquisition card is 10Hz, and the high Sampling rate version is 100Hz

(1000Hz can be customized).

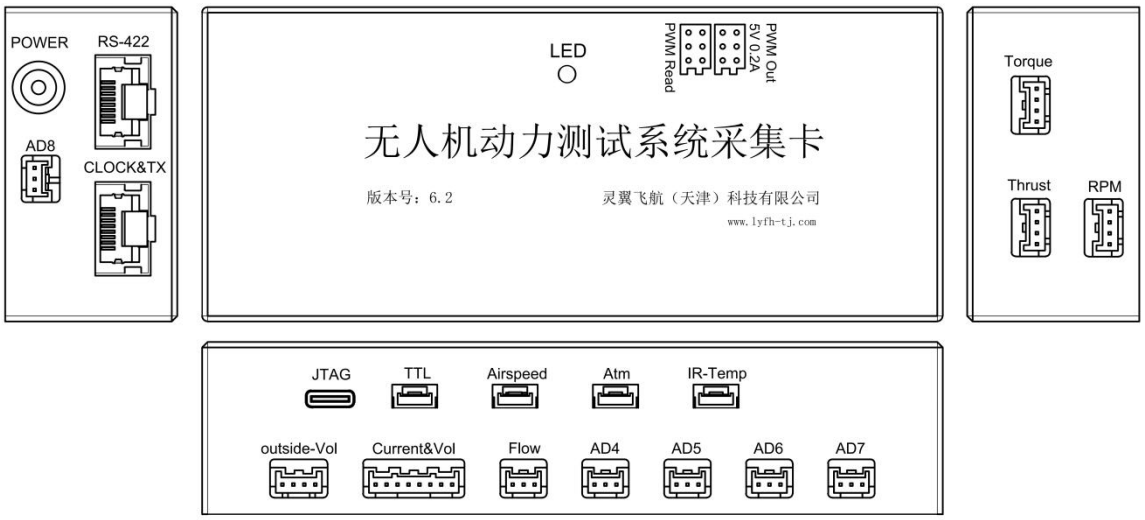

FIG 3-4-1 Acquisition card interface

*Indicator: Blinking blue during normal operation. If the indicator is off when the power is on, the acquisition card is abnormal.

*Buzzer: After the device is powered on successfully, the buzzer will sound "drip drip". When software communication is successful, software communication is disconnected or accelerator is unlocked or locked, the buzzer will emit “drip”.

2. Acquisition Card Interface Introduction

No.	Items	Position	Function
1	PWM Out	Top side right most steering gear interface	ESC Signal.
2	5V 0.2A	Second steering gear port on the top right	Power supply port for the ESC.
3	PWM Read	Top side left two steering gear interface	One for the remote-control unit receiver--Throttle; One for ESC signal.
4	Torque	Right side interface	Torque sensor .
5	Thrust		Thrust sensor.
6	RPM		RPM module .
7	JTAG	Lower interface	Updated port of the lower computer firmware.
8	TTL		Reserved TTL interface.

9	Airspeed		Airspeed sensor .
10	Atm		Atmospheric environment module Interface.
11	IR-Temp		Infrared Temp Sensor .
12	Outside-Vol		Outside Voltage sensor .
13	Current & Vol		Current & Voltage sensor.
14	Flow		Related Flow sensor.
15	AD4		Reserved interface for analog signal input.
16	AD5		Reserved interface for analog signal input.
17	AD6		Reserved interface for analog signal input.
18	AD7		Reserved interface for analog signal input.
19	POWER	Left interface	24V power supply interface for Acquisition card .
20	AD8		Reserved interface for analog signal input.
21	RS-422		Upper computer communication interface.
22	CLOCK& TX		Clock and signal output interface.

FIG 3-4-1 Acquisition Card Interface Sheet

3. Ez-Test100 Acquisition Card Parameter

Acquisition Card Parameter			Notes
Basic info	Acquisition speed	100Hz/10Hz	
	Bus type	422@460800bps	
	Operating System	Win7 & upper version	
	Equipment Power Supply	DC24V 2A	
PWM Output	Channel Number	2	PWM2 and PWM Read are multiplexed.
	Resolution	1μs	
	Output Range	50-500Hz	

	Output Error	<1μs	PWM Read and PWM2 cannot be used simultaneously.
Full bridge differential measurement (thrust sensor)	Channel Number	2	
	ADC Resolution	24bit	
	Sampling Range	±20mV	
	Channel Scan Mode	Pseudo-synchronous acquisition	
	Gain Error	±0.05%	
AI differential analog measurement	Number of ADC differential channels	8	Custom interface, please don't use without advise .
	ADC Resolution	24bit	
	Sampling Range	±1.5V	
	Channel Scan Mode	Synchronous acquisition	
	Gain Error	±0.01%	
I2C Sensor Interface	Channel Number	3	
	Supported Model	Infrared Temp Sensor	
		Atmospheric environment module Interface	
		Airspeed sensor	
FREQ Counter （RPM)）	Channel Number	2	
	Channel Number	0.1Hz	
	Function	Frequency measurement	
	Min pulse width	10us	
	Electrical standard	TTL	
PWM Read	Channel Number	1	
	μs Resolution	1μs	
	Hz Range	50-500Hz	
	Sampling Error	<1μs	

Sheet 3-4-2 Acquisition Card Parameter

IV. Introduction of structural components

(I) LY-Micro-30KGF Thrust Stand

1.Structure Introduce

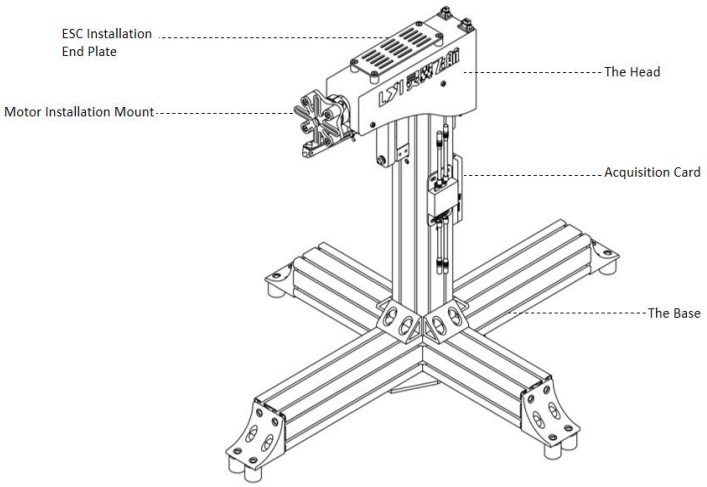

FIG 4-1-1 Thrust stand structure

2. Sensor Introduce

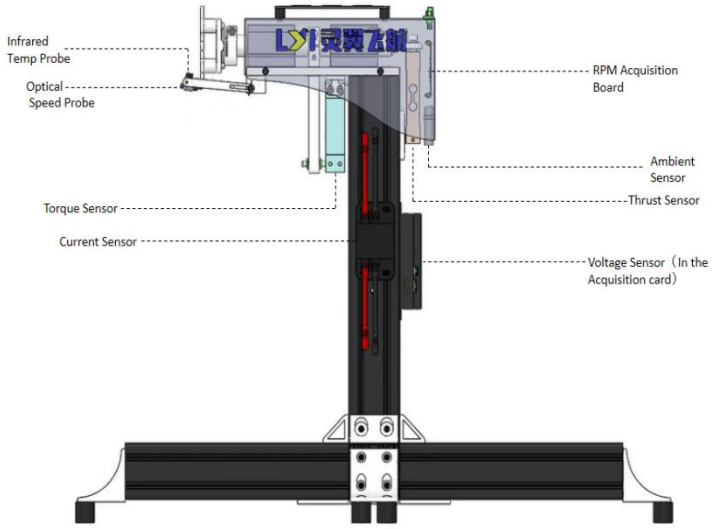

FIG 4-1-2 Sensor Position

*LY-Micro-30KGF structure and sensors introduction are taking LY-30KGF as an example.

(II) LY-70KGF-MAX Thrust Stand

1. Structure Introduce

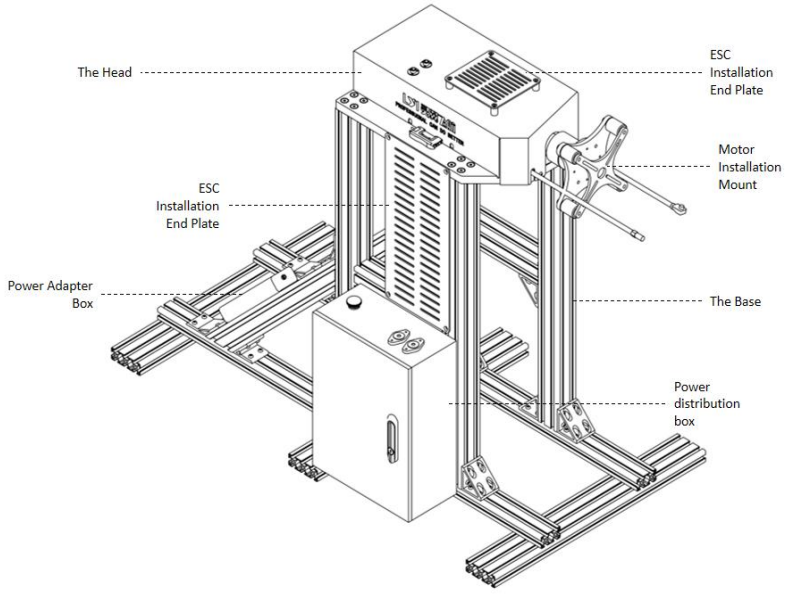

FIG 4-2-1 Thrust stand structure

2.Sensor Introduce

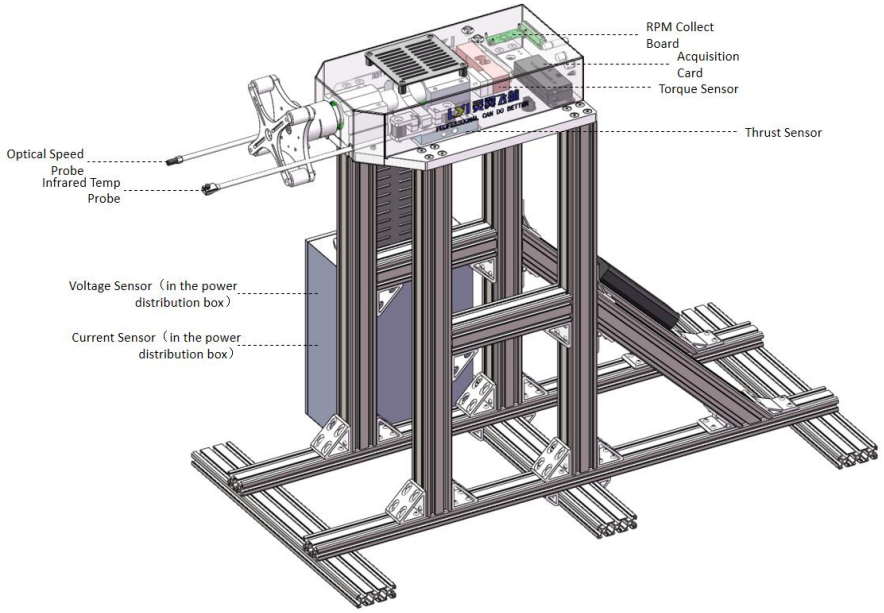

FIG 4-1-2 Sensor Position

*LY-70KGF-MAX structure and sensors introduction are taking LY-70KGF thrust stand as an example.

V. Software Introduction

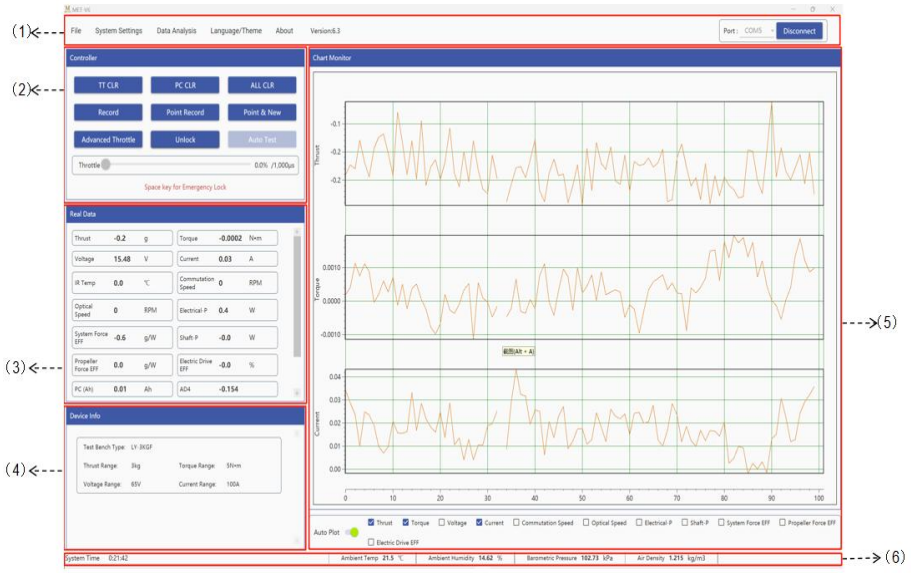

FIG 5-1 Main Interface of the software

（1）Tool bar　　（2）Control panel　　（3）Real-time data

（4）Device info　　（5）Chart Monitor　　（6）Environment parameter Interface

(I) Tool bar

Tool bar consists in File、 System Setting、 Data Analysis、 Language/Theme、 About、 Version and connection port. It can realize the functions of data search, system basic parameter setting, data analysis and so on.

1. File

Click File to open the Test Data Storage folder (MetData). You can view raw test data (Log), Point test data (Point), Test Report, Average Throttle Point Data.

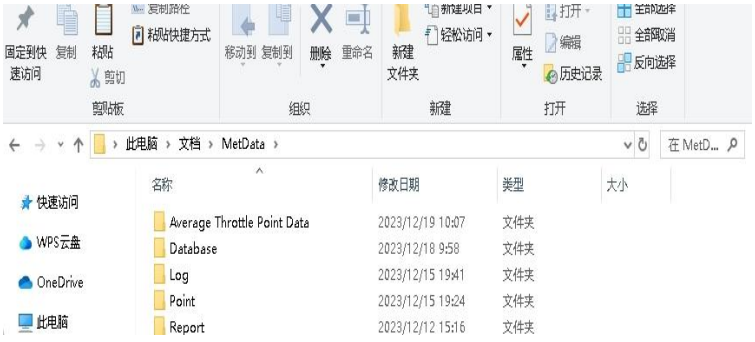

FIG 5-1-1 Data storage File

*The "Database" is a program configuration file. Users can delete the configuration file and replace

the test stand model. For details, see the Quick Use Guide.

2. System Settings

System Settings consists in the Basic Setting、Safe Guard、Test info、Auto Test、Data Setting and Factory Setting.

(1) Basic Setting

In the basic Settings, parameters such as throttle PWM interval, pole pair number, Optical sticker number, thrust direction, torque direction, and Sampling rate can be set.

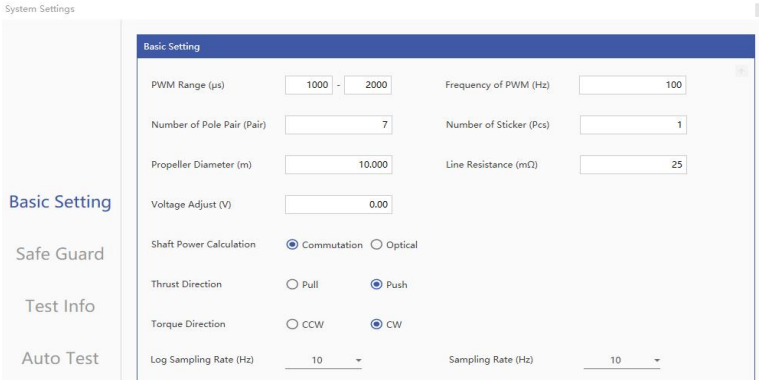

FIG 5-1-2 Basic Setting Interface

① Throttle PWM Range (Pulse Width Modulation) : In general for the ESC which supports the calibration， the setting range is from 1100 to 1940μs （FUTABA standard stroke）or 1000-2000μs（Flight control standard stroke），after the setting, it is required to calibrate on ESC. For ESC which is not supported the stroke calibration, it can refer to the ESC instruction to finish the calibrated process.

② PWM output Frequency： It refers to the PWM change period, generally 72Hz or 400Hz, the software system preset value is 400Hz, except for special cases, the user does not need to set it separately.

③ Pole pair number (Pair)： It stands for motor poles in pair. Before testing, it is required to set the pole pair number. For example, if the number of motor slot poles is "12N14P", enter "7" into the Pole pair number.

*It must be set before the testing. If the pole pair number is wrong, the commutation speed data will have the error.

④ Number of the stickers (Pcs)： It refers to the number of reflective stickers affixed to the propeller or motor when it is required to test Optical Speed. For example: For the two blade propeller, generally posted two reflective stickers, then enter 2 in the system. For the three-blade propeller , the reflective sticker posted is generally 3, to keep same number, enter 3 in the software.

*It must be set before the testing. If the Optical stickers are set wrong, the Optical speed data will have the error.

⑤ Propeller Diameter (m)： The input value of the propeller diameter here is used to calculate the thrust coefficient and power coefficient. If the user does not need to measure the relevant parameters, it does not need to be set.

*In the initial interface, the thrust coefficient and power coefficient are not displayed in the real-time data, which can be checked in the System Settings - Data Settings.

⑥ Line Resistance (**MΩ**): It refers to the line resistance from the bus end to the power end measured by a milliohmmeter (+- poles should be calculated)。 It is mainly used to calculate the power loss (line loss power, terminal voltage, corrected total power) during the test of long power lines or thin power lines. In the initial setting of the software, the internal resistance of the line is 0. If the user does not need to measure the relevant parameters, it is not necessary to set it.

*In the initial interface, line loss power, terminal voltage, and corrected total power are not displayed in the real-time data. You can select this option in System Settings - Data Settings.

⑦ Voltage Adjust (V)： Through the high-precision multi-meter, the measured voltage data and the software display data have a small gap (within 1V), you can input a positive or negative number, fine tune the voltage value, to achieve high-precision measurement, before the user adjustment, please contact the manufacturer.

*If the voltage deviation is greater than 1V, we don't advice to adjust the voltage. Contact the manufacturer to check the voltage.

⑧ Shaft Power Calculation: Users can choose commutation speed or Optical speed to calculate the shaft power calculation. We advice that LY-Micro-30KGF use commutation speed while LY-70KGF-MAX to use optical speed.

⑨ Thrust Direction: The forward force generated by the motor and propeller (the back end of the test stand points in the direction of the motor) is the pull force. At this time, if the thrust direction is set to "Pull", the display value of the thrust in the real-time data is +. If the thrust direction is set to "Push", the display value of the thrust is -. The backward force generated by the motor and propeller (the motor points to the back end of the test stand) is the push. At this time, if the thrust direction is set to "Pull", the thrust display value is -. If the thrust direction is set to "Push", the thrust display value is +.

⑩ Torque Direction: The left-handed helix theorem in the direction of pull is CW (clockwise rotation) while the right-handed helix theorem is CW (Counterclockwise rotation). When CW is selected, the propeller torque of CW steering will be displayed as +, the propeller torque of CCW steering will be displayed as -, and the polarity will be reversed when CCW is selected.

⑪ Sampling Rate (Hz)： It refers to the data acquisition frequency of the acquisition card. The standard version is 10Hz, and the sampling rate of 10, 50, and 100Hz can be selected for the 100Hz version. As the acquisition frequency increases, the random noise will also increase. For Sine, Linear, Step, Frequency sweeping test mode, we advice to use 100Hz, other modes, use 10Hz.

⑫ Log Sampling Rate (Hz)： Refers to the rate at which raw data (Log) is recorded.

*The 100Hz high-frequency acquisition version can record data in five modes of 0.1, 1,10, 50, and 100Hz, while the 10Hz version can record data in three modes of 0.1, 1, and 10Hz.

(2) Safe Guard

The user can set 9 parameters including thrust, voltage, current, IR Temp (infrared temperature), commutation speed, optical speed, Electrical-P (total power), PC (power consumption (Ah)), and PC (power consumption (Wh)).

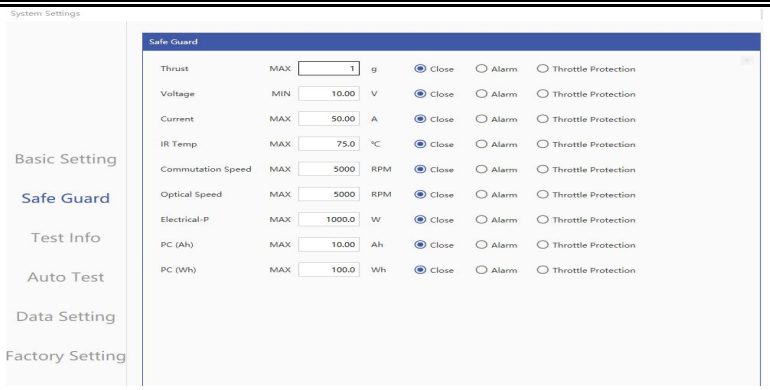

FIG 5-1-3 Safe Guard Interface

Two modes for Safe Guard:

One is “Alarm”, when the test value reaches the protection value, the software will alarm (the real-time data display position will flash red and the device will make an alarm sound), but the throttle lock operation will not be performed.

One is "Throttle Protection", after checking, when the test value reaches the protection value, the alarm is executed and the throttle is locked.

*When the throttle is below 20%, the software will lock directly. When the throttle is higher than 20%, the throttle will slow down to 20%, and then perform the locking operation.

(3) Test Info

Test Info part includes: Motor Type、 Propeller Type、 ESC Type、 Tester and other notes. User can input info according to the test requirement. Log will synchronous record the related info.

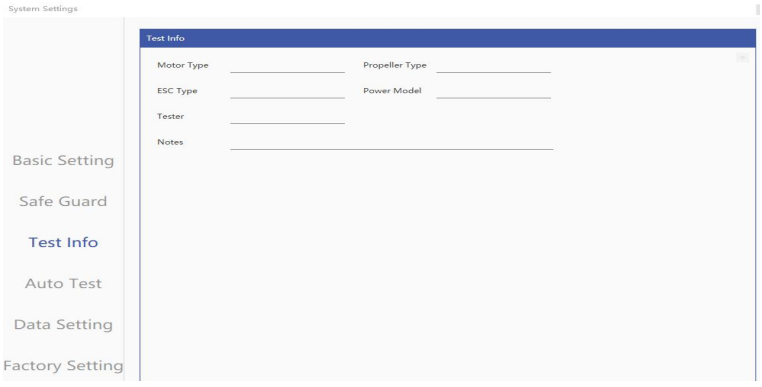

FIG 5-1-4 Test Info Interface

(4) Auto Test

Auto Test includes seven modes in total: Increase、 Cycle、 Custom、 Sine、 Linear、 Step and Frequency sweeping. Users can select the test mode according to the

requirements, after setting, save the parameters, click "Auto Test" after "Throttle unlock" in the control panel, and the software will automatically record the data.

① Increase Mode： Throttle value can be set from 0 to the max, and the increase mode is testing according to the set throttle point growth to process.

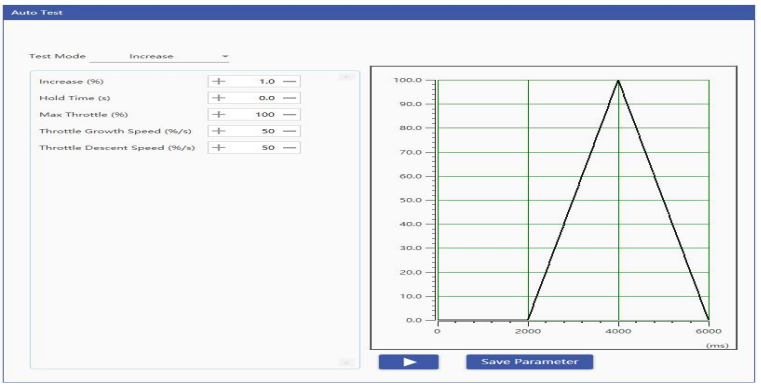

FIG 5-1-5 Auto Test-Increase Mode

“Increase（%）” indicates the throttle point interval for the increase test.

“Hold Time（s）” represents the output time for a single throttle point to maintain the current throttle value.

“Max Throttle（%）” refers to the max throttle value during the increase test.

“Throttle Growth Speed/ Descent Speed （ %/s ） ” stands for the throttle growth/descent speed in the process of switching throttle points. Set to 0, indicating that the switch between throttle points is a step state.

② Cycle Mode： The throttle increases first, then lowers, and can be tested in cycles.

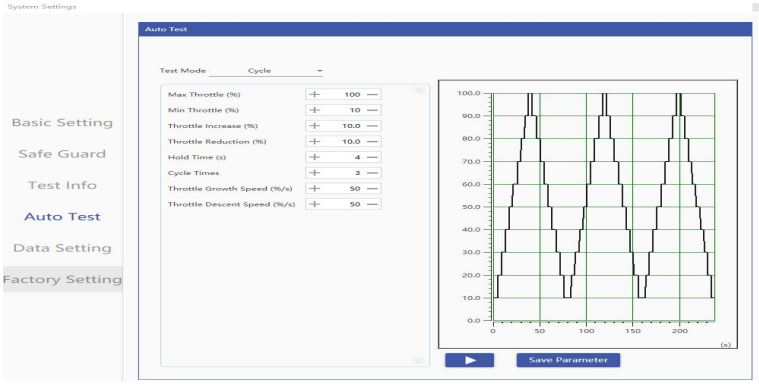

FIG 5-1-6 Auto Test-Cycle Mode

“Max Throttle（%）” refers to the max throttle during the cycle test.

"Min Throttle（%）"refers to the min throttle during the cycle test.

"Throttle Increase / Throttle Reduction （%/s）" indicates the interval at which the next throttle point increases/decreases from the current throttle point in the cycle test.

"Hold Time （s）" represents the output time for a single throttle value point to maintain the current throttle value.

"Cycle Times" refers to the times that the loop test program is executed.

"Throttle Growth Speed/ Descent Speed （%/s）" stands for the throttle growth/descent speed in the process of switching throttle points. Set to 0, indicating that the switch between throttle points is a step state.

③ Custom Mode： User can customize throttle position and hold time to generate custom test program.

FIG 5-1-7 Auto Test-Custom Mode

"Cycle Time" represents the times of the loop test program is executed.

* Click "Download Template"， User can download the editing template of the custom throttle, and edit the custom throttle in the EXCEL file. "Loading", you can load the edited throttle custom file to the software directly and save Parameter to start your test.

④ Sine Mode

The throttle sine function is:

$$\text{Throttle (\%)} = \frac{b-a}{2}\sin\left(\frac{2\pi}{T}t\right)+\frac{a+b}{2}$$

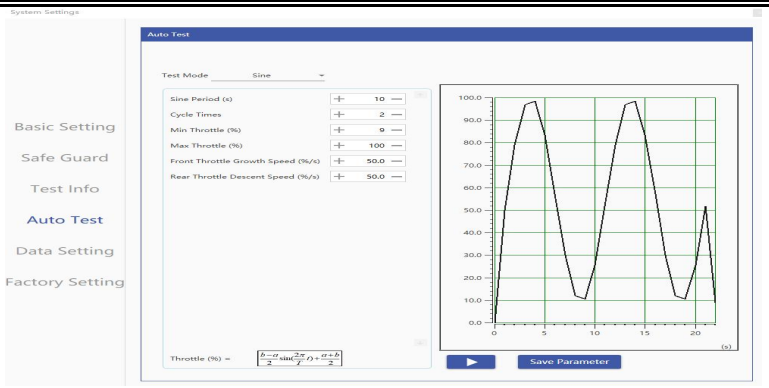

FIG 5-1-8 Auto Test-Sine

“Sinusoidal Period（s）”， T in the function represents the period of the sine function.

“Cycle Number”" indicates the number of cycles to perform the sine function test.

“Max Throttle（%）” refers to b, stands for the max throttle limit.

“Min Throttle（%）” refers to a, stands for the min throttle limit.

“Front Throttle Growth Speed（%/s）” refers to the throttle growth rate from 0% to the first test point. Set to 0, indicating a step switch between the throttle point from 0% to the first test point.

“Rear Throttle Descent Speed (%/s) ” indicates the throttle descent speed during the process from the last test point to 0%. Setting to 0 indicates a step change between the throttle position from the last test point to 0%.

⑤ Linear Mode： Test throttle linear growth/descent

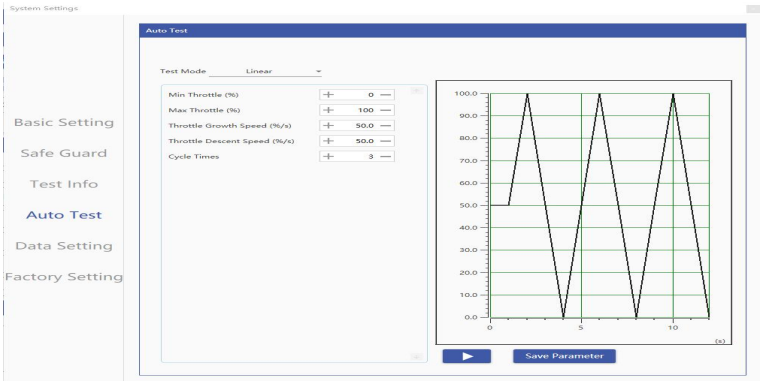

FIG 5-1-9 Auto Test-Linear Mode

“Max Throttle（%）” refers to the max throttle during the cycle test.

“Min Throttle（%）”refers to the min throttle during the cycle test.

“Throttle Growth Speed/ Descent Speed（%/s）” stands for the throttle

growth/descent speed in the process of switching throttle points.

"Cycle Times" refers to the times that the loop test program is executed.

⑥ Step Mode: Test the quick switching response of the throttle between different throttle points.

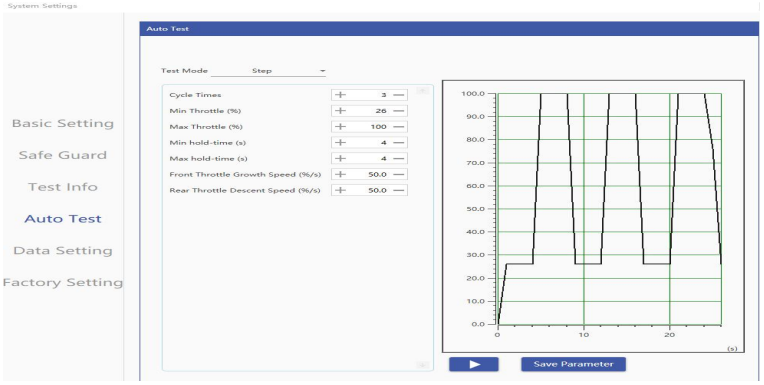

FIG 5-1-10 Auto Test-Step Mode

"Max Throttle (%)" refers to the max throttle during the cycle test.

"Min Throttle (%)" refers to the min throttle during the cycle test.

"Max Hold-time (s)" indicates the time that the throttle value is held at the upper throttle limit.

"Min Hold-time (s)" indicates the time that the throttle value is held at the lower throttle limit. "Front Throttle Growth Speed（%/s）" refers to the throttle growth rate from 0% to the first test point. Set to 0, indicating a step switch between the throttle point from 0% to the first test point.

"Rear Throttle Descent Speed (%/s) " indicates the throttle descent speed during the process from the last test point to 0%. Setting to 0 indicates a step change between the throttle position from the last test point to 0%.

⑦ Frequency Sweeping Mode:

The throttle sine sweep function is

$$\text{Throttle (\%)} = \frac{b-a}{2}\sin(\lambda t^2)+\frac{a+b}{2}$$

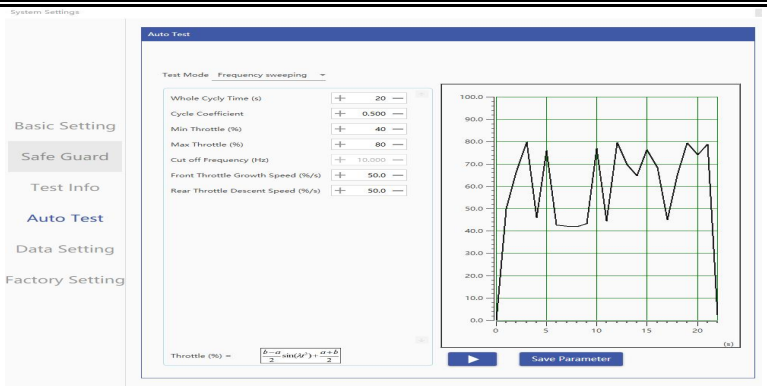

FIG 5-1-11 Auto Test-Frequency Sweeping Mode

“Full Cycle Time（s）” stands for Sine frequency sweeping test’s full cycle time.

"Periodic coefficient" is λ in the function.

“Max Throttle（%）” refers to b, stands for the max throttle limit.

“Min Throttle（%）” refers to a, stands for the min throttle limit.

"Cutoff frequency" is the result of calculation and cannot be entered. The value of cutoff frequency is equal to the full cycle time (s) multiplied by the period coefficient.

“Front Throttle Growth Speed（%/s）” refers to the throttle growth rate from 0% to the first test point. Set to 0, indicating a step switch between the throttle point from 0% to the first test point.

“Rear Throttle Descent Speed (%/s) ” indicates the throttle descent speed during the process from the last test point to 0%. Setting to 0 indicates a step change between the throttle position from the last test point to 0%.

(5) Data Setting

In the Data Setting, there are multiple types of data can be set. You can select Real-time or Log to display data in the real-time data window and save logs.

No.	Parameter	Explanation	Notes
1	Frame Time	Each frame corresponds to the Windows time, accurate to 1ms.	The parameters are initially set and displayed in the log.
2	Throttle	PWM corresponds to the throttle value %. It is linear relationship.	The parameters are initially set and displayed in the log.
3	IR Temp	Measure the temperature of the motor housing at the current time	The initial setting parameters and it is displayed in the real-time data window and in the saved log.

4	Commutation Speed	It is derived from the ESC exchange phase test.	The initial setting parameters and it is displayed in the real-time data window and in the saved log.
5	Optical Speed	The speed measured using the Optical RPM sensor.	The initial setting parameters and it is displayed in the real-time data window and in the saved log.
6	Electrical-P	The electric-P is the electric power ,which is the overall power consumed during the operation of the UAV power, including the power of the motor to drive the propeller to rotate and do work and the thermal energy consumption of the power system (the thermal effect of the current), which is derived from the voltage * current.	The initial setting parameters and it is displayed in the real-time data window and in the saved log.
7	Shaft-P	Shaft-P is the shaft power. It is the output power of the power system (motor and ESC), calculated by the RPM * torque.	The initial setting parameters and it is displayed in the real-time data window and in the saved log.
8	System Force EFF	It is the efficiency of the power system to produce static thrust, derived from thrust/electrical power, in g/W.	The initial setting parameters and it is displayed in the real-time data window and in the saved log.
9	Propeller Force EFF	Propeller force effect represents the efficiency of a rotor propeller in generating static thrust derived from thrust/shaft power, expressed in g/W.	The initial setting parameters and it is displayed in the real-time data and in the saved log.
10	Electric Drive EFF	The electric drive efficiency is the external work efficiency of the motor and the electric regulator as a whole, which is derived from the shaft power/total power.	The initial setting parameters and it is displayed in the real-time data window and in the saved log.
11	PC（Wh）	Power consumption (Wh) is the integration of electrical power over time.	The initial setting parameters and it is displayed in the real-time data window and in the saved log.
12	PC（Ah）	Power consumption (Ah) is the integration of the current value over time.	The initial setting parameters and it is displayed in the real-time data window and in the saved log.
13	Line Loss Power	Line loss Power consumption is the power loss on the bus line and is calculated as I^2*r, where I is the bus current and r is the line resistance.	In addition to the relevant parameter test requirements, users generally do not need to check.
14	Terminal Voltage	Terminal voltage is the voltage loss on the bus line, and the calculation formula is V+I*r. V is the test stand terminal voltage, I is the bus current, r is the line resistance.	In addition to the relevant parameter test requirements, users generally do not need to check.
15	Corrected	Electrical Power +Line Loss Power	In addition to the relevant

	Electrical-P		parameter test requirements, users generally do not need to check.
16	Power Coefficient	System coefficient is a characteristic parameter of propeller, which expresses the relationship between propeller power consumption and shaft power.	In addition to the relevant parameter test requirements, users generally do not need to check.
17	Thrust Coefficient	Thrust coefficient is a characteristic parameter of propeller, which expresses the relationship between propeller thrust and shaft power.	In addition to the relevant parameter test requirements, users generally do not need to check.
18	PWM read （μs）	The duty cycle of PWM is read in μs.	In addition to the relevant parameter test requirements, users generally do not need to check.
19	PWMread （Hz）	PWM frequency read in Hz	In addition to the relevant parameter test requirements, users generally do not need to check.
20	Flow	The AD3 channel is usually connected to a flow sensor to monitor the flow rate of cooling water and other flows.	In addition to the relevant parameter test requirements, users generally do not need to check.
21	Total Flow	Total value of the flow.	Users generally do not need to check.
22	Pressure Difference	Differential pressure sensor, usually used with pitot tube, unit is bar.	To customize the airspeed module user, select this parameter for the test.
23	Airspeed	True airspeed is calculated from differential pressure and pitot tube tests (calculated using true air density).	To customize the airspeed module user, select this parameter for the test.
24	Propeller Power	Propeller power is the output power corresponding to the thrust generated by the power system in the current state. Thrust * Airspeed (valid only in dynamic thrust test).	In addition to the relevant parameter test requirements, users generally do not need to check.
25	Propeller Efficiency	It is the efficiency of the system output corresponding to the motor output in the current state. System output/motor output (valid only in dynamic thrust test).	In addition to the relevant parameter test requirements, users generally do not need to check.
26	System Efficiency	It is the overall propulsive efficiency of the power system. It is obtained by total power/propulsion power (propulsion power = speed * thrust).	In addition to the relevant parameter test requirements, users generally do not need to check.
27	Advance Ratio	Characteristic parameters of propeller (valid only under dynamic thrust)	In addition to the relevant parameter test requirements, users generally do not need to check.
28	Ambient Temp	Ambient temperature in the current test	The default parameters are

		environment.	displayed in the Environment Parameters window.
29	Humidity	Ambient humidity in the current test environment.	The default parameters are displayed in the Environment Parameters window.
30	Barometric	Atmospheric pressure in the current test environment.	The default parameters are displayed in the Environment Parameters.
31	Air Density	Air density in the current test environment.	The default parameters are displayed in the Environment Parameters window.
32	Run Time	System parameter, it refers to the frame time of the lower computer.	The default parameters are displayed in the Environment Parameters window.
33	Delayed	System parameter, it refers to the communication time difference between the lower computer and the upper computer.	Select this parameter as your test required.
34	AD4-AD8	Reserved channel, can test various analog sensors (note that under the guidance of the manufacturer).	User can choose according to their requirements.

FIG 5-1-1 Data interpretation table

*General data parameters have been preset in the initial version, and users generally do not need to set them separately except for special parameters or customized parameters that need to be tested.

(6) Factory Setting

The parameters in factory Settings are set by the manufacturer. You need to enter a password to set the parameters. Users do not need to set the parameters separately.

2. Data Analysis

MET test software is equipped with a professional data analysis software,that is **DataAnalyzer,** which allows users to select test data through data analysis options and enter into the data analysis software. Users can view **chart view, data view, throttle point average and data curve analysis**. At the same time users can output throttle point average and test report.

*Data analysis please refer to Section 6--- Introduction on Software Data Analysis .

3. Language/Theme

Software can be set into two language mode: simplified Chinese and English and a

variety of colors can be configured according to users' requirement.

4. About

Regarding the relevant introduction of the development manufacturer and the official website, users can click on the website address to view the latest product information.

5. Version

Version is the software version type.

6. Connect Port

In the upper right corner of the software, you can view the software connection status. You can select the serial port to connect or disconnect the device.

(II) Controller

Controller includes TT CLR、PC CLR、ALL CLR、Record、Point Record、Point & New、Advanced Throttle、Unlock and Auto Test.

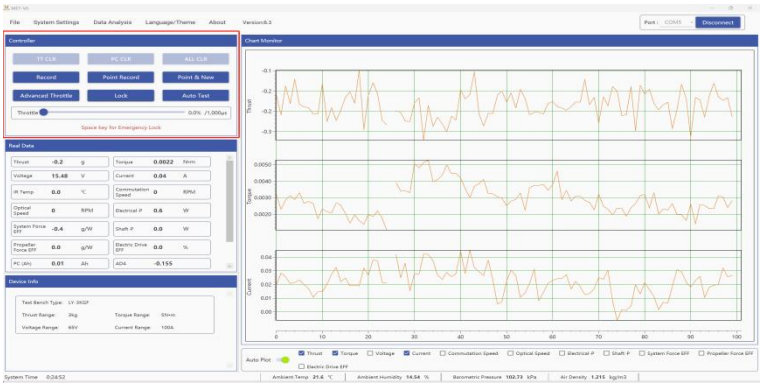

FIG 5-2-1 Controller Interface

1. TT CLR：click "TT CLR"，it can achieve Thrust and Torque data reset to 0.

*It is recommended to clear zero before each test to ensure the accuracy of data testing.

2. PC CLR：click "PC CLR"，it can achieve Power Consumption data reset to 0.

*This function can be used if you need to test the power consumption in a single instance.

3. ALL CLR： click "ALL CLR", it can achieve the data of the thrust、torque、current、power consumption reset to 0.

4. Record：click "Record"，it can achieve the real time data record, the testing data

will be stored into the **File** (File-METData-Log) , user can open the **File** to find the recorded data directly. After clicking "Record", "Record" will be displayed as "Stop record". Click again to stop the recording data.

*Manual test needs to record data, auto test will automatically record data, there is no need to click to **Record.**

5. Point：click “Point”， the software will record a piece of data at the current time (the average value of the data collected in 1 second) and save it in the Log. Click "Point" again, and the software will record the data again in the same Log saved by the previous data.

6. Point and New：click “Point & New”， the software will record a piece of data at the current time (the average value of the data collected in 1 second) and save it in the new Log.

7. Advanced Throttle： click “Advanced Throttle”， the dialog will pop up the advanced throttle window, which can realize the precise control of the throttle (the maximum adjustment accuracy of the throttle is 0.1%, 1μs).

8. Unlock：click “Unlock”， it can realize the function of unlocking the throttle and control the throttle. After clicking the “Lock”, this position is displayed as "Unlock", and clicking again can realize the throttle lock.

*Under the unlocked state, press the space bar to realize emergency lock.

9. Auto Test：After the throttle is unlocked, you can click "Auto Test" to execute the automatic test program, which includes seven test modes: Increase, Custom, Cycle, Sine, Linear, Step and Sine Sweeping. You can select and set the Auto test mode in (System Setting - Auto Test) .

(III) Real-time Data

After the throttle is unlocked, drag the throttle to realize real-time data changes in the real-time data window.

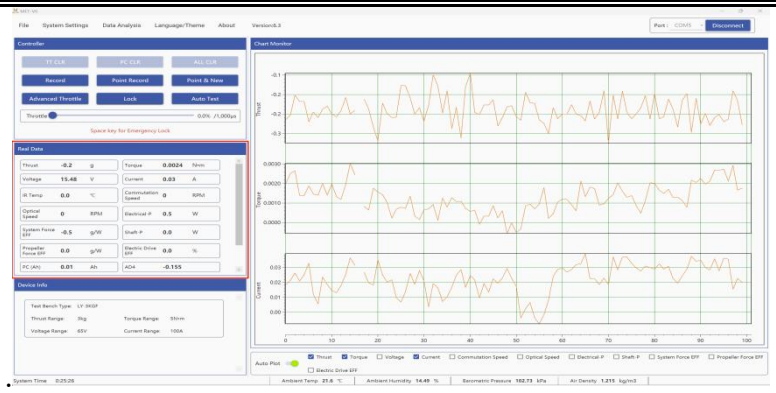

FIG 5-2-2 Real Time Data Interface

*At most 35 data channels can be displayed, of which 5 are standby ports. The system displays 14 data groups for initial Settings. The thrust, torque, voltage, and current are the preset data and cannot be changed.

(IV) Device Info

Device Info window shows the basic info such as Motor Type、Thrust Range、torque range、voltage range and current range.

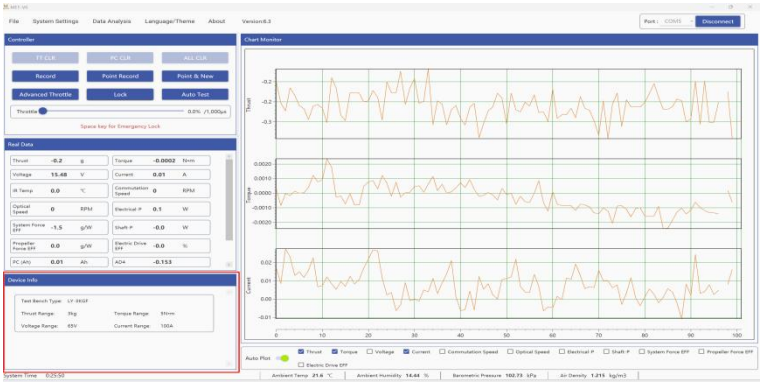

FIG 5-2-3 Device Info Interface

(V) Chart Monitor

In the Chart Monitor, after the throttle is unlocked, drag the throttle to display data curves such as thrust, torque, voltage, current, and speed in real time. Select the data box below as required to realize chart display (a maximum of four groups of data can be displayed).

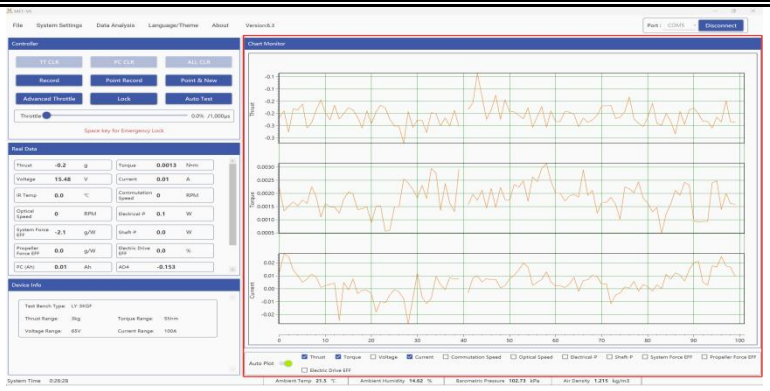

FIG 5-2-4 Chart Monitor Interface

The Chart Monitor has the function of data automatic adjustment, open the automatic adjustment, you can adjust the range of longitudinal coordinates in real time according to the change of real-time data, convenient for users to observe the real-time change of data. To turn off automatic adjustment, users can select the vertical coordinate of the real-time icon, hold down the Ctrl key, and adjust with the mouse.

*Before testing， turn on the Auto Plot, drag the throttle to the maximum throttle position to be tested. After the data is stable, the throttle is locked and the automatic adjustment function is turned off. The real-time chart longitudinal coordinate adaptation range can be quickly obtained.

(VI) Ambient Parameter Interface

The ambient parameters display window displays four environmental parameters, including ambient temperature, ambient humidity, barometric, and air density, as well as the operating time of the lower computer system.

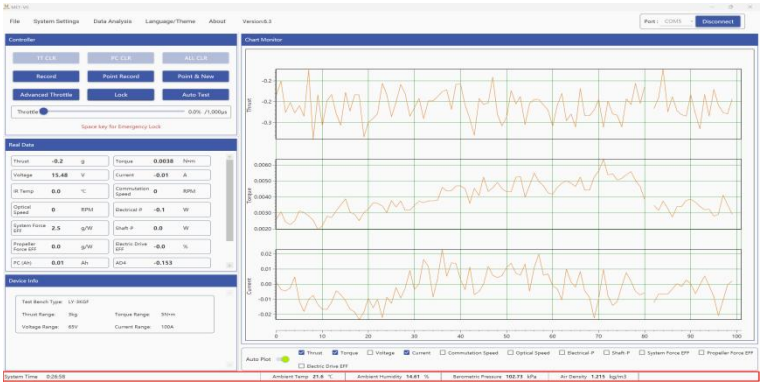

FIG 5-2-5 Ambient Parameter Interface

VI. Data Analysis

The MET test software is equipped with the professional data analysis software DataAnalyzer, and the data tested using the MET test software can be analyzed by the data analysis software. After the data test is completed, users can click the data analysis in the toolbar to view the data of the latest test or find the data they want to view through the search data function, click the data, you can directly enter into the data analysis.

FIG 6-1 Data Analysis Interface

（1）Toolbar （2）Header Window （3）Chart Window

(I) Toolbar

1.Open File

Click “Open File”， you can find the log, and choose the raw test data to process the data analysis.

2. Average Throttle Point Output

Click “Average Throttle Point Output”， users can output the average throttle point data of the current test data and store the.xlsx file, which can be compared with other data curves in the curve analysis software interface.

3. Curve Analysis

Click “Curve Analysis”， the user can draw the dynamic system characteristic curve of the currently loaded data.

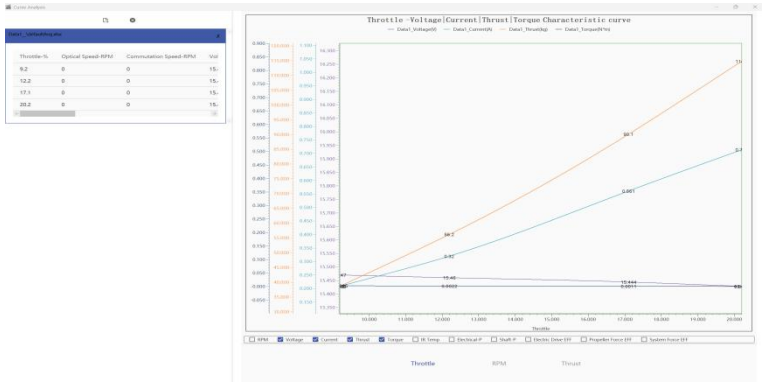

FIG 6-1-1 Characteristic Curve Interface

*The test data can generate the throttle average of different points, so that the dynamic characteristic curve can be drawn and analyzed.

*It can analyze the throttle, speed, thrust and per parameter characteristic curve.

4. Output Report

The report output has the option of setting the report output. The user can choose to set the company name, filter setting (delete the unstable data set in the time before the throttle position, and obtain the more stable data average under the throttle) and characteristic curve setting according to the requirements. After the setup is complete, the user can output the Report, and the output report is stored in (File /METData/Report).

(II) Header Window

You can select the header to display or hide. By checking the box below, the user can view the curve of the data, and at the bottom right of the chart, the user can choose the chart view, the data view, and the average throttle point value.

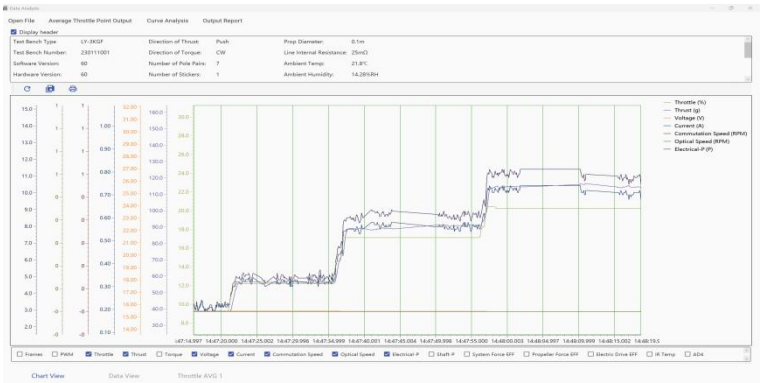

FIG 6-1-2 Chart View Interface

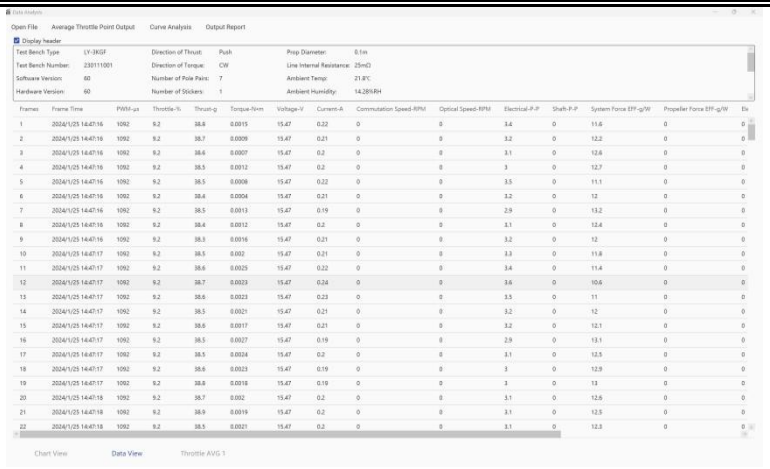

FIG 6-1-3 Data View Interface

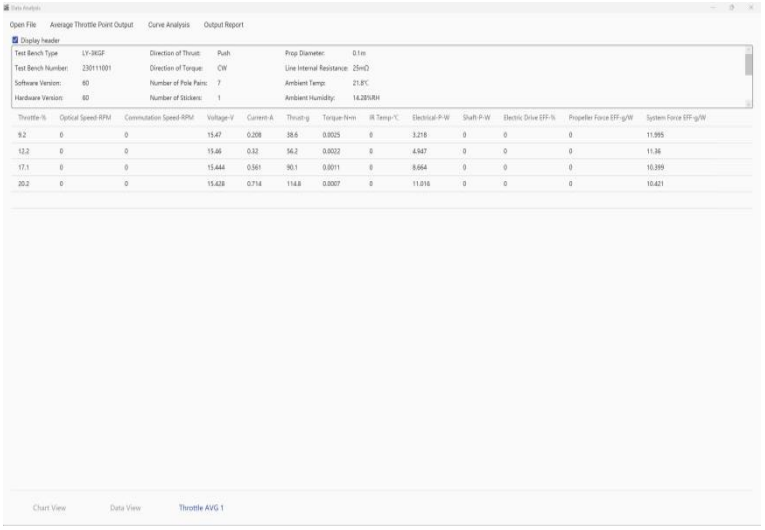

FIG 6-1-4 Average Throttle point View Interface

VII. Troubleshooting

Troubleshooting List				
No.	**Questions**	**Performance**	**Possible Cause**	**Solution**
1	Communication failure	The software cannot be connected.	1. The test stand is not power on.	Refers to the QSG to power on the test stand.
2			2. The test stand is not connected to the computer communication line.	Refers to the QSG to communication line connection.
3			5. Acquisition card is not working properly (acquisition card indicator does not show blue light).	Check the electrical condition of the test stand. If the test stand is powered on normally and the acquisition card indicator is off, contact the manufacturer.
4			4.No valid serial port is identified.	Install the serial port driver (Serial port driver is included in the USB flash drive file).
5			5.The communication module driver is not installed.	Install the driver of the wireless data transmission (in the USB flash drive file).
6			6.USB port damaged	Replace the USB port
7			7.Communication module damaged.	Contact the manufacturer.
8	Fail to control the motor	Alarm/No response	1. The power supply of the motor is not connected, and the voltage display value is 0.	Connect the power
9			2. The ESC signal cable is not connected to the throttle control port or the signal is reversely connected to the ground cable.	The ESC signal is connected to the throttle control interface, and the signal is correctly connected to the ground cable.
10			3.The line at the PWM Out interface of the acquisition card is not connected or the signal is not reversed with the ground cable or the signal is reversed with the ground cable.	The line at the PWM Out interface of the acquisition card is connected, and the signal is correctly connected to the ground wire.

11			4.ESC stroke is not calibrated	Refers to the QSG to calibrate the ESC.
12			5.Motor and ESC are not matched.	Few manufacturers' products ESC are not universal, please change the matching ESC (or contact the ESC factory).
13	Thrust /Torque Data abnormal.	Thrust/Torque indication significantly deviates.	1.The three-phase line connected to the motor is not in a relaxed state.	The three-phase line connected to the ESC and motor should remain loose and not tight.
14			2. Small size propeller is not testing the Push.	Small size propeller should choose the Push direction to test the thrust.（Blade under 13")
15			3. Thrust/Torque sensor damaged	1. Click "TT CLR" on the software 2. Remove the plug from the capture karat/torque port. 3. If the thrust/torque data on the software exceeds 5% of the range, as the result, the sensor is damaged, please contact the manufacturer.
16	Current /Voltage Data abnormal.	Current /Voltage indication significantly deviates.	1. The motor power supply plug or the ESC supply plug is in poor contact.	Make the motor or ESC power plug to be tightly connected.
17			2. The precision of the reference device is too low.	Use a multi-meter to measure. If the deviation is too large, contact the manufacturer.
18			3. Current /Voltage sensor damaged.	Use a multi-meter to measure. If the deviation is too large, contact the manufacturer.
19	Optical Speed abnormal	The Optical speed indicator ratio is proportional	1. Number of the sticker input is not same as the actual quantity.	The number of stickers in the software basic Settings is consistent with the actual

		to the actual speed.		number of stickers.
20			2.The Optical speed module is not calibrated according to the process and requirements.	Calibrate the Optical speed module according to the QSG.
21	Commutation Speed abnormal	The indication of commutation speed is 0.	1.Any two phases of ESC three-phase line are not connected to a signal converter interface, the RPM1.	Choose any two phases of ESC to connect to a signal converter, the RPM 1.
22		The ratio is proportional to the actual speed.	2.Number of Pole Pairs are set wrong.	Number of Pole Pairs should be set right.
23	Electric drive efficiency abnormal	The electric drive efficiency exceeds 100% or is too low.	1. RPM Data abnormal.	Refer to speed problem solution.
24			2. Torque Data abnormal.	Refer to thrust/torque problem solution.

FIG 7-1-1 Troubleshooting List

VII. Maintenance

UAV power system test stand is a high-precision test equipment, in the use of equipment, it is required to strictly abide by the terms of the user manual and precautions. Routine inspection should be carried out before testing. Regular inspection, maintenance, and regular calibration can reduce test risks and failures, effectively improve product reliability, and ensure test accuracy.

(I) Pre-test Inspection List

To ensure test safety and test data accuracy, you are advised to check the following items before testing.

Pre-test Inspection List				
No.	**Status**	**Inspection Items**	**Inspection Content**	**Yes or not**
1	Power on the test stand	Test environment	The test environment should be open and no incoming flow to ensure that the site is clean and free of easily blown debris.	
2		Fix the stand	Make sure that the test stand is firmly fixed with the ground (or the contact surface below), and push the main body of the test stand by hand if there is a shaking gap, it needs to be fixed again.	
3		Motor	Make sure the motor is securely mounted on the motor base.	
4			Ensure that the connection bolts between the motor mounting base and the motor base are tight. If the propeller is tested for a long time, it needs to be tightened with thread glue.	
5		Line	Ensure that the connection between the motor three-phase line and the ESC is kept soft. Dragging or hard connection will affect the test accuracy	
6	Connect the software	Software setting	Check and fill in the correct PWM value range to ensure that the minimum PWM value will not trigger the motor to start and prevent the power system from starting in a locked state and cause safety hazards.	
7			Check and input the Number of Pole Pairs	
8			Set the Number of Stickers	
9			In the Safe Guard, please set the items which required to protect or alarm.	
10	Power on the motor	Motor Steering	Check motor steering to make sure motor steering is correct.	
11		Propeller	When the power system is powered off, install the propeller to ensure that the propeller is firmly installed	

			without damage or invisible change.	
12			When the power system is off, rotate the propeller by hand to ensure that the propeller rotation will not interfere with any test bench or other components.	
13		Test Range	Please ensure that the test range is under the specification.	
14		Change the motor and propeller	Make sure that the software is locked and the powertrain is powered off. Then user can replace the the power system: motor, ESC and propeller or operate other items.	

FIG 8-1-1 Pre-test Inspection List

(II) Periodic inspection and maintenance

It is recommended that users carry out regular inspections and maintenance according to the following standards to maintain the best state of the test stand and reduce safety risks.

Periodic inspection and maintenance List						
No.	Inspection Items	Per Test	Each disassembly	100 tests /3 months	300 tests /1 year	Maintenance advice
1	Bolts of the motor mounting Seat	√	√	√	√	Self-inspection
2	Linear bearing lubrication	×	×	√	√	Return to factory/Self-inspection
3	Mounting bolt of the acquisition card	×	×	√	√	Self-inspection
4	Mounting bolt of current sensor	×	×	√	√	Self-inspection
5	Test bench structure mounting propeller	×	×	√	√	Self-inspection
6	Thrust sensor calibration	×	×	×	√	Return calibration
7	Torque sensor calibration	×	×	×	√	Return calibration
8	Current sensor calibration	×	×	×	√	Return calibration
9	Voltage sensor calibration	×	×	×	√	Return calibration

FIG 8-2-1 Periodic inspection and maintenance List

*The time or number of tests specified in the maintenance/inspection cycle is whichever comes first.

*The start time in the table is based on the first delivery time of the device.

*Bolt fastening check method: For the thread that needs to be screwed with thread glue, use a hex screwdriver to tighten the bolt in a positive direction. If the bolt can be easily screwed, remove the bolt, apply thread glue again and install it back to the original position.

For threads that do not require adding thread glue, tighten the bolt.

*Linear bearing lubrication: Clean with WD-40 cleaning agent and then inject mechanical lubricating oil.

*Do not use high viscosity or medium viscosity mechanical lubricating oil, otherwise it will increase the static friction force when measuring thrust and reduce the measurement accuracy.

If you have any questions about this manual, please contact us:
sandy@wing-flying.com.