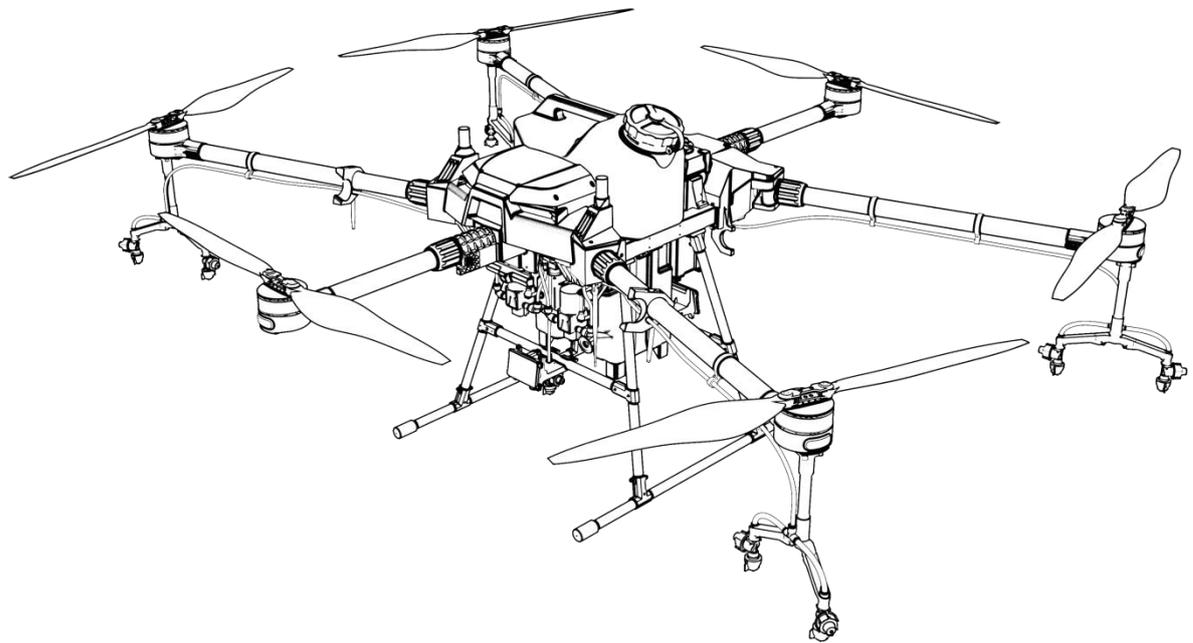


# TopXGun

## 3WWDZ-25.1

# Agriculture drone

### User Manual V1.0



TopXGun (Nanjing) Robotic Ltd.,Co

2020.11

### **Usage Recommendation**

TopXGun provides user with the following documents:

1. "Packing List"
2. "Quick Start Guide of Plant Protection UAV TG26"
3. "User Manual of Plant Protection UAV TG26"
4. "Usage Guidelines of Agriculture Assistant APP"

Users are advised to use the packing list for item verification. Refer to "Quick Start Guide for Plant Protection UAV TG26" to understand its operation. For detailed usage and functions, please refer to "User Manual of Plant Protection UAV TG26" and "Usage Guidelines of Agriculture Assistant APP".

**User Manual of Plant Protection**

**UAV 3WWDZ-25.1**



**Quick Start Guide for Plant**

**Protection UAV TG26**



**Usage Guidelines of Agriculture**

**Assistant APP**



**Agriculture Assistant APP**





## **Preface**

The plant protection UAV 3WWDZ-25.1 is a mature multi-rotor aircraft, leading the industry in terms of function, appearance, control, safety and other aspects. There are certain usage risks of multi-rotor drone due to the mechanism and structure. Please strictly follow the safety tips and user manual during the operation. Violation of regulations when using this drone may result in direct or indirect loss and damage.

## **Disclaimer**

Please read the manual carefully before using the aircraft. Once the drone is used, it is deemed to be an acknowledgement and acceptance of all the content of this user manual. This drone is suitable for people with 18 years of age and older. TopXGun is not responsible for the loss of personal or property due to the following problems:

1. The user does not assemble and use the drone as required by this manual.
2. The user operates the drone in poor physical or mental conditions such as drinking, drug abuse, fatigue, etc.
3. The user actively or intentionally operates the drone to create damage.
4. The user modifies the drone without using accessories from TopXGun, which is resulted in it could not work properly.
5. Injury caused by the user's misoperation or subjective misjudgment.
6. Damage caused by natural cause, such as aging of circuit and so on that affects the aircraft.
7. Damage caused by the user's operation of the drone while knowing that it is in an abnormal working condition.
8. The user still operates the drone under severe weather conditions such as typhoon, hail and fog.
9. The user operates the drone in the magnetic interference area, radio interference area and government no-fly area.
10. The user operates the drone in case of poor visibility and occlusion of the line of sight.
11. The user operates the drone to cause the infringements by obtaining any data, image data and other infringement behaviors.
12. Other losses that are not within the scope of the company's liability.

## **Safety operation instructions**

### **1. Pesticide Usage**

- Wear protective clothing to prevent direct body contact with the pesticide while operating.
- Avoid the use of powder pesticides as much as possible or else they may reduce the service life of the spraying system.
- Use clean water to prepare the pesticide to avoid blocking the strainer. Do not remove any filter and clear any blockages before using the equipment.
- After using the pesticide, please clean up the residual liquid in time. It is strictly forbidden to pollute the river and drinking water source, and ensure that it will not cause harm or impact on people, animals and the environment in the surroundings.
- The effect of the pesticide is closely related to the concentration of the pesticide, the spraying rate, the altitude of the drone from crops, the wind direction, the wind speed, etc. The above factors should be taken into account comprehensively when using the pesticide in order to achieve the best effect.
- Strictly follow the safety instructions of pesticide production company.
- Particular working fluids are prohibited.

### **2. Usage Environment**

- Always fly in an open space, away from the crowd.
- It is recommended to fly below 2000 meters.
- It should fly in the environment with the temperature between 0°C and 40°C.
- It is recommended to fly in an environment with the wind speed below level 4.
- It is strictly forbidden to fly in rain, fog, snow or other extreme weather.
- It is strictly forbidden to fly indoors.
- It must fly in a legal area. Before flying in the legal area, please consult your local flight management department to comply with local laws and regulations.

### **3. Pre-flight Inspection**

- Make sure that every device is fully charged.
- Make sure that all parts are in good condition. If there are some parts that are worn or damaged, please replace them before flight. Make sure that the landing gear and the tank are tightly mounted and all the screws are firmly tightened.
- Make sure that the propellers are not broken and firmly mounted, the propellers paddle and arm are fully extended, and the screws are tightened. Make sure the motors are clean and free of damage.
- Make sure the spraying system is free of blockage and works properly.
- Please calibrate the compass before flight.

### **4. Operation**

- Keep away from the rotating propellers and motors.
- When folding, be sure to pay attention to the crushing danger.
- Be sure to fly under the take-off weight of 58.90KG to avoid danger.
- Operators must be professionally trained and pass the assessment, and the untrained personnel must not fly the aircraft.
- Make sure that the propellers are removed before calibrating the drone and upgrading the firmware.
- When the drone and the remote controller are in frequency-connecting process, make sure that the propellers are removed and that human and animals are far away from the motor.
- A pilot should not operate this product in poor condition such as after drinking, fatigue, illness, etc.
- If the operating environment does not meet the working condition of the radar module, the drone will not avoid obstacles when it returns automatically. If the remote-control signal is normal, the flight speed and altitude can be controlled by the remote controller.
- When working, be sure to turn on the remote controller first, and then turn on the power supply. After landing, turn off the power supply first and then turn off the remote controller.
- Please maintain the control of the drone throughout the process, and do not rely entirely on the information provided by the hand-held ground station.
- Obstacle avoidance and terrain following functions will not be available in the specific flight mode or flight environment. Please observe the attitude of the drone at all times and judge the flight condition reasonably to avoid obstacles in time.

## **5. Flight Restrictions and Local Laws**

- Browse the official website of the Aviation Authority of your location for the latest list of restricted flight areas.
- The maximum control flight altitude is below 20 meters. Please consult the local flight management department before taking off, to comply with local laws and regulations.

**Special precautions:** Safety operating instruction notes includes but not limited to above items.

## **Intellectual property rights**

The intellectual property rights of this product and its manual belong to TopXGun Robotics Co., Ltd. Without written permission, any organization or individual may not copy, reproduce and distribute them in any form. If quotation is required, the source should be indicated and the manual should not be modified, deleted or quoted contrary to its original intention.

## **About this manual**

This manual is used as user's guidance. Photos, graphics, charts and

illustrations provided in the manual are only for explanatory and illustrative purposes, and may differ from the physical product. Please refer to the physical product.

Due to product upgrade or other reasons, the content of this document will be updated from time to time. Unless otherwise agreed, it is without further notice. Before using this product, please read this manual carefully.

Execution standard of this product: Q/TG 001-2018

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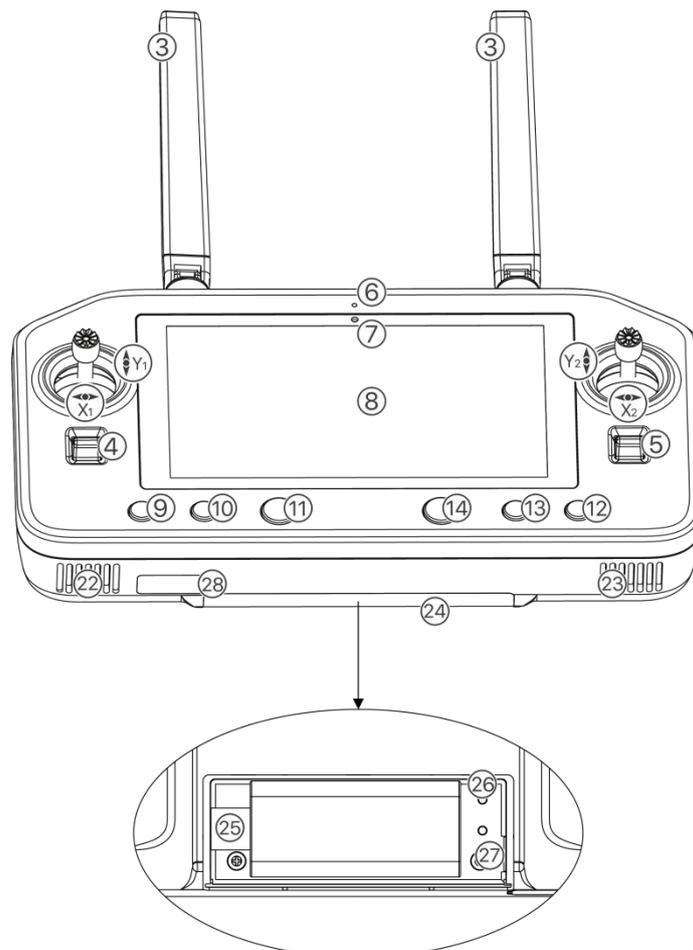
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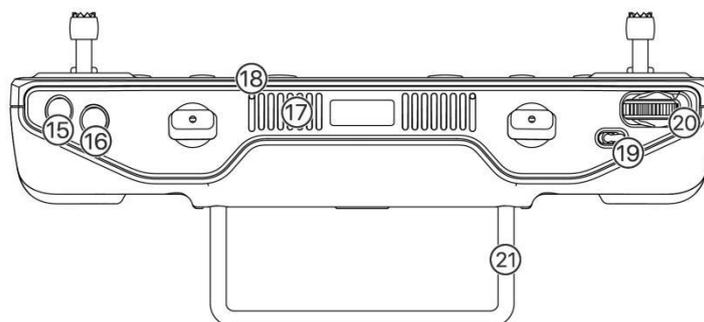
## 1. Product overview

The agricultural drone 3WWDZ-25.1 Agricultural plant protection UAV has undergone several iterations of upgrade, and now reaches the leading level in practicability, reliability and safety. The protection level of the whole machine is IP56, full body waterproof, dust-proof and anti-corrosion. Some key modules, such as spray system, radar system and power system, reach IP67 for easy cleaning and maintenance. GNSS+RTK positioning system can achieve centimeter-level high precision positioning, and also supports dual antenna anti-magnetic interference direction finding technology. Equipped with wide-angle FPV camera and high-definition digital image transmission system. Users can observe the work environment in front of them in real time.

### 1.1. Remote Control

#### 1.1.1. Component Definition



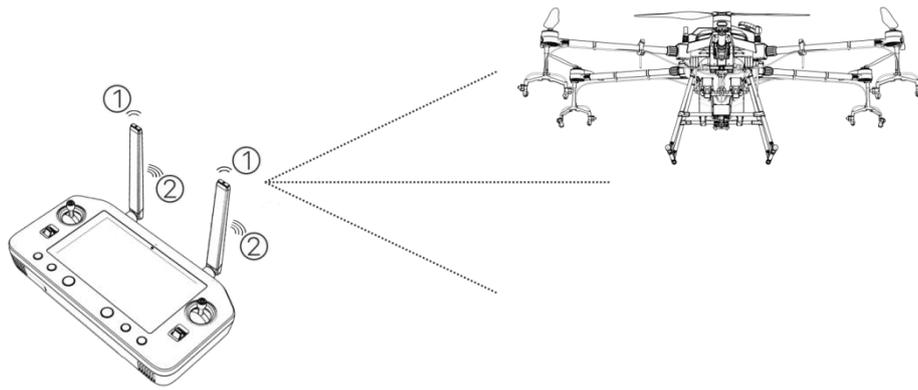


The main control buttons of the remote control (American hand)			
Serial number	Corresponding name	Corresponding function	Function Description
Y1	Throttle	Left stick -- up and down	The drone moves vertically (goes up and down)
X1	Yaw	Left stick -- left and right	Turn left and right. The drone rotates.
Y2	roll	Right joystick -- left and right	Fly left and right
X2	Pitch	Right joystick -- up and down	Fly forward and backward
3	Remote control antenna	Primary and auxiliary antenna	Transmit the control signal, telemetry signal, telegraphic signal
4	Fine-tuning button	Left and right fine adjustment buttons--up and down	auto-piloting mode, for adjusting the flight speed and altitude (not available in this version of the firmware)
5	Fine-tuning button	Left and right fine adjustment buttons--up and down	auto-piloting mode, for adjusting the flight speed and altitude (not available in this version of the firmware)
6	Status Indicator	Remote control status indication	Refer to the "Indicator Status" chapter
7	Light intensity sensor	Automatic photo-sensitivity	Automatically adjust the screen brightness according to the ambient light intensity
8	HD touch display		For interface display and touch selection
9	AB point button	Short press	Turn on/off AB point operation mode when the drone is flying.
10	Landing Light button	Short press	Turn on/off the landing light
11	Power button	Long press for 3 seconds to turn on/off	Long press to turn the remote control on/off. When the remote control is on, a short press can be used to turn the screen on/off .
12	Radar button	Short press	Switch radar on/off

13	Pump button	Short press	Switch pump radar on/off
14	RTH (return-to-home) button	Long press for 2 seconds, the drone will return home	Long press the RTH button to activate the smart return mode.
15	Button A	Short press	Click to record A point
16	Button B	Short press	Click to record B point
17	Air outlet		Do not cover the air outlet of the remote control when using.
18	Microphone		Record audio (currently not available).
19	Switch mode button	Toggle the switch	Switch between GPS mode and operation mode.
20	Wheel	Toggle	Spin the wheel to adjust the corresponding signal output, which is only supported in industry applications. The function is not defined when the RC works with F10.
21	Remote control handle		Convenient for users to hold and carry.
22	Speaker		Output audio
23	Air inlet		Do not cover the air inlet of the remote control when using.
24	Wireless network card slot		For install an external wireless network card
25	Wireless network card port		For connect to wireless network card
26	MicroSD card slot		MicroSD card can be inserted
27	Rocker storage hole		The remote control rocker storage hole
28	Charger interface		Remote control charging interface, or connect to PC to update the firmware of the remote control

### 1.1.2. Antenna placement

The antenna of the RC adopts a foldable design, and the signal strength varies with the positions of the antenna. It is recommended to keep the antenna vertical to the ground when you control the drone. In this case, the signal is the strongest. The position or distance between the RC and the drone is adjusted in time to ensure that the drone is always in the optimal communication range. Therefore, the antenna of the RC should not point to the drone during the flight. The recommended operation is shown in Figure 1-1-3.



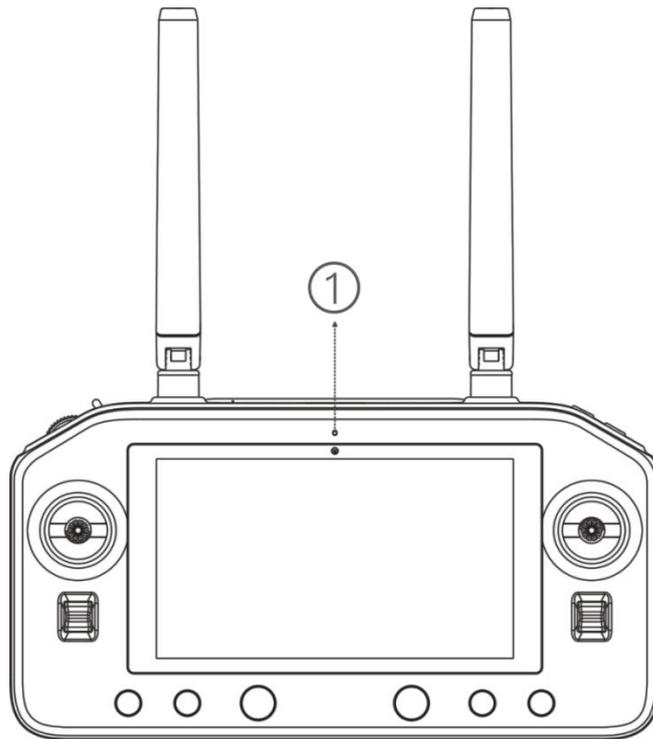
1. Weak signal    2. Strong signal    3. Weak signal    4. Strong signal

Figure 1-1-3 Signal strength of the remote controller

**Notes:**

1. Do not fold the antenna during the flight to avoid obstruction between the remote controller and the drone, otherwise the quality of signal will be seriously reduced.

**1.1.3. Indicator Status**



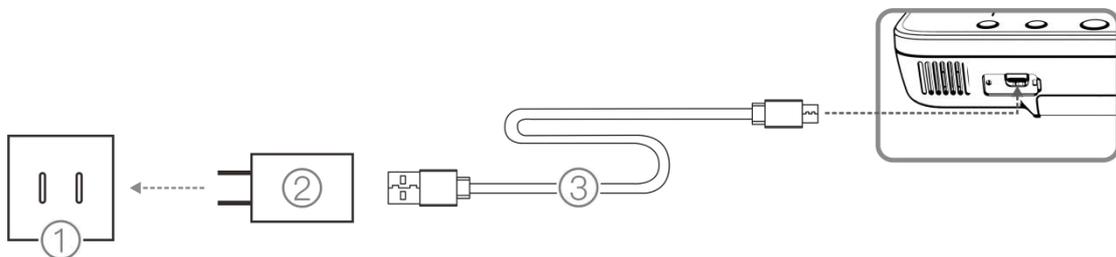
1. Indicator status

The RC status indicator shows the status of the RC. Details are shown in the table below:

Indicator status	Remote control status	On/off status
Solid Red	RC is not connected to the aircraft	ON

Solid Green	RC is connected to the drone properly	ON
Light Green Flash	RC is pairing	ON
Green Flash	RC temperature is too high	ON
Red Flash	RC is in low battery	ON
Blue Flash	The control stick is not in the middle position	ON
Solid Red	Charging and the battery level is less than 10%	OFF
Solid Yellow	Charging and the battery level is between 10% and 90%	OFF
Solid Green	Charging and the battery level is over 90%	OFF

#### 1.1.4. 充电示意



1. AC power supply 100-240V 2. USB charger 3. USB-C cable

#### Attention please:

1. Please use the Type-C interface to charge the remote control.
2. Fully charged for about 3.5 hours with the designated quick charger.
3. Please use the official charger when charging the remote control. If not, it is recommended to use an FCC/CE-compliant, 5V 2A charger or a 9V 2A fast charger that complies with the QC2.0 protocol.
4. To ensure the best condition of the battery of the remote control, please make sure to fully charge the remote control every 3 months.
5. If the remote control is found to have peculiar smell, smoke or liquid leakage, etc., stop charging and send the remote control back for testing and identification in time.
6. Do not charge the remote controller when the ambient temperature exceeds 60°C.
7. Keep away from areas that babies and toddlers can touch while charging. It is recommended not to leave it unattended.

### 1.1.5. Frequency-matching Instruction

When the complete set of drone is purchased, the remote control transmitter and the drone have been frequency-matched before dispatching, and can be used directly after power-on. In other cases, use the following methods to match the frequency:

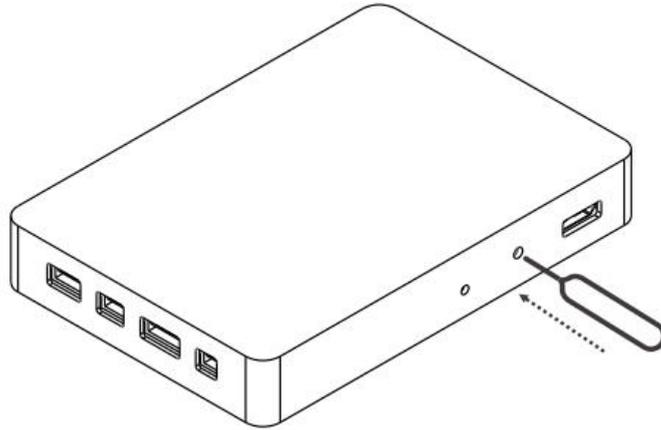
1. Turn on the remote control parameter adjustment assistant, as shown below



2. Click the "Start Frequency Matching" button, the indicator light of the remote control will be light green flashing. APP shows a pop-up of "frequency matching" and there is a 30s time limit to turn on the remote control. The receiver turns from green flashing to solid green, and the remote control quickly beeps for 4 times to show frequency matching is successful.



3. Use a sharp tool (e.g. a pen, etc.) to press the receiver's Frequency Matching button for 3s and release it to complete the frequency matching. After successful matching, the remote control indicator will be solid green. If the frequency matching button is not pressed within 30 seconds, "Frequency Matching failed" will be displayed.



**Notes:**

1. Keep the distance between the remote control and the receiver within 1 m when you are matching frequency.
2. Ensure the propeller of the drone is removed during the frequency matching, and keep livestock and human away from drone motors.

**1.1.6. Specification Parameters**

Remote control number chain	
Frequency range	2.4000GHz - 2.4830GHz
Signal effective distance (outdoor, no obstruction, no interference)	Maximum communication distance 10km 3km image transmission (plant protection scenario)
Image Latency	less than 70ms
Interference recovery	<1s
Antenna type	Omnidirectional antenna (2.5dBi)
Wi-Fi	
Protocol	IEEE 802.11a/n/ac, Wi-Fi compliant
Operating frequency	4.900 GHz ~ 5.845 GHz (5.0 GHz ISM Band)
Bluetooth	
Protocol standard	Bluetooth 4.2
Working frequency range	2.400-2.4835GHz

FPV Camera	
Pixel	4 million
View angle	102 ° horizontally, 57 ° vertically
Video resolution	1080p
FPV auxiliary light	15lux @5m direct light
Display	
Screen size	5.5 inch
Touching mode	Capacitive
Screen color	16 million colors
Screen resolution	1920x1080
Screen Brightness	1000cd/m <sup>2</sup>
Other parameters	
Operating System	Android OS
Operating Temperature	-15°C to 40°C
Storage Temperature	-25°C to 60°C
Charging Temperature	5°C to 40°C
Battery Type	12000mAh @3.7V lithium battery
Rated power	About 6W
Charging time	About 3.5 hours (using official fast charger)
Continuous working hours	More than 6 hours
FPV camera	DC 12V, less than 0.5A
Receiver	DC 5V 1A
Weight	About 750g

## 1.2. Charger Introduction

TC2604 charger is a two-channel lithium-polymer battery charger with a maximum charging current of 50A. It supports two modes, which are charging and maintenance..

### 1.2.1. Instruction

The definition of the charger component is shown in Figure 1-2-1.

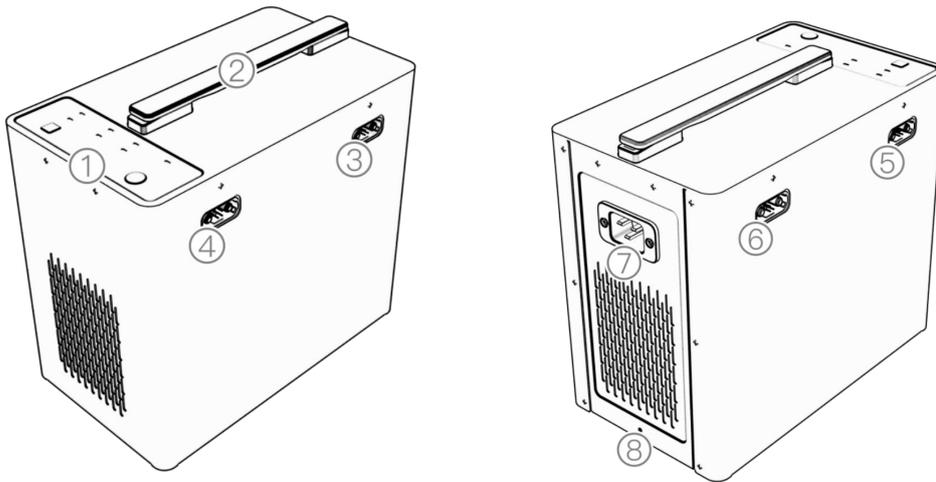


Figure 1-2-1 Charger Component

1. Operation interface 2. Handle 3. Battery charging port 4. Battery charging port 5. Battery charging port 6. Battery charging port 7. AC input port 8. Ground terminal

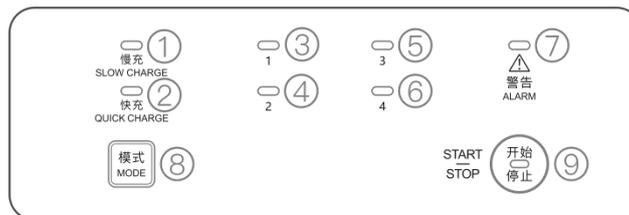


Figure 1-2-2 The Operation Panel

1. Slow Charge indicator 2. fast Charge indicator 3. Charge indicator 1 4. Charge indicator 2 5. Charge indicator 3 6. Charging indicator 4 7. Operating indicator 8. Charging mode button 9. Power on/off button

## 1.2.2. Function Description

### 1.2.2.1. Status indicator LED Descriptions

Start and self-check: First check whether all the terminals are correctly connected, then

press “start/stop”button on the operational panel. The battery charge LED, Quick/Slow charge LED will be turn into green, and the charger status LED will flashes red, green and blue alternatively. The product complete normal start and self-check along with the end of one beep.

### 1) Charging logic

Charging Mode	Battery capacity>12000mAH	Battery capacity<=12000mAH
Fast charge	The charger will charge one battery at a time, according to the remaining capacity from high to low.	The charger will sort the batteries according to the remaining capacity from high to low, and can charge two batteries with higher power at the same time.
Slow charge	The charger automatically divides the batteries into two groups, and each group will be sorted according to the remaining capacity. The charger will charge the batteries with low remaining capacity first, when the battery has the same remaining capacity as the ones in another group, then two groups will be charged simultaneously until the end of charging.	

### 2) Description of the battery charging status indicator (the quick or slow charging indicator LED will remain on according to the selected mode)

LED flash rules	warning	Description
off	/	No battery access to the corresponding

		numbered socket
Yellow Light Solid On	/	The battery accessed to the corresponding numbered socket, wait for charging
Green Light Breathing	/	The corresponding numbered socket is in slow charge mode.
Green Light Fast Flash	/	The corresponding numbered socket is in quick charge mode.
Green Light Solid On	/	The corresponding numbered socket is fully charged.
Yellow Light Continuous Single Flash	/	Battery temperature is too low, the charging current is limited.
Yellow Light Continuous Double Flash	/	Battery temperature is too low, charging is prohibited.
Yellow Light Continuous Triple Flash	/	Battery temperature is too high, charging is prohibited.
Yellow Light Continuous Flash for 4 times	/	Large difference between output voltage and battery voltage.
Red single flash	D.D.D...	Batteries not plugged in/unofficial

		batteries/communication abnormalities
Red double flash	D.D.D...	Batteries with different voltages are mixed
Red triple flash	D.D.D...	Faulty setting on BMS side of battery

### 3) Charger state indicator

LED flash rules	Warning	Instruction
Solid yellow	D-	Self-checking
Solid green	/	Self-Check Success
Yellow single flash	/	Charger temperature is too high, power drop work
Yellow double flash	/	Input voltage under-voltage alarm
Yellow triple flash	/	Input voltage high voltage alarm
Red signal flash	DD.DD.DD...	temperature is too high, fan is abnormal (total fault)
Red double flash	DD.DD.DD...	Charger input voltage abnormal (less voltage)
Red triple flash	DD.DD.DD...	Charger input voltage abnormal (over voltage)
Red solid on	DD.DD.DD...	Broken, abnormal

### 4) Fast/slow charge indicator instruction

Fast charge	slow charge	Battery state	warning	state
-------------	-------------	---------------	---------	-------

indicator	indicator	indicator		
Green solid on	/	Green light flash quickly	/	Fast charge state
/	Green solid on	Green breathing	/	Slow charge state

### 5) 开始/停止指示灯说明

LED flash rules	Warning	Instruction
Red solid on	D-	Self-checking
Red flash	/	The charger is in working status, the AC Voltage Level is 110V
Red breathing	/	The charger is in working status, the AC Voltage Level is 220V

### 1.2.3. Charge steps

Step 1: Connect the power cord to the charger's power port, and connect the other connector to the AC power supply ( 100-240V , 50/60Hz )

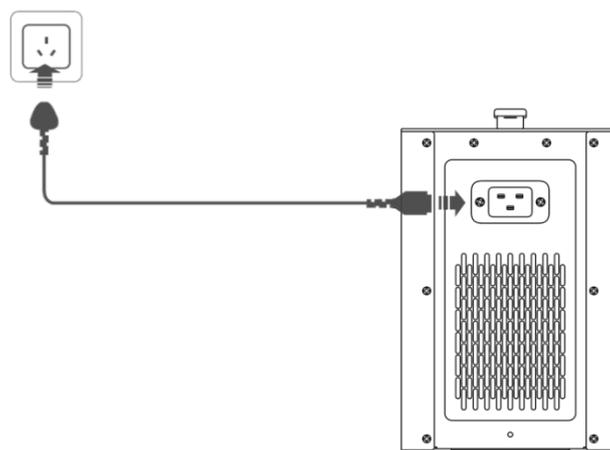


Figure 1-2-3 charger power cable connect

Step 2: Connect the battery: Please connect the charger wiring to the battery charging port according to the connection mode shown in the figure below. See Figure 1-2-4.

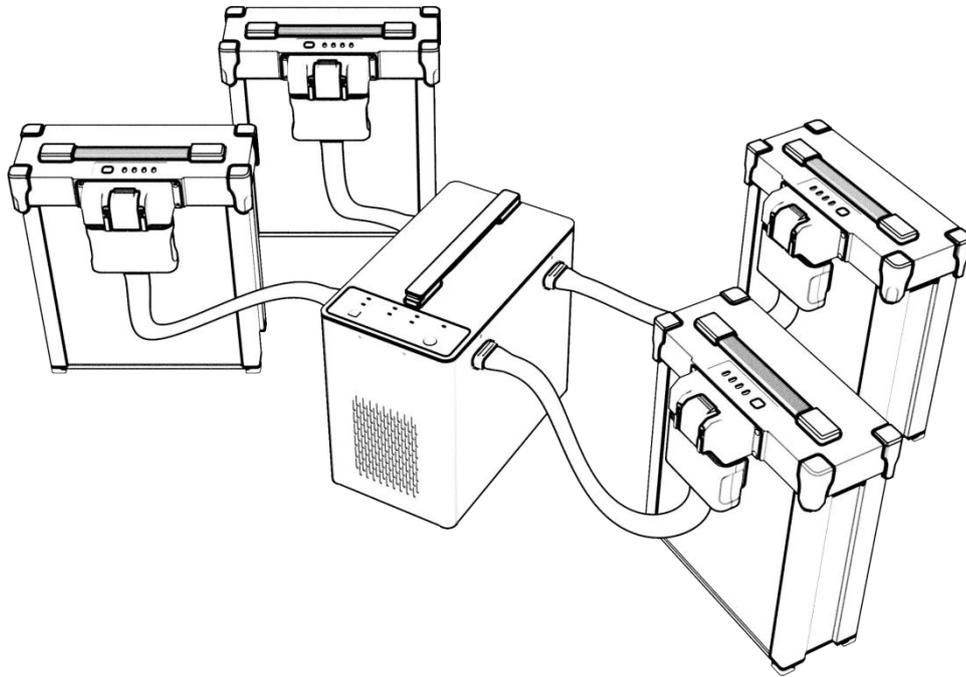


Figure 1-2-4 battery connect

Step 3. After making sure that all wires are connected correctly, press the "Start/stop" button in the operation panel, and the charger will start self-check. The indicator light in the corresponding channel of battery insertion is always on yellow light, and the alarm indicator is off when the self-test is normal. If the self-test is abnormal, please refer to the description section of the indicator state.

Step 4. Selection of working mode: After the charger self-test is completed, the charger defaults to fast charging mode. You can select fast charging mode or slow charging mode by pressing the button.

Step 5. Press the "Start/Stop" button in the operation panel to shut down the battery after charging, unplug the AC power cord, and unplug the battery.

Charge mode	Battery state	Channel indicator state	Plug or unplug battery instruction
Fast charge	Full battery	Channel light green always on	Unplug battery directly
	Battery wait charging	Channel yellow green always on	Unplug battery directly
	During charging	Green flash	If plugging and unplugging is needed, please press the start and stop button before plugging and unplugging. direct plugging and unplugging are prohibited if not press stop button

Slow charge	Full battery	Channel light green always on	Unplug battery directly , After plugging and unplugging, the charger will reorder the battery
	Battery wait charging	Channel yellow green always on	Unplug battery directly , After plugging and unplugging, the charger will reorder the battery
	During charging	Green flash	If plugging and unplugging is needed, please press the start and stop button before plugging and unplugging. direct plugging and unplugging are prohibited if not press stop button

**Notes:**

1. Make sure the charger is grounded before use.
2. Do not use the product in the environment of direct sunlight, humidity, high temperature, dust, vibration and lightning
3. Products should be kept away from dangerous substances such as high pressure, heat source, corrosive agent, flammable gas, etc., and must be used at appropriate ambient temperature (5-45 °C is recommended).
4. Products should be placed in a stable horizontal position, and good ventilation and heat dissipation conditions should be ensured when working.
5. When charging this product, please strictly follow the battery safety instructions and cautions.
6. Before connection, please ensure that all ports and input lines of modules and batteries are free from obvious defects such as clog, damage, breakage and short circuit.
7. Before use, please ensure that the power supply line has enough capacity to avoid overheating or even fire caused by insufficient capacity, especially when two or more equipment are used at the same time.
8. Do not pull out the input wire during the product operation, and pull out the battery in time after charging.
9. Make sure to connect the battery before starting to charge.
10. The design of this charger is only applicable to the supporting battery of the aircraft. If the user USES the charger for purposes other than those listed in the manual, the Company shall not assume any responsibility.
11. Do not use the charger unattended. If there is any abnormal function, please stop charging immediately.
12. In case of fire, do not use liquid extinguishing media to avoid electric shock. Use dry powder extinguishing media correctly.

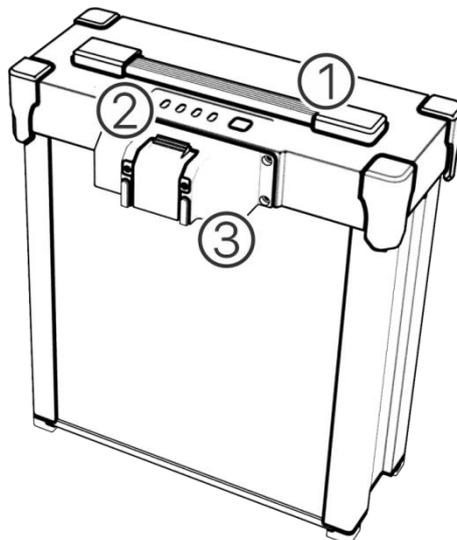
### 1.2.1. Specification Parameters

Subject	Parameter
Input	100V-240V-11A 50/60Hz
Output Power	2600W
Charging Current	Max: 50A, adjustable
Operating Temperature	5°C~45°C
Operating Humidity	0%~75%
Storage Temperature	-10°C ~ 70°C
Storage Humidity	0%~75%
Voltage detection	Support
Protection function	Over-current protection Over-temperature protection Over-voltage protection Short circuit protection Reverse connection protection
Weight	5.65kg
Size	295*275*320mm

### 1.3. Smart Battery Introduction

TB1424battery is a polymer lithium power battery, which has the characteristics of small size, light weight and large capacity.

#### 1.3.1. Component Definition



1. Charging port 2. Output port 3. Indicator

Figure 1-3-1 Battery Component

### 1.3.2. Specification Parameters

Subject	Parameter
Typical capacity	24000mAh
Nominal voltage	51.8V
Standard charging current	24A (Environment Temperature 25±5°C)
Maximum charging current	12A, ambient temperature, 0~10°C
	24A, ambient temperature, 10~20°C
	72A, ambient temperature, 20~45°C
Limited charge voltage	58.8V
Maximum discharge current	24A, ambient temperature, -10~0°C
	120A, ambient temperature, -0~10°C
	180A, ambient temperature, 10~60°C
Operating Temperature	0~45°C (Charge)
	-10~60°C (Discharge)
Storage temperature	-20~25°C (One Year)
Weight	8.9Kg

### 1.3.3. LED indicator Status

#### 1.3.3.1. Battery Status Display

When the battery is in standby mode, short press the power button once to display the current battery level, and it will turn off after 3 seconds, as shown in the following figure:

LED1	LED2	LED3	LED4	Sound notification	Battery level
ON	ON	ON	ON	/	88%-100%

ON	ON	ON	Flash	/	75%~87%
ON	ON	ON	OFF	/	63%~74%
ON	ON	Flash	OFF	/	50%~62%
ON	ON	OFF	OFF	/	38%~49%
ON	Flash	OFF	OFF	/	25%~37%
ON	OFF	OFF	OFF	/	13%~24%
Flash	OFF	OFF	OFF	/	0%~12%

### 1.3.3.2. Battery level

When the battery is in sleep status, long press the power display button for more than 5 seconds until the power indicator flashing, and the power LED indicator will show the battery life status. After 5 seconds all LED will turn off. When the battery life is less than 80%, the usage is prohibited.

LED1	LED2	LED3	LED4	Sound notification	Battery life
ON	ON	ON	ON	/	100%
ON	ON	ON	Flash	/	95%~99%
ON	ON	ON	OFF	/	90%~94%
ON	ON	Flash	OFF	/	85%~89%
ON	ON	OFF	OFF	/	80%~84%
ON	Flash	OFF	OFF	/	75%~79%
ON	OFF	OFF	OFF	/	70%~74%
Flash	OFF	OFF	OFF	/	< 70%

### 1.3.3.3. Charging Status

The battery displays the charging status while charging: in the off state, press the power display button once, and then long press LED1 ~ LED4 to turn on the battery charging status display function.

LED1	LED2	LED3	LED4	Sound notification	Battery life
Flash	Flash	OFF	OFF	/	0%~49%
Flash	Flash	Flash	OFF	/	50%~74%
Flash	Flash	Flash	Flash	/	75%~99%
ON	ON	ON	ON	/	100%

### 1.3.3.4. Exceptions and other indications

When charging status is abnormal, the battery LED light will display which battery protection function is triggered .

LED1	LED2	LED3	LED4	Display Patterns	Status info
OFF	Flash	OFF	OFF	LED2 two times/sec	Excessive charging current
OFF	OFF	Flash	OFF	LED3 two times/sec	Excessive battery voltage
OFF	OFF	Flash	OFF	LED3 two times/sec	Charger not matching
OFF	OFF	OFF	Flash	LED4 two times/sec	Low charging Temperature
OFF	OFF	OFF	Flash	LED4 three times/sec	High charging Temperature
Flash	OFF	OFF	Flash	LED1, LED4 flashing	Battery cell excessive pressure difference
OFF	Flash	Flash	OFF	LED2, LED3 flashing	Battery upgrade failed
Flash	Flash	Flash	Flash	LED1, 2, 3, 4 flashing	Upgrading / Log Exporting

#### Notes:

1. Before using, ensure sufficient battery level. When the battery has not been used for

a long time, please use the dedicated charger to discharge the battery to the storage voltage, and then store it in a dry and ventilated environment.

2. This battery needs to be charged with a dedicated charger (TC2604). In order to avoid accidents, please do not change the charger in any condition.
3. The battery should be handled gently to avoid collision with hard objects.
4. Do not use batteries if they emit odors or heat, or they are in an abnormal shape/color or has any other problems.
5. If the battery is in use or charging, it should be immediately removed from the drone or charger. Stop using this kind of battery.
6. It is necessary to ensure the battery surface temperature does not exceed 35°C before use, and after normal flight, the battery surface temperature should not exceed 55°C.
7. Please replace the battery plug when it is loose when connected to the aircraft, or the inner side is oxidized and blackened.
8. It is a normal phenomenon that the flight time will be shortened when the ambient temperature is lower than 10 °C.
9. The battery surface should be cleaned in time after the operation, in order to avoid agrochemical corrosion.
10. The drone is strictly forbidden to be used in the environment of strong static electricity, magnetic field or high voltage power line.
11. It is strictly prohibited to pierce the battery casing with nails or other sharp objects, or to hammer or step on the battery.
12. If the electrolyte enters the eye after the battery leaks, flush with water instead of rubbing the eyes. Seek medical help immediately. Eyes will be injured if not treated in time.

## **1.4. Drone Introduction**

### **1.4.1. Functional Features**

3WWDZ-25.1 Agricultural plant protection drone has the following features:

1. Made of professional carbon fibers with lighter weight and higher strength. Foldable arms are designed for easy transport.
2. Swappable tank and battery made mode changing easier, and also improve the efficiency.
3. With high-precision GNSS navigation system and precise IMU sensor, the drone has accurate positioning function to ensure safety and reliability.
4. Dual water pumps are equipped and each has an independent control spray system. Flow meter is provided to ensure the high precision of spraying and good atomization effect.
5. The Agriculture Assistant APP supports smart route planning, so that the drone can operate autonomously. It helps to make the pilot's work easier.
6. No waste gas is emitted so the drone is environmental friendly and meets the government requirements for energy conservation, environmental protection and the

development of a “green agriculture”, which is easy to maintain, and inexpensive to use and maintain.”

### 1.4.2. Drone Components

Drone components are shown in the figure 1-4-1 Main view

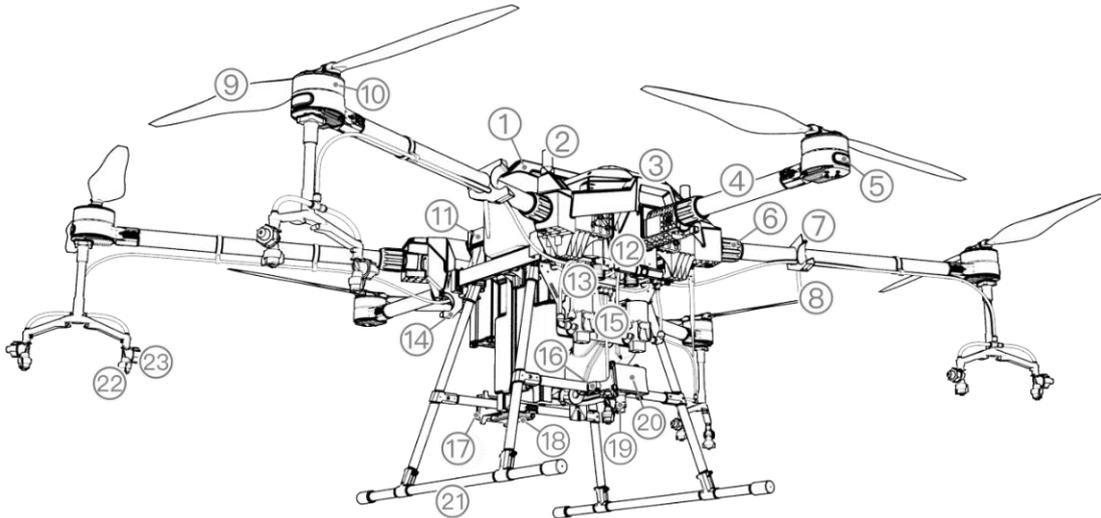


Figure 1-4-1 Main view

Tank 2. RTK Antenna 3. Head Direction 4. Arm 5. Status Indicator 6. Arm Sleeves  
Clamping Unit 8. Tank 9. Propeller 10. Motor 11. Battery 12. FPV camera  
13. Flow meter 14. Clamping Unit 15. Pump 16. Independent magnetic compass  
17. Front Obstacle avoidance radar 18. Terrain following radar 19. Landing Light 20.  
Rear Obstacle avoidance radar 21. Landing gear 22. Nozzles 23. Pressure relief valve

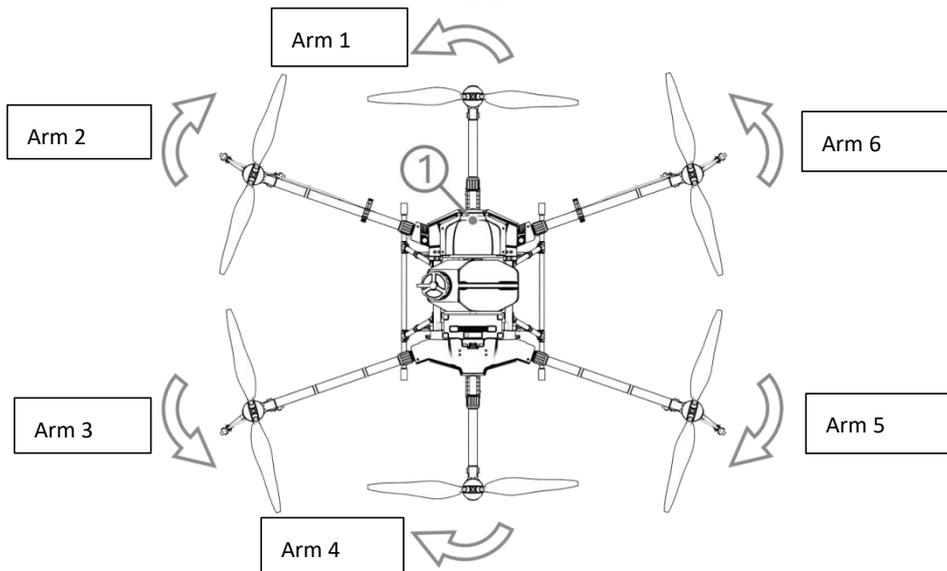


Figure 1-4-2

1. Head Direction

#### Notes:

The propellers on arm 1, arm 3 and arm 6 rotate counterclockwise, while arm 2, arm 4 and arm 5 rotate clockwise. See Figure 1-4-2.

### 1.4.3. Preparation for Flight

#### 1.4.3.1. Unfold Arms

Step1: Take the TG26 plant protection drone out of the box.

Step2: Remove the protection sponge around the propellers and arms.

Step3: Unfold the arm to 180° from the folded state (See Figure 1-4-3) to the unfolded state (See Figure 1-4-4).

Step4: Tighten the arm sleeves as shown in Figure 1-4-4.

Step5: Unfold the propeller to 180°, as shown figure1-4-5.

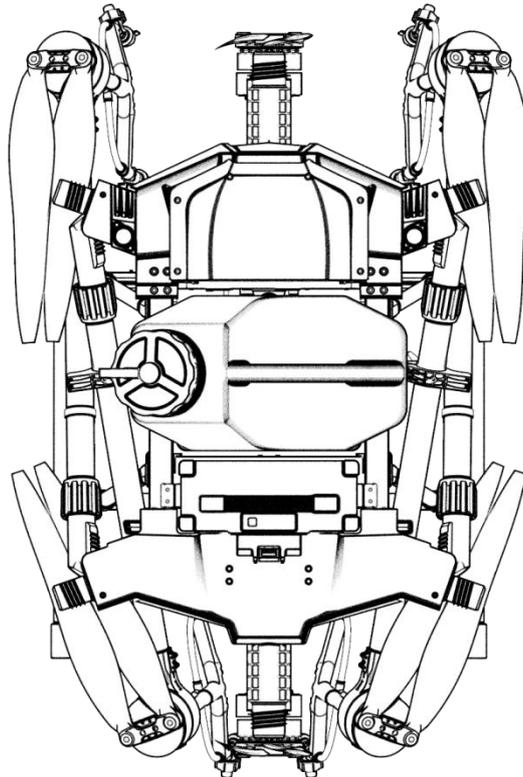


Figure 1-4-3 Arm Folded State

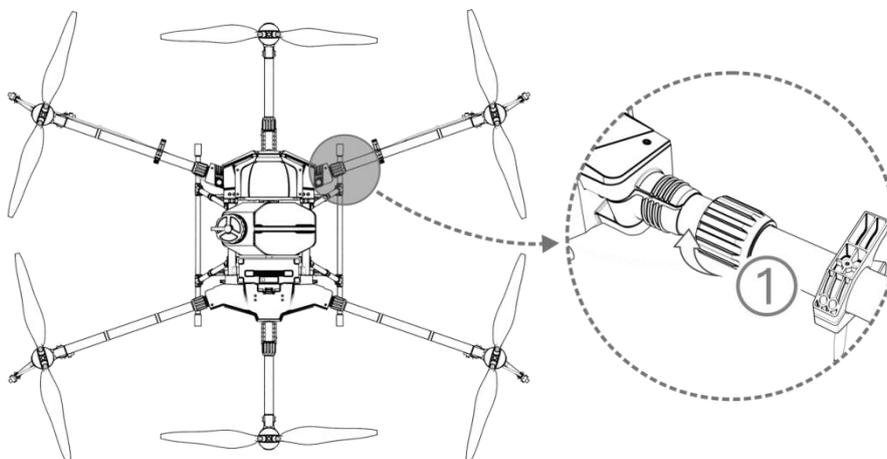


Figure 1-4-4 Arm Unfolded State

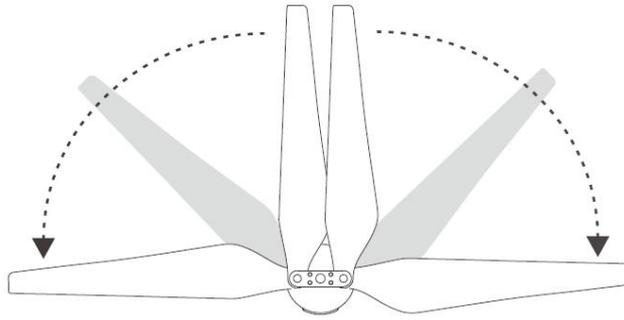


Figure 1-4-5 unfold the propeller

#### 1.4.4. Install Battery

Ensure to use the official battery and check the battery level is enough for flight.

Step 1: Place the battery vertically down in the battery rail on the rear side of the drone body.

Step 2: Connect the battery output port to the body, and the battery is locked in when you hear a “click”. As shown in Figure 1-4-6.

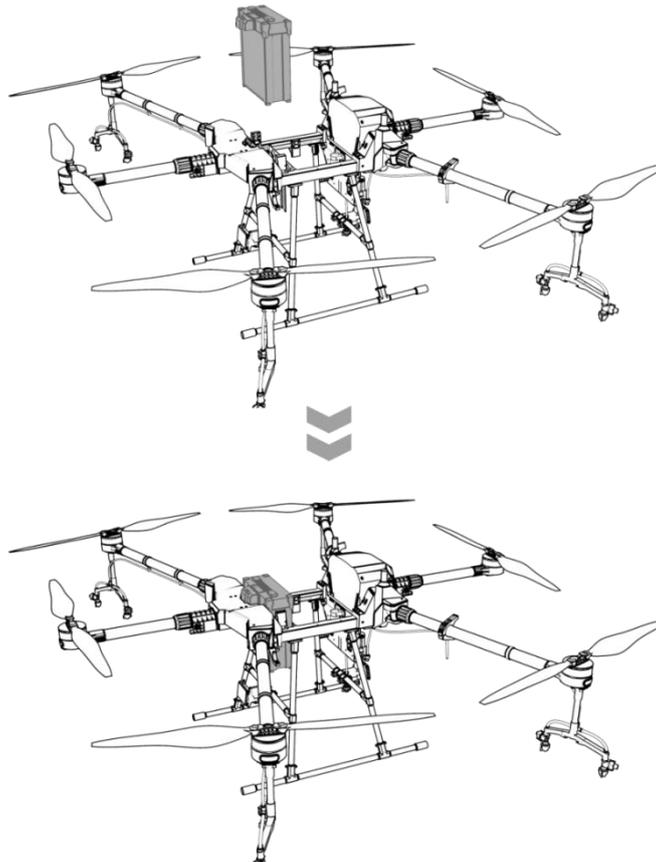


Figure 1-4-6

## 1.4.5. Equipment Calibration

### 1.4.5.1. Compass Calibration

Method 1: Access the calibration function in the APP installed on the remote control:

Step1: Pull down the throttle.

Step2: Quickly toggle down "Flight Mode Switch" to the down position ("S") and toggle it up to the up position("G") for about 6-10 cycles until the status indicator light flashes blue.

Step3: Place the drone head forward and keep the drone level with the ground. Slowly rotate clockwise for at least one circle until the status indicator flashes green.

Step4: Turn the drone head down with the body vertical to the ground. Slowly rotate the drone clockwise for at least one circle until the status indicator shows solid green for four seconds.

Step5: Calibration fails if the status indicator shows solid red for 4 seconds. Repeat step 2-4 until the operation succeeds. See Figure 1-4-7.

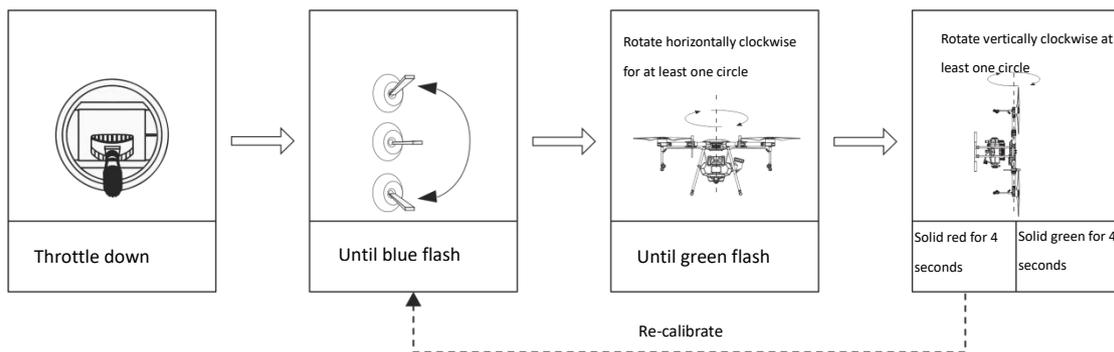


Figure 1-4-7 Compass calibrate

Method 2: Enter the calibration function via APP:

Step1: Click  on the right top in the APP to enter the Setting interface, and the click

 into Flight Setting;

Step2: Click  , and the drone navigation light flashes blue.

Step3: Repeat the Step 3-5 in Method 1.

#### Notes:

1. Before calibration, the propellers on the drone should be removed.
2. Do not calibrate it in areas with strong magnetic fields, such as magnetic mines, parking lots, building area with underground steel reinforcement, etc. During the calibration, do not carry ferromagnetic materials, such as keys, mobile phones, etc.
3. Do not calibrate the compass indoors.

### 1.4.5.2. Flow Meter Calibration

Flow calibration must be performed when the drone is used for spraying for the first time, otherwise the operation effect will be affected.

Preparing before calibration :Press “” button to start the pesticide pump when the drone is on the ground to discharge the air in the pipeline.

Step1: Add about 5000ml of liquid into the tank.

Step2: Plan a regular-shaped field of no less than 0.34 hectares with the length no less than 100 meters, and select "No remaining " at the "Liquid Level Switch".

Step3: Upload the flight route, and start the operation until the liquid runs out and breakpoint is recorded.

Step4: After the drone returns, the APP will pop up the dialog box of “Sprayed Volume ”.

Step5: Enter “5000ml” in the “Spray Volume ” dialog box.

Step6: The calibration is completed.

#### Notes:

1. Re-calibrate after replacing with different nozzles.
2. Re-calibrate after replacing with different consistency agrochemical.
3. Re-calibrate if the error between actual operation area and theoretical operation area is more than 10%.

## 2. Flight

### 2.1. Flight Instructions

According to the regulations of the International Civil Aviation Organization (ICAO) and national air traffic control on airspace control and the regulation of drones, drones must fly in the prescribed airspace. For flight safety, flight restriction function (including altitude and distance restrictions and no-fly area) is enabled by default to help users to use the product safely and legally .

When GPS is available, the no-fly area affects the flight together with altitude and distance restriction. The drone flyable airspace is the intersection of restricted airspace. Without GPS, the drone flight height is not limited by Plant Protection Assistant APP.

### 2.2. Altitude and Distance Restriction

Height limit is used to limit the flight height of an drone and maximum radius is used to limit the flight distance of an aircraft. The maximum flying altitude when the drone is dispatched is 20 meters. See Figure 2-1-1.

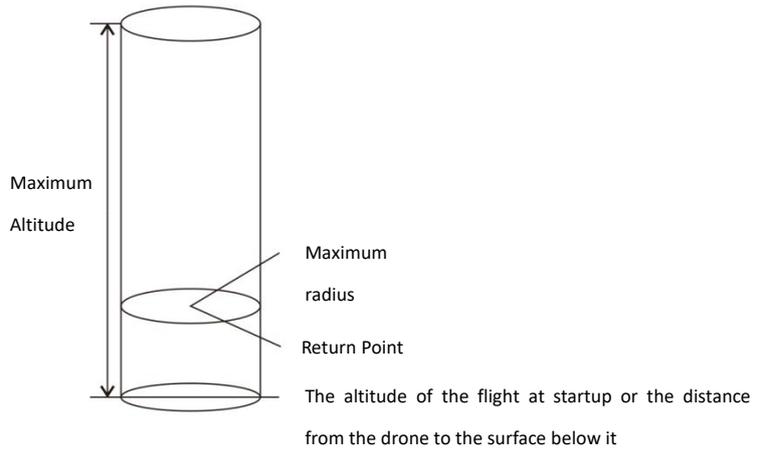


Figure 2-1-1 Altitude and distance restriction

GNSS State	Flight mode	Flight limit		Notification
<b>With GNSS</b>	GPS mode and autonomous mode	Max altitude	20m	Warning
		Max radius	9999m	Warning
	Attitude mode	Max altitude	20m	Automatically switch to GPS mode with warning
		Max radius	9999m	Automatically switch to GPS mode with warning
<b>Without GNSS</b>	Attitude mode	Max height	No limit	No warning
		Max radius	No limit	No warning

### 2.2.1. Fly Free Area and Restricted Area

The area includes airports restricted flight areas and special flight restricted areas. For more details, please refer to special flight restricted areas defined by the local authorities.

Restricted area (when GNSS is valid): The 'no-fly' area is defined by a circle with a special location as the centre point and R as radius. The drone is not allowed to fly within no-fly zone. For the R value, please refer to the specific rules for the restricted area as shown in Figure 2-1-2.

no-fly zone

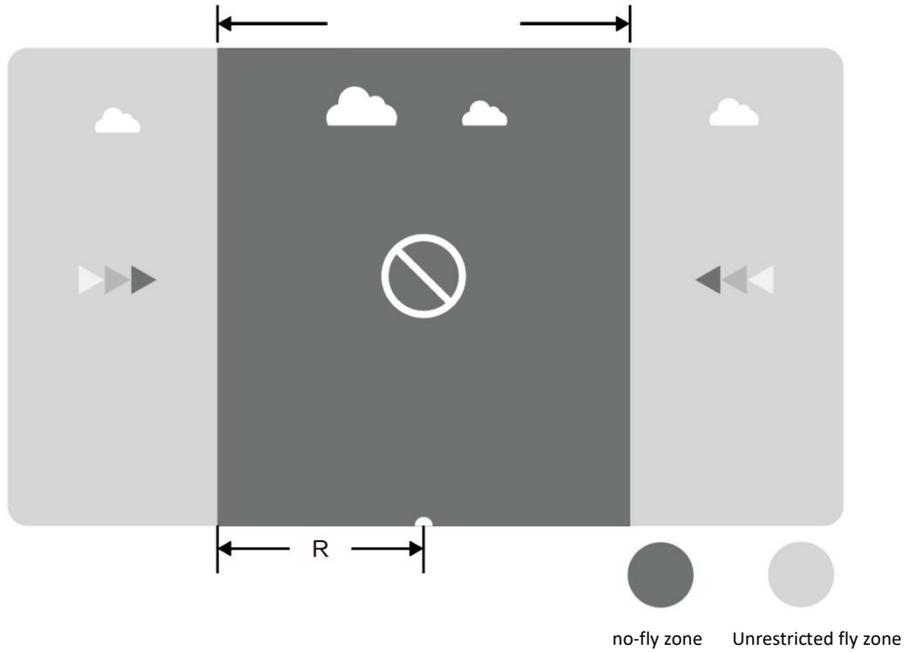


Figure 2-1-2 No-fly area and restricted area

GNSS signal is normal		
Area	Special area with flight restriction	Status indicator light for the drone
no-fly zone	The motor can not be started.	Solid Red
	If the drone flies without GNSS, it will land automatically immediately after GNSS is available, and stops the motor automatically after landing.	
Unrestricted fly zone	The drone can fly normally without flight restrictions.	No warning

**Notes:**

In order to ensure flight safety, please try to avoid airports, highways, railway stations, subway stations, urban areas and other areas for flight and try to fly within the visual range.

**2.3. Indicator Description**

For the first flight test, it is recommended to understand the meaning of the flight status indicator to ensure the flight safety.

No.	State	Content	Indicator Display
1	Normal	Power-on, Self-test is Pass, GPS Satellite is Search for service	Quickly flashes blue for twice
2		Preparation is completed; waiting for take-off	Solid blue

3		Taking-off and flying	Head direction, solid red; Opposite head direction, solid green.
4		Mode switch	Flash green for 5 seconds
5		Magnetic compass calibration (Horizontal)	The indicator flashes blue twice per second.
6		Magnetic compass calibration (Vertical)	The indicator flashes blue twice per second.
7		Magnetic compass calibration succeed	Solid green for 4 seconds
8	Abnormal	Magnetic compass calibration failed	Solid red for 4 seconds
9		Self-Test Failed	Solid red
10		Low Voltage/Volume Level I	Flash red slowly
11		Low Voltage/Volume Level II	Solid red
12		IMU failure	Solid red
13		Barometer failure	Solid red
14		GPS failure	Solid red
15		Independent magnetic compass failure	Solid red
16		Motor failure	Solid red
17		RC lose control	Solid red

## 2.4. Operation Description

### 2.4.1. Pre-flight Inspection

1. Please check the following to avoid the flight accident.
  - 1) Place the drone in the open operation area with the user facing the tail.
  - 2) Make sure that the battery of the drone is installed properly and tied up with battery straps.
  - 3) During the flight, it is necessary to turn on the remote controller before plugging in the battery of the drone.
  - 4) Ensure the battery of the drone and the remote controller are adequately charged, also the agrochemical required for spraying is sufficient.
  - 5) Make sure that the motors and propellers rotated in the correct direction and the structure is stable, all arms and propellers of the drone have been fully unfolded, and the arm sleeves have been tightened.
  - 6) Make sure that the spraying pipes are free of blockage and leakage, and the nozzles can spray water normally. If there is no liquid out during ground testing,

please turn on the pressure relief valve on the side of the nozzles manually. After discharging the air bubbles, turn off the pressure relief valve, and the nozzles can be used for operation.

## 2.4.1. Lock and Unlock

### 2.4.1.1. Unlock

Unlocking operation is shown in Figure 2-3-1 below. When you unlock the drone, the motors rotate in the sequence of No. 1 , No. 2 , No. 3 and then No. 4. When motor No. 1 starts, push the throttle slightly up and all the motors start at the same time.

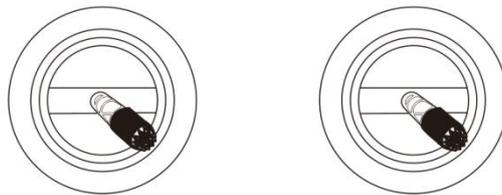


Figure 2-3-1 Unlock

### 2.4.1.2. Lock

The drone supports two active locking methods:

- Perform the operation shown in Figure 2-3 2 to lock.
- After the drone lands, the throttle stick should be kept at the down position for at least 3 seconds, and then the drone will be locked automatically.

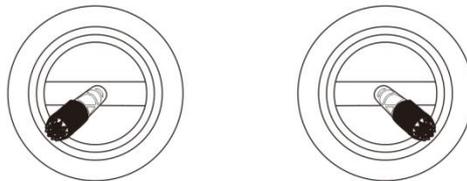


Figure 2-3-2 Lock

## 2.4.2. Take off and land

### 2.4.2.1. Take off

Step1: Click on “” and then long press “” for 2 seconds to turn on the remote controller.

Step2: Turn on power supply of the drone.

Step3: The pilot should keep a distance with the aircraft of more than 10 meters. Enter the operation interface of the Plant Protection Assistant APP to ensure that the signal of GNSS is good, and the status indicator light of the drone is not showing red which

means there's no warning.

Step4: Perform the unlock action, the drone motors will start one by one, then slowly push up the throttle stick to takes off.

Step5: The drone remains at its current altitude and hovers after the throttle lever is centered, as shown in Figure 2-3-3.

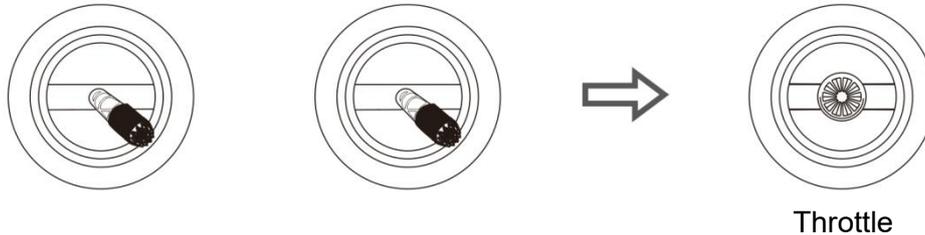


Figure2-3-3 unlock and hover

#### 2.4.2.2. Land

Step1: Slowly pull down the throttle stick, and the drone lands on the ground.

Step2: After the drone lands, place the throttle stick to the down position, and then perform the locking action as shown in Figure 2-3-4.

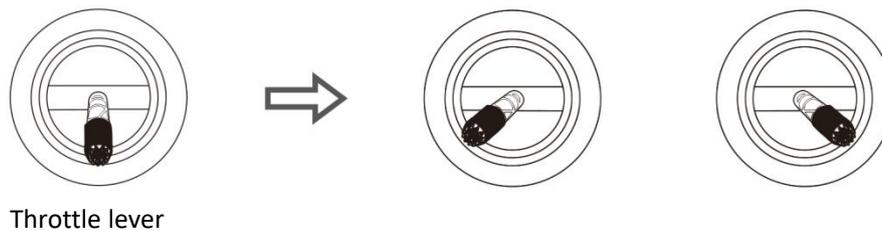


Figure 2-3-4Land and lock

#### Notes:

1. For the first test flight, the flight altitude shall not exceed 4 meters.
2. Do not fly beyond visual range for the first test flight.
3. If there is light flashing showing alert or there is a warning on the interface of the Plant Protection Assistant APP during the flight, please land immediately and check the drone according to the plant protection assistant warning information.

#### 2.4.3. GPS Operating Mode

##### 2.4.3.1. Mode Introduction

GPS operation mode have the features of being easy-to-use and quick-to-start, which is suitable for the operation in small, irregular and complex filed. In GPS mode, the maximum flying speed of the drone is 8m/sec. The spraying speed of the liquid is related to the flying speed. The faster the drone flies, the greater the flow rate is. When the drone hovers, the flow is shut down automatically.

### 2.4.3.2. Operating Procedure

Step1: Before taking off, click “” button to start the testing spray, to check if there is air in the pipeline.

Step2: The drone takes off and flies to the field for operation.

Step3: Press the spray button “”, and fly the drone to the field and start the operation.

#### Notes:

1. During the operation, make sure that the drone is in the visual range.

## 2.4.4. AB Point Mode

### 2.4.4.1. Mode Introduction

AB point operation mode is suitable for use in the regular area. It has fewer operation steps. In the AB point operation mode, the drone can operate automatically after point A and B are recorded. The spray will turn off automatically when the drone changes lines. The flight route for AB point operation mode is shown in Figure 2-3-5. In the figure, the dotted line length is the line spacing, which can be set in Plant Protection Assistant APP according to the working conditions.

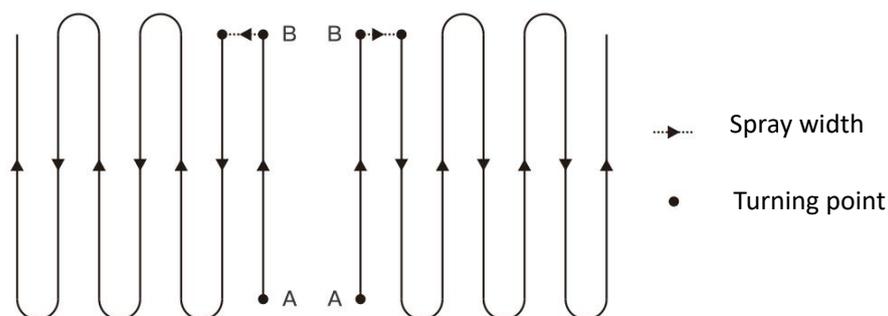


Figure 2-3-5 AB point operation route

### 2.4.4.2. Operating Procedure

Step1. After the drone took off, fly the drone to point A of the operating field, and click the A Button. The Plant Protection Assistant APP will send a voice notification of “point A is recorded successfully”.

Step2. Fly the drone to the B point of the operating field, and click the B Button. The Plant Protection Assistant APP will send a voice notification of “point B is recorded successfully”.

Step3. Click the AB Button. The Plant Protection Assistant APP will send a voice notification of “point B is recorded successfully”.

Step4. Toggle the remote control stick to the left/right to fly the drone to the direction of

the next line and then the drone will perform according to planned route.

### 2.4.4.3. Exit AB Point Mode

The AB point mode can be exited by the following methods:

1. Enter Automatic Obstacle Avoidance Hover Mode.
2. Manual emergency brake the drone. The drone will record the break point and hover.
3. During the operation in AB Point Mode, click the “AB” button on the remote controller (blue light is off) and the drone will exit the AB point operation mode and hover. If the user clicks the “AB” button on the remote controller again, the drone will fly directly to the break point or projection point and continue the operation. (Returning to the break point or projection point can be set in the Plant Protection Assistant APP).

#### Notes:

1. During the operation, it is necessary to ensure that the drone is within the visual range.
2. AB points can be recorded when the GNSS signal is strong and there is no break point ;
3. The distance between "A" and "B" point should be no less than 10 meters.
4. During operation, the flight altitude can be adjusted by the remote controller to meet the actual need. When the throttle is in the central position, the drone will maintain its current altitude.

## 2.4.5. Auto Flight Mode

### 2.4.5.1. Mode Introduction

Users can survey the field and mark the obstacle, and set the border point using the field surveying function of the Plant Protection Assistant APP. The Plant Protection Assistant APP will calculate and generate the best route to intelligently plan the route. This mode is suitable for large or irregular field. The operation route of fully autonomous operation mode is shown in Figure 2-3-6. In the figure, the dotted line length is the line spacing. It can be set in the Plant Protection Assistant APP.

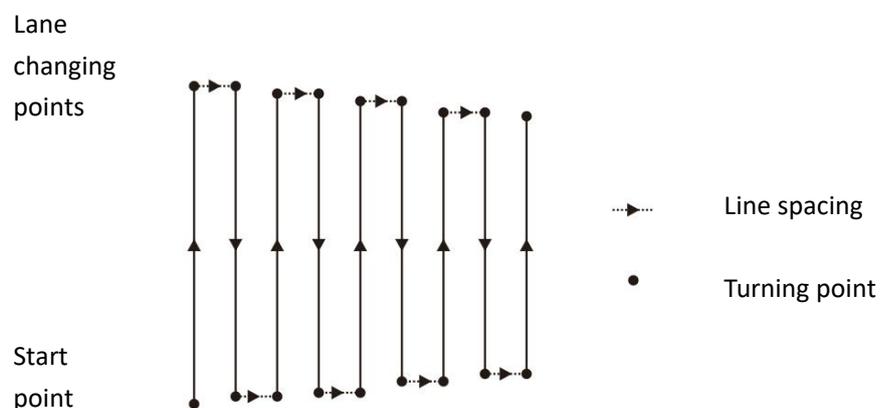


Figure 2-3-6 auto operation route

#### 2.4.5.2. Field Surveying Steps

- Step1. Open the Plant Protection Assistant APP and there will be three options (GPS mapping mode, drone mapping mode and RTK mapping mode), you can choose according to the actual situation.
- Step2. Set a name for the field.
- Step3. Mark the Borderline: select the points at each corner of the border of the field.
- Step4. Mark the obstacle: if there are obstacles in the field, click the obstacle point and select the shape of the area. Click on the turning points of the shape to set it as an obstacle point , and then click "OK" after the obstacle points setting is completed.
- Step5. calibration point settings: After editing the operation area, calibration points need to be added.calibration points are used for map rectify. When setting calibration points, make sure the reference object is easy to identify; the surrounding area is clear and suitable for drone to take off. The operation area setting is completed when calibration point is set.

#### 2.4.5.3. Fully Autonomous Operation Steps

- Step1: After the Plant Protection Assistant APP is connected to the aircraft, expand the land/task list in the main interface.
- Step2: Select a field (or a field in the task list) and click to use the filed.
- Step3: Place the drone at the calibration point of the operation area, click on "Rectify Offset", then click "Rectify Drone Position".
- Step4: After the field is chosen, set the following parameters one by one : route angle, turn mode, route inner contraction, obstacle point spacing, altitude, usage per mu, ways of bypassing obstacle area.
- Step5: According to the route condition, select the routes ready to be sprayed (all routes are selected by default).
- Step6: Click "Start Operation" on the operation interface.
- Step7: Slide to unlock, and the drone will take off automatically and execute the planned route.
- Step8: Complete the operation (also can be finished manually during operation) and then generate the operation report.

#### Notes :

1. During the operation, it is necessary to ensure that the drone is in the visual range.
2. During the operation, the throttle stick of the remote controller can be toggled to adjust the flight altitude according to the plant condition. When the throttle stick is in the central position, the drone will resume its setting altitude.
3. For more detailed operation, please refer to the " User manual of the Agriculture Assistant APP ".

## 2.5. Function Introduction

### 2.5.1. Remaining Dosage Quantity

#### 2.5.1.1. Function Introduction

TG26 is equipped with real-time level meter, which can detect the remaining quantity in real time and display in percentage to the users. During operation, reasonable breaking points can be selected by combining remaining dosage and route length. This can reduce the drone "flying but not operating" situation, which will improve the operation efficiency.

Red box marked as remaining dosage tip:



### 2.5.2. Resume at the break point

#### 2.5.2.1. Function Introduction

If the break point is recorded during the operation due to running out of agrochemical, low battery, manual braking, obstacle avoidance, etc., the drone can be set to resume operation at the break point following the established route.

#### 2.5.2.2. Record the Break Point

During The operation, the drone will record the break point and can resume the operation at the break point if the following situation happens:

1. Insufficient liquid in the tank;
2. When the low voltage protection function is enabled and the Level 1 warning is

triggered;

3. Pitch or roll stick on the RC is pull/pushed;
4. When the drone enters the RTH mode;
5. When the drone has obstacle avoidance radar and have detected the obstacle leading to an automatic brake;
6. When the location signal or heading signal is weak, the drone will automatically exit the operation mode and enter into the protection mode, and record the current coordinate as the break point.

**Notes:**

1. Every time any one of the above conditions are met, the drone will update the break point.
2. When the operation is paused and break point is recorded, the drone can perform the following according to the situation : hover or rising by 2 meters and then hover.

### **2.5.2.3. Return To The Break Point**

The steps for returning to the break point are as follows:

Step1: Manually manipulate the drone to hover in any open place and ensure there is no obstacle between this position and the break point.

Step2: In the Plant Protection Assistant APP, tap the button "Return to the Break Point " or tap the AB Button.

Step3: Select "Return to the Break Point" or "Return to the Projection Point" (return to the operation route at the nearest possible junction by following a perpendicular line) in the Plant Protection Assistant APP.

Step4: The drone automatically rises or descends to the operating altitude and returns to the break point.

Step5: Resume the set route and continue the operation.

Notes:

1. For more detailed operation, please refer to the " User manual of Agriculture APP".

### **2.5.2.4. Return To The Projection Point**

When there is a obstacle on the way back to the break point, you can choose return to projection point.

Step1. After the operation is paused, you can manually fly the drone to bypass the obstacle.

Step2. Click the bottom right corner of the APP to continue the operation. Select

"Return to the Projection Point" , and 1, 2, and 3 options will appear, corresponding to no. 1, 2, and 3 points marked in the route.



Step3. Click on one of the points, and the drone will fly to the point to continue the operation.

### 2.5.3. Terrain-Following Radar

#### 2.5.3.1. Introduction

The stabilization working range of terrain-following radar is between 1 and 10 meters. After the terrain-following radar is turned on, the relative height of the drone and the plants can be kept unchanged during the operation. The drone will fly following the terrain to ensure uniformity of the spraying. The pilot can turn on/off this function by pressing the "Radar Button" on the remote controller.

#### 2.5.3.2. Terrain Setting

For both plain and mountainous terrain, the drone adopts different tracking strategies and the user needs to set the simulated scene of the flight according to the actual operating terrain.

The setup procedure is as follows:

Step 1: Click  at the top right corner into the setting page, then click  into radar setting.

Step 2: According to the terrain situation, select "plain" or "mountain" on the right side of the column "Terrain Settings".

#### Notes:

1. Radar module housing should not be crushed causing deformity.
2. Keep the radar antenna cover clean and wipe the surface regularly with a soft damp

cloth depending on the frequency of use.

3. Use with caution when flying the drone over an object surface with a slope, and the correlation between simulated slope and flight speed is: 10° (< 2m/s), 6° (< 4m/s), and 3° (< 6m/s).

#### **2.5.4. Low Battery Protection**

The drone has the function of low battery protection. The user can set the warning threshold, which is the battery level in percentage, in the Plant Protection Assistant APP. When the value is reached, the drone will act according to the setting. The action can be set as: hover, land, return, no action (warning prompt only).

##### **2.5.4.1. First-level Protection**

As the first-level protection, the drone indicators flash red. The protection will be triggered after the indicators flash for 10 seconds. The factory default first-level low power threshold is 30%, and the protective action is "no action". At the same time, the Plant Protection Assistant APP sends voice notification for low battery.

##### **2.5.4.2. Second-level Protection**

As the first-level protection, the drone indicators flash red. The protection will be triggered after the indicators flash for 10 seconds. The factory default second level low power threshold is 10%, and the protective action is "auto landing". At the same time, the Plant Protection Assistant APP sends voice notification for low battery.

##### **Notes:**

1. When first-level low battery warning occurs, fly the drone to the safe area and land as soon as possible.
2. It is necessary to avoid the second-level low power warning as much as possible to avoid safety accidents.
3. After the low battery protection action is triggered, the drone can only be switched to attitude mode or RTH mode.
4. When the drone starts to automatically land, the protection mode can be quit by switching to attitude mode.

#### **2.5.5. Lost Control Protection**

##### **2.5.5.1. Overview Of Return To Home (RTH) Mode**

When the GPS signal reaches the seven stars for the first time during taking-off or flight and the signal quality is good, the drone will record the current location as the RTH point.

The process for drone automatically returning to the RTH point is called RTH.

### 2.5.5.2. Protection Logic

When GNSS signal is good, the compass work normally, and the RTH point has been successfully recorded, if the remote controller signal is lost by any reason during the operation process, the drone will execute protection action. The protection actions include landing , hovering and returning.

Notes :

1. When the remote control has good connection, RTH can be canceled by toggling the remote controller switch to "S" , and the drone can be controlled manually.
2. When the remote control has good connection, RTH can be canceled by long pressing the “” button for 2 seconds.

### 2.5.6. Front and Back Obstacle Avoidance (Optional)

The drone is equipped with a new 77 GHz millimeter wave radar for obstacle detection, which is unaffected by ambient light and dust. When the working conditions are met, the radar can detect the obstacles in front of and behind the aircraft. The maximum detection distance can be up to 20 meters. When obstacles are detected, the drone self-brake to ensure safety during the operation. The obstacle avoidance function is enabled by default and can be turned off in the Agriculture Assistant APP.

#### 2.5.6.1. Detection Range

The detection range of the radar module is shown in the following pictures. The vertical direction is  $0^{\circ}$  to  $15^{\circ}$  (see Figure 2-4-1) and the horizontal direction is  $\pm 45^{\circ}$  (See Figure 2-4-2). If any obstacle is outside the detection range, the radar module cannot sense it so the pilot should operate carefully. If an obstacle suddenly appears in the detection area, the radar module needs 0.6s to detect and track the movement of the target.

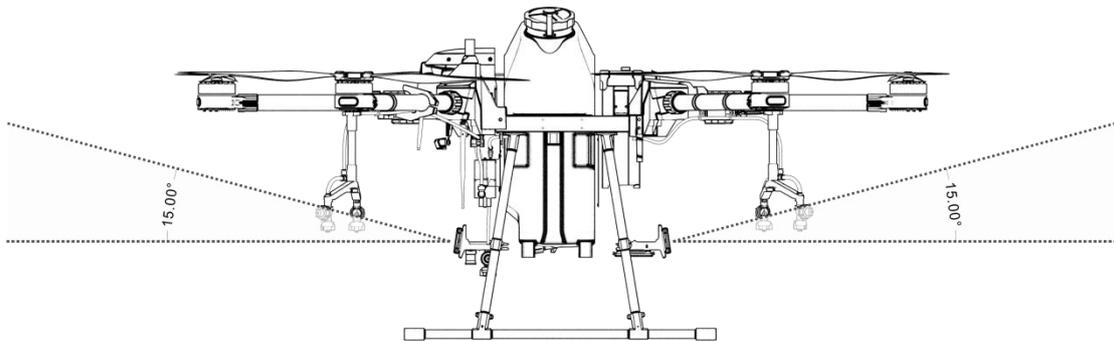


Figure 2-4-1 Vertical View

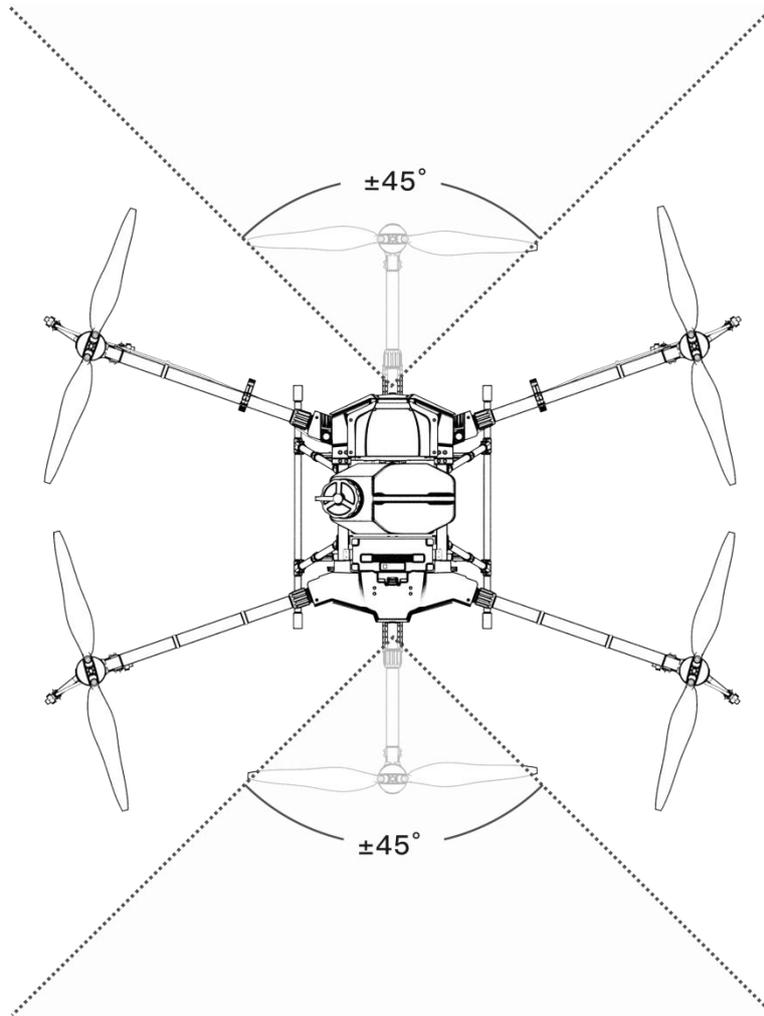


Figure 2-4-2 Horizontal View

### 2.5.6.2. Status Description

The distance between drone and the obstacle is X

Status 1	Status 2	Status 3
$X \geq 18M$	$18M \geq X \geq 8M$	$X < 8M$

**Status 1** : When obstacle distance is greater than 18 meters, drone will not brake and the APP will not display warning.

**Status 2** : Entering the yellow warning zone, the drone slows down to 1 m/s and maintain this speed. The APP will show the distance between the drone and the obstacle in yellow.

**Status 3** : Entering the red warning zone, the drone will brake urgently and enter the Safe

Mode. In the Safe Mode, it will remain hovering and cannot be operated to fly towards the direction of the obstacle. The APP will displays the obstacle distance in red. Operating the drone fly to the opposite direction of the obstacle will exit the safe mode.

### **Special Condition :**

If any obstacle appears suddenly during the flight, the drone will stop with maximum braking force.

### **2.5.6.3. Execution Logic**

1. When the obstacle avoidance function is turned on, it will function when the drone is in "S" flight mode or when the drone is landing.
2. After the obstacle avoidance function is turned on, in order to ensure sufficient braking distance, the maximum flying speed is 6m/s.
3. The obstacles can not be detected when the vertical FOV is large (greater than 10° or less than -10°).
4. When the obstacle avoidance function is turned on, the vertical FOV is limited to 10°; it can be 10° to 27° when the drone is decelerating or braking. When the rear obstacle avoidance radar detects correctly and the drone backward flying speed is greater than 0.2 m/s, the rear obstacle avoidance radar is activated;
5. When the forward flying speed is greater than 0.2m/s and the front radar is working normally, it will be activated.
6. When the drone is detecting with the front radar and the obstacle distance is greater than 18m, it is determined that there is no obstacle in the front direction, and the obstacle avoidance level is 0.
7. The drone will be in the speed limited status, if the distance of the front obstacle is greater than 8m and less than 18m. When the forward speed is greater than 1m/s, drone will automatically decelerate to 1m/s. When the forward speed is less than 1m/s, the restricted forward speed can not exceed 1m/s. When the front obstacle avoidance level is 1, the level will be 0 after the drone has a backward speed greater than 0.2m/s.
8. If the front obstacle distance is less than 8m, the drone will be braked immediately and enter Safe Mode. The drone cannot be controlled to fly forward or turn left/right , forward obstacle avoidance level is 2, which can be released when the backward speed is greater than 0.2m/s.
9. In the GPS mode, when the horizontal speed is less than 1 m/s during takeoff and landing , the drone is allowed to trigger the emergency brake at a distance of 5 m from the obstacle and enter the Safe Mode.
10. When the obstacle disappears, the drone will be in the protection mode for 2 seconds, after which it will gradually lift the speed limit.
11. Execution Logic of backward and front obstacle avoidance are the same.

#### **2.5.6.4. Description of typical obstacle avoidance scenarios**

**Trees, poles:** within 20 meters, obstacle avoidance radar can detect the obstacle, and continuously showing warning data. When the distance is less than 18 meters, the drone will brake automatically to ensure safety.

**Wires:** Take the 1.5-cm-diameter wire as an example, because the reflection of the wire is poor, the radar will be able to detect the wire 13m before the it when the drone is flying right towards the wire at a speed of 3m/s. The thinner the wire or the higher the flight speed is, the poorer the obstacle avoidance effect will be.

##### **Notes:**

1. When using the radar module, follow the local radio regulations and legal requirements.
2. For obstacles of different sizes and materials, the effective working range of the radar module will vary. For example, pedestrian, power cables, dry branches and conifers, the effective detection distance will decrease. Please operate carefully.
3. Radar modules are suitable for flat terrain and may cause false alarms when the slop angel is large.
4. When the surface beneath the drone is less than 1.5m, it is prone to cause false alarms.
5. Never disassemble the radar module by yourself. Otherwise improper installation might cause malfunction of the radar.
6. Do not crush or squeeze the housing of radar module.
7. Radar modules can be used normally in rainy days, and radar detection performance might decrease by 10-20%.

#### **2.5.7. RTK Function (Optional)**

##### **2.5.7.1. Introduction**

RTK can achieve centimeter-level positioning accuracy to improve the accuracy of agricultural plant protection. When RTK is activated and GNSS signal is good, the drone will start the dual antenna direction finding function, which not only has high directional accuracy, but also can be operated reliably in places with strong magnetic interference such as high voltage power line and metal building.

##### **2.5.7.2. RTK Airborne Terminal Setting**

RTK services can be obtained by:

Step1. Set the base station to base station mode according to 2.4.7.3.

Step2. Click on the satellite status in the top menu bar of the main interface to enter the RTK setup interface.

Step3 Set the data source to "Datalink". After connecting to the base station successfully, you can view the RTK status. Wait for the display to show "Fixed

Solution" and then you can start the operation .

### 2.5.7.3. RTK Base Station Setting

Step1: Turn on the base station and wait when RTK is connecting to the satellites .

Step2: Click the satellite status in the top bar of the main interface to enter the RTK setting interface.



Step3: Click the connection button in the status bar of the base station and select the Bluetooth address of the corresponding RTK base station.

Step4: After successful connection, click the configuration button to choose either of the following two modes:

A. Marking mode: accurately map of the plot;

B. Base station mode: provide precise positioning service for the drone in operation;

Step5: After selecting the mode, the RTK system can work normally when "Fixed "is displayed.

#### Notes :

1. Please make sure the base station is level when setting up the base station and ensure that the height is higher than the plants in the operating area.
2. Do not move the base station during the drone is in operation.
3. In order to ensure the signal quality, it is suggested that the antenna of the base station point to the sky and keep perpendicular to the ground.
4. In order to ensure the communication quality between the base station and the aircraft, there must be no obstruction between the base station and the aircraft.

## **3. Maintenance and Common Troubleshooting**

### **3.1. Remote Control Maintenance & Precaution**

- The RC needs to be wiped regularly to keep it clean and avoid water, agrochemical and dust entering the RC.
- Please fold the antenna after using to avoid damage.
- If the drone cannot hover and keeps flying to one direction when the control stick is at the neutral position, the control stick of the RC needs to be calibrated.

### **3.2. Drone Maintenance & Precaution**

- Delicate electronic components are inside the drone. Do not soak the drone in water when cleaning.
- Regular inspection of components is required. Make sure the screws are fastened at all the joints .
- The front and rear ventilation filters of the drone can filter water droplets and ventilate. The ventilation filters need to be replaced regularly to ensure the drone's internal ventilation and cooling.
- During transportation, make sure to fold the arms so that the the motor base is placed on the folding structure.
- If the structural parts(such as frames, arms, landing gears) are damaged, please contact the after-sales service for replacement.

### **3.3. Motor Maintenance & Precaution**

The working environment of motor for agricultural plant protection drone is harsh. Water mist, liquid and agrochemical residue are the main factors causing damage. Therefore, it is necessary to:

- Clean the housing of the motor with a warm cloth after operation, remove the residue on the surface, and do not flush the inside of the motor with high pressure water, so as to avoid water leaking into the motor, which will shorten the service life.
- Check of the motor regularly. When the resistance of motor is high, the sound is abnormal or the gap between the motor and the motor base is becomes large, please contact after-sales immediately and maintain according to the instructions by the after-sales.

### **3.4. Propeller Maintenance & Precaution**

- If the propeller cracks or is damaged, please replace it in time. Otherwise, it will not have enough lift and the drone will be unstable, which will cause safety problems.
- Pay attention to the marking on the propellers when installing them. Motor 1 and 3 should match "CCW" propellers, and motor 2 and 4 should match "CW" propellers.
- Clean up agrochemical residues after finish the operation.
- Install the propeller into the propeller foam holder during transportation.

## 3.5. Battery Maintenance & Precaution

### 3.5.1. UPS

#### 3.5.1.1. Specification Parameters

No.	Project	Specification Parameters
1	Cell Type	Rechargeable Lithium Ion Battery
2	Individual Cell Voltage	11.1V
3	Capacity	2500mAh
4	Discharge	-20°C~55°C
5	Charge	0°C~45°C
6	Storage (Within 3 Months)	-5°C~35°C

#### 3.5.1.2. Notes

- When the plant protection drone is not used for a period of time, please connect the drone to the battery once a month for no less than 20 minutes, in order to prevent the battery from discharging.
- Do not disassemble the battery.
- It is strictly forbidden to throw the battery into the fire, otherwise it might explode.
- Batteries should not be immersed in liquids such as fresh water, sea water, beverages, etc.
- Use damaged batteries are prohibited.

### 3.5.2. Battery

- Charge in the slow charging mode regularly to balance the battery voltage.
- Avoid charging at temperature above 45 °C.
- If the battery fall from height, it might cause short circuit and even combustion.
- Make sure the battery is firmly connected to the drone, otherwise it may affect the performance of the drone.
- If corrosion or discoloration is found in the battery plug of the drone, wipe it with absolute alcohol in time and contact the after-sales department and follow the instructions.
- Do not use the batteries which have dent, scratches and deformation on the surface.  
Serious mechanical damage may lead to the risk of short circuit and combustion. ;
- Make sure all wires are not damaged. Severely damaged wires may cause short circuit or combustion.

#### Storage Instructions:

For storage of a large number of batteries, it is recommended that 4-6 batteries form one unit with an interval of more than 30 cm between each storage unit.

- Please avoid direct sunlight for more than 10 minutes under any storage condition.
- Battery storage environment should be maintained at room temperature (15-35 °C). Long-term storage above 35°C accelerates the aging of battery. After long-term storage at 0-15°C, the service time will be shortened. After several times of use at room temperature, the normal condition can be restored.
- Battery storage should avoid humid environment. Keep storage environment dry and not ventilated.
- Battery storage locations should not be places where large items are often moved in and out to prevent accidental collisions.

#### **Transportation Instruction:**

- It is recommended to using a temperature-resistant or flame-retardant box with a cover to store batteries. It is recommended to use the shockproof and tilt-proof sponge in the original box in other packaging.
- Avoid putting the charging and discharging cables on the edge of the box to prevent accidental being crushed causing short circuit when being used .
- During the operation, if the batteries are placed in a vehicle, ventilation should be guaranteed and avoid direct sunlight. The place exposed to direct sunlight in a sealed vehicle may have a temperature of above 80°C, which may cause the battery to burn.

#### **Emergency instructions:**

Adequate sand, fire extinguishers, and heat-resistant gloves should be provided in places where batteries are stored, transported, and used.

When smoking and burning of batteries are found, the following measures should be taken immediately:

1. Battery is just starting to smoke (or has a burnt odor): Determine the part where short circuit happens immediately. Lift the battery handle or charge-discharge cable(with heat-insulating gloves if necessary) and quickly drag the battery into the open room or outdoor. Completely bury the whole battery with sand (the charge-discharge cable needs to be buried if it is smoking). Be careful to wait until the battery has completely cooled down before taking it out (otherwise the battery may continue to smoke).
2. Batteries emit heavy smoke: immediately use sand, fire extinguishers to extinguish or bury the burning batteries, while removing the surrounding batteries and other flammable objects. If the surrounding flammable and explosive objects (liquids) cannot be removed, immediately use large quantities of water for rapid fire extinguishing and cooling.
3. Batteries are on fire: immediately use a large amount of water, fire extinguishers and sands to extinguish fire (disconnect the power supply of surrounding electrical equipment first) while removing the surrounding batteries and other flammable material.

**Notes** : When using fire fighting equipment to extinguish fire, strictly follow the

requirements and specifications of the local Fire Fighting authorities.

### **3.6. Plug Maintenance & Considerations**

- The plug must be inserted completely when it is connected, otherwise it will heat up the plug and affect flight safety.
- The power plug and battery plug should be replaced if they have turned black or has sparks.

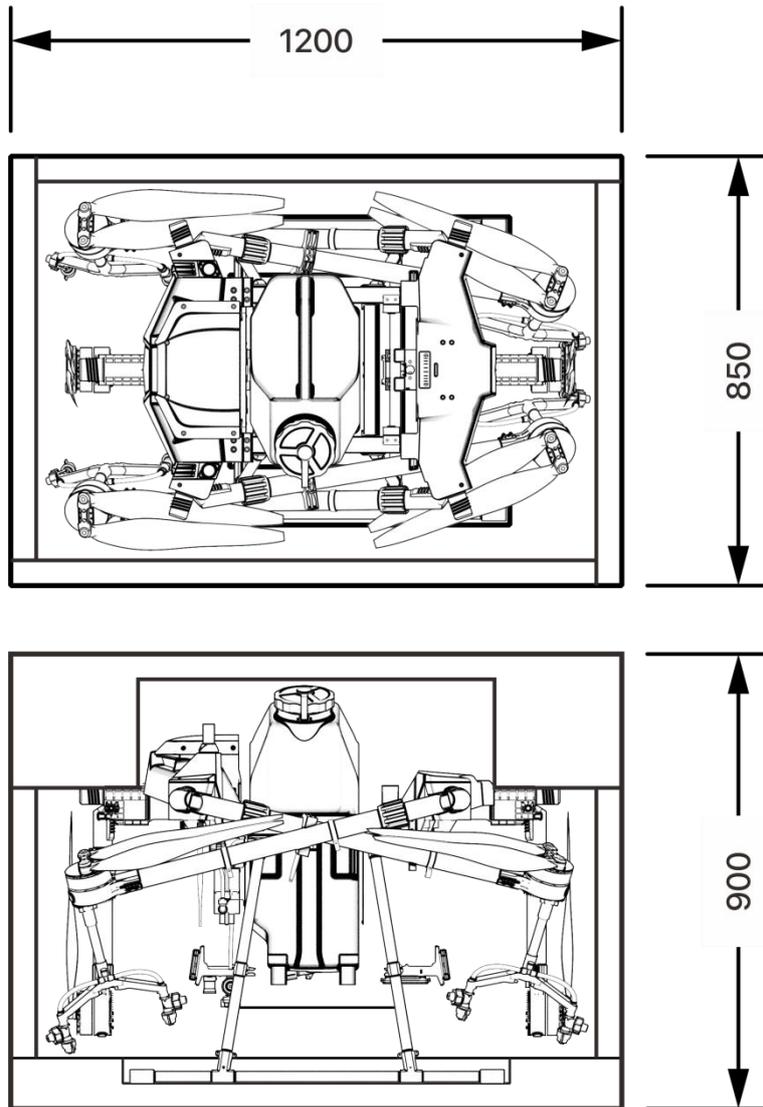
### **3.7. Spray System Maintenance & Considerations**

- Fill the water tank, pipe and nozzle with clean water to clean them when the operation of the day is finished.
- Avoid mixing herbicides and pesticides, otherwise it will be harmful to plants.
- In the case of long-term storage or transportation, always empty the tank.
- It is forbidden to run the water pump at high speed on an empty tank for a long time.
- Avoid using powders and high-concentration emulsifiers to avoid blocking the spray pipe.

## **4. Transportation Instructions**

Packaging method: The drone will be placed in the package box with flexible supporting material embedded in the package box while shipping.

Package size: 1200mm\*850mm\*900mm as shown below.



## 5. Hazards and safety checklist and countermeasures

No.	Hazard	Countermeasure
1	High-speed rotating propeller	Keep a safe distance from the drone and keep it away from people, animals or other obstacles while operation.
2	Charger while charging	Place in a dedicated charging area and environment. Ensure good ventilation. When the charger is connected to power, make sure the charger is grounded.
3	Tank	Flush it with clean water after use and cover it with the cap, and store in the place beyond the reach of people and animals.
4	Battery	The maximum voltage is up to 50.4V. Please use in strict accordance with the relevant safety regulations and the instructions of the battery, and pay attention to safety.

5	Agrochemical	When handling agrochemical, pay attention to the risk of different kinds of agrochemical. Familiar yourself with the using methods in advance.
6	During the operation	Do not operate in bad weather, such as strong wind (wind speed 8 m/s and above), heavy rain (rainfall 25 mm/12 hours and above), snow, fog, etc.

## 6. Manufacturer Information

Manufacturer : TopXGun (Nanjing) Robotic Ltd,.Co

Address : NO.8 building, Jiyun Building, Jiangsu Software Park, No.1 Dongji Avenue, Jiangning District, Nanjing, China

Tel: 025-83798727

Website: [www.topxgun.com](http://www.topxgun.com)

## 7. Appendix

### 7.1. Specification Parameters

Specification	Parameter
<b>Package</b>	
Package Size	1223*873*925mm
Net Weight	26.1Kg
Gross Weight	40.4Kg
<b>Frame</b>	
Wheelbase	2056 mm
Arm Length	405mm (Front and rear), 710mm (Left and right)
Overall Dimension	2120×1730×800 mm (Unfolded State) 1090×750×800 mm (Folded State)
<b>Power Motor</b>	
Model	T80
Stator Dimensions	80x20mm
KV	100rpm/V
Maximum Thrust	16.5Kg (1 motor)
Rated Power	7560W (Total Power of 6 Motors), 1260W (1 Motor)

Weight	655g
<b>Power ESC</b>	
Rated Working Current	40A
Operating Voltage	51.8V ( 14S LiPo )
Maximum Signal Frequency	500Hz
Drive PWM Frequency	20KHz
<b>Foldable Propeller</b>	
Material	Polymer + Carbon Fiber
Diameter	34 inch
Pitch	12.8 inch
Weight	278g
<b>Spray System</b>	
<b>Tank</b>	
Capacity	26L
Weight	2.2Kg (including liquid level sensor and other accessories)
<b>Nozzles</b>	
Recommended model	110015VS
Quantity	9
Maximum Spray Flow Rate	6000ml/min (110015VS nozzle, use water as an example)
Spray Range	4.0~8.0 meter (depending on the plant)
Recommended Spray Range	7.5m (Operating Height: 2 m)
Droplet	110015VS : 170 - 265 $\mu$ m (related to spraying preparation type, spraying flow rate, etc.)
<b>Radar System</b>	
<b>Terrain Following Radar</b>	
Modulation Mode	FMCW
Frequency	76GHz~77GHz
Waterproof Level	IP67
Height Range	1-12m
Range Accuracy	0.1m

<b>Obstacle Avoidance Radar</b>	
Detection Range	1-20m
Using Condition	Available in modes other than altitude mode, flight relative height > 1.5m and speed < 6m/s;
Safe Distance	4.0m
Avoidance Direction	Front and rear
Waterproof Level	IP67
<b>FPV Camera</b>	
FOV	Horizontal 102°, Vertical 57°
Resolution Ratio	720P
Auxiliary Light Brightness	15lux@5m Directly
Auxiliary Light Power	6W
<b>Flight Parameter</b>	
Drone Weight (With Battery)	33.5Kg
Maximum Take Off Weight	60.3Kg
Hover Precision (GNSS signal properly)	Horizontal ± 1.0m, Vertical ± 0.5 m
	Horizontal ± 10 cm, Vertical ± 10 cm (RTK enabled)
	Vertical ± 0.1m (Radar enabled)
Hover Time*	> 8min (Fully loaded)
	> 20min (empty tank)
*The hover time is measured near sea level, when the wind speed is less than 3m/s, and the ambient temperature is 25 °C .	
Maximum Flight Speed	10m/s
Maximum take-off altitude	2000m
Recommended operating ambient temperature	0~40°C
<b>Remote Controller</b>	
Model	TC1
Operating Frequency	2.400-2.4833GHz
Signal effective distance (no interference, no obstruction)	Maximum communication distance: 10 km; image transmission distance: 3km (plant protection environment)
Battery Voltage	3.7V (rechargeable lithium battery)
Battery Capacity	12000mAh

Weight	750g
Size	220x134x43mm
Supported Languages	Simplified Chinese / English
<b>GNSS System</b>	
Frequency	GPS: L1/L2, GLONASS: L1/L2, BDS: B1/B2
Hover Accuracy (RMS)	RTK Not Enabled: Horizontal: $\pm 0.6\text{m}$ , Vertical $\pm 0.3\text{m}$
	RTK Enabled (fixed solution): Horizontal: $\pm 0.1\text{m}$ , Vertical: $\pm 0.1\text{m}$
Orientation Accuracy (RMS)	$0.4^\circ$
Communication Frequency	<sup>1</sup> *840MHz-845MHz (Choose according to region, regulation and policy)
	<sup>2</sup> *900MHz-915MHz (Choose according to region, regulation and policy)
	<sup>3</sup> *2.400GHz~2.4835GHz (Choose according to region, regulation and policy)
<b>Handhold RTK Mapping Kit</b>	
Measurement Accuracy	Point Positioning: 2.0m CEP50 DGNSS: 0.5m CEP50 RTK: 2cm+1ppm (Horizontal) CEP50
Charge Time	$\leq 4\text{h}$
Battery Life	Individual: 8h When is enabled: 4h
Battery Capacity	3000mAh
Waterproof Level	IP65
Size	70*70*50mm
Weight	300g
<b>RTK Base Station</b>	
Supported Mode	Base Station Mode/ Handhold RTK Mapping Mode
Duration	8h
Digital Communication Frequency Band	<sup>1</sup> *840MHz-845MHz (Choose according to region, regulation and policy)
	<sup>2</sup> *900MHz-915MHz (Choose according to region, regulation and policy)
	<sup>3</sup> *2.400GHz~2.4835GHz (Choose according to region, regulation and policy)
Signal Coverage (No interference, no obstruction)	4km (840MHz-845MHz)
	3km (900MHz-915MHz)
	1km (2.400GHz~2.4835GHz)
Waterproof Level	IP65

Size	70*70*50mm
Weight	360g
<b>Charger (TC2604)</b>	
Input Power	100V-240V~11A 50/60Hz
Output Power	2600W
Channel	4 Channel
Supported Language	Simplified Chinese
Net Weight	5.85Kg
Gross Weight	6.80Kg
Size	265*150*248mm
Package Size	350*330*245mm
<b>Battery (TB1424)</b>	
Voltage	51.8V
Capacity	24000mAh
Discharge Power	15C
Waterproof Level	IP54
Battery Life Time	600 cycles
Weight	9.0Kg
Size	142*248*286mm
Package Size	300*350*350mm