User Manual

150 Series Winch for Unmanned Helicopter

Content

Dear Users,

Thank you for your trust in choosing this product.

We always believes that professionalism creates quality and insists on customer first. Continuous investment in product research and development, the pursuit of precision, and efficient and excellent service allow us to continue to innovate and launch products that satisfy customers.

This manual will guide you to use the 150 Series Winch safely and efficiently. Before operation, please be sure to read this manual and follow the instructions in the manual.

I. Disclaimer

This statement applies to all licensees who use the 150 Series Winch including users who purchase this product, authorized dealers, distributors, and developers. Before using this product, please read this statement carefully and make sure that you fully understand and accept all the contents of this statement. Once you start using this product, it means that you have recognized and accepted all the terms and conditions in this statement.

This product is an intelligent winch system for drones, designed to achieve rapid suspension of objects through drone platforms. When using this product, users also have certain responsibilities and obligations and need to comply with the following regulations:

Users should carefully read and understand the instructions for use of this product and use this product correctly in accordance with the instructions. At the same time, users should ensure that the use environment is safe and comply with relevant national laws and regulations.

Users should strictly abide by the use agreement and shall not use this product for illegal or unlawful purposes, or conduct malicious attacks or abuse this product. Users shall be fully responsible for their use of this product and bear all legal consequences that may arise therefrom.

The intellectual property rights of this product belong to our company. Without the written authorization of our company, no one may copy, modify, disseminate, display or otherwise use any part or all of the content of this product.

This product may contain third-party software or technology, which may be protected by the intellectual property rights of third parties. Users should comply with the corresponding usage agreement.

II. Precautions

When using for the first time, please strictly follow the operation manual. If there are any operating problems, please contact our professional personnel for guidance. We is not responsible for product damage or personal risk caused by failure to follow the manual.

1. Do not use this product under adverse weather conditions (rain, snow, strong wind, etc.). This product is only suitable for use in conventional usage scenarios and operating ranges. If the user needs to use this product in other scenarios or operating ranges, please obtain written authorization from our company in advance.

2. This product must be properly stored to avoid long-term exposure to high temperature, humidity, high pressure, strong magnetic field and other environments to avoid affecting the performance and life of the equipment.

3. When using the drone winch in an emergency, such as: cargo is entangled in trees, emergency rescue in mountainous areas, etc., you can turn on the one-button rope breaking function to quickly get the drone out of trouble and ensure flight safety.

4. When using the drone's no-load winch to transport cargo:

(1) To prevent the rope from being entangled or the rope from escaping the pulley groove, the rope release operation cannot be performed after the hook touches the ground.

(2) Do not perform overloading or dangerous operations to prevent damage to the equipment or damage to the flight platform due to overloading.

5. When using an automatic unhooking device for cargo transportation, the rope of the mount needs to be placed at the bend of the hook to prevent unhooking and other accidents; do not perform large maneuvers on the drone during flight to prevent the cargo from losing weight and unhooking.

6. Please check whether all parts are intact before use. If any parts are aged or damaged, please replace them with new ones.

7. The operator must not operate the drone when drinking, taking drugs, feeling dizzy, weak, nauseous, or in other poor physical or mental conditions to avoid injury.

8. Please make sure you are proficient in using the remote control before operation, and keep a safe distance during flight to avoid danger.

III. Product Overview

I> Basic Introduction

150 Series Winch is a large-load UAV winch system with a self-weight of 13Kg and a maximum load of 150Kg. It has a high load-to-weight ratio and is suitable for a variety of application scenarios such as emergency UAV delivery, cargo transportation, and express (take-out) delivery.

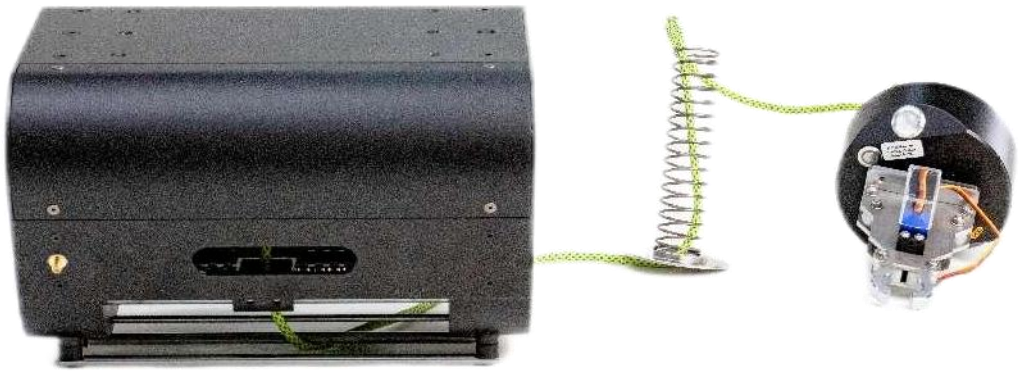

FIG 3-1-1 UAV platform equipped with 150 Series Winch system

150 Series Winch can be directly connected to a 12S (44V-52V) power battery for power supply, it is suitable for different models of medium and large unmanned helicopters and multi-rotor UAV platforms.

150 Series Winch supports RS232/RS422, and CAN 、SBUS control, and is compatible with a variety of multi-rotor drone platforms: it can be integrated into a third-party remote control or flight control.

150 Series Winch can be equipped with a mechanical unhooker or an electric unhooker to realize automatic unhooking and automatic stopping when the cargo touches the bottom, realizing the one-button automatic cargo release function. The electric unhooker can realize the air throwing function and monitor the rope tension, swing angle and other functions. The product has automatic cable arrangement and anti-rewinding function design, which effectively solves the problems of winding and rewinding during use.

II> System composition

1.150 Series Winch components

150 Series Winch consists of a winch body, an intelligent delivery module, and a hook release device.

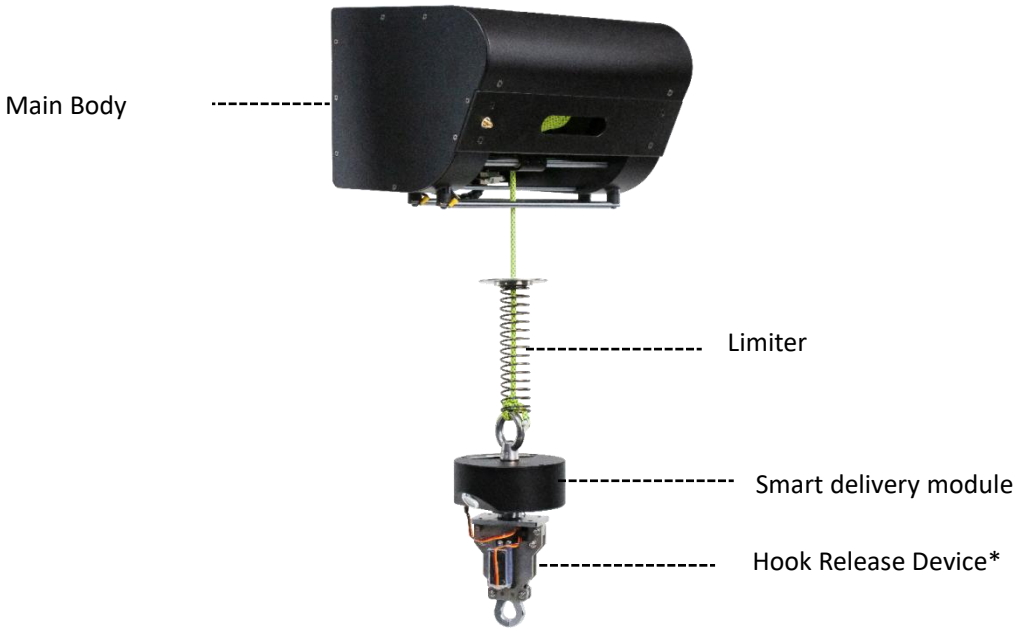

FIG 3-2-1 Diagram of the 150 Series Winch

*The figure shows a Smart Auto Release (electric-controlled unhooking device) as an example.

FIG 3-2-2 Diagram of 150 Series Winch indicator lights

*Indicator lights

Lighting status	Indication status
Blue light flashes slowly	Equipment is operating normally.
Yellow light flashing	Motor failure
Red light flashing	Motor overload protection

Hover State	Green light flashing slowly	Light load
	Yellow light flashing slowly	Heavy load
	Red light flashing slowly	Overload

Table 3-2-1 Sheet of Indicator light status

FIG 3-2-3 Diagram of 150 Series Winch line interface

B. The manufacturer provides a connector adapter cable to achieve power supply and communication, and the power plug is XT60.

Cable Color	RS232	RS422	RS485	CAN
Red	RX	R+	A	CANH
Yellow	TX	T+	B	CANL
White	/	R-	/	/
Blue	GND	T-	GND	GND

Sheet 3-2-2: 150 Series Winch Definition of Aviation Connector Line

*Aviation Connector interface cables are included with the product.

2. Smart Auto Release Module

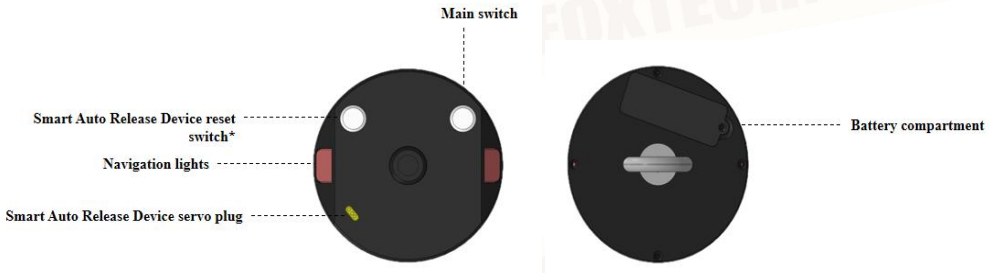

FIG 3-2-4 Diagram of Smart Auto Release delivery module

*Smart Auto Release device reset switch: used by ground staff when mounting cargo; press the reset switch once (press and hold for 0.5S) to switch the electric thrower on or off.

3. Hook Release Device

The 150 Series Winch is equipped with two types of hooking release devices: a Smart Auto Release (electric unhooking device) and A Mechanical release device a (mechanical unhooking device). The Smart Auto Release device can realize one-touch throwing of the cargo or automatic unhooking when it touches the bottom; the mechanical unhooking device needs to be lowered to a designated location and the cargo is released when it touches the bottom.

FIG 3-2-6 Smart Auto Release device

FIG 3-2-5 Mechanical Release device

III> System Logic Operation Diagram

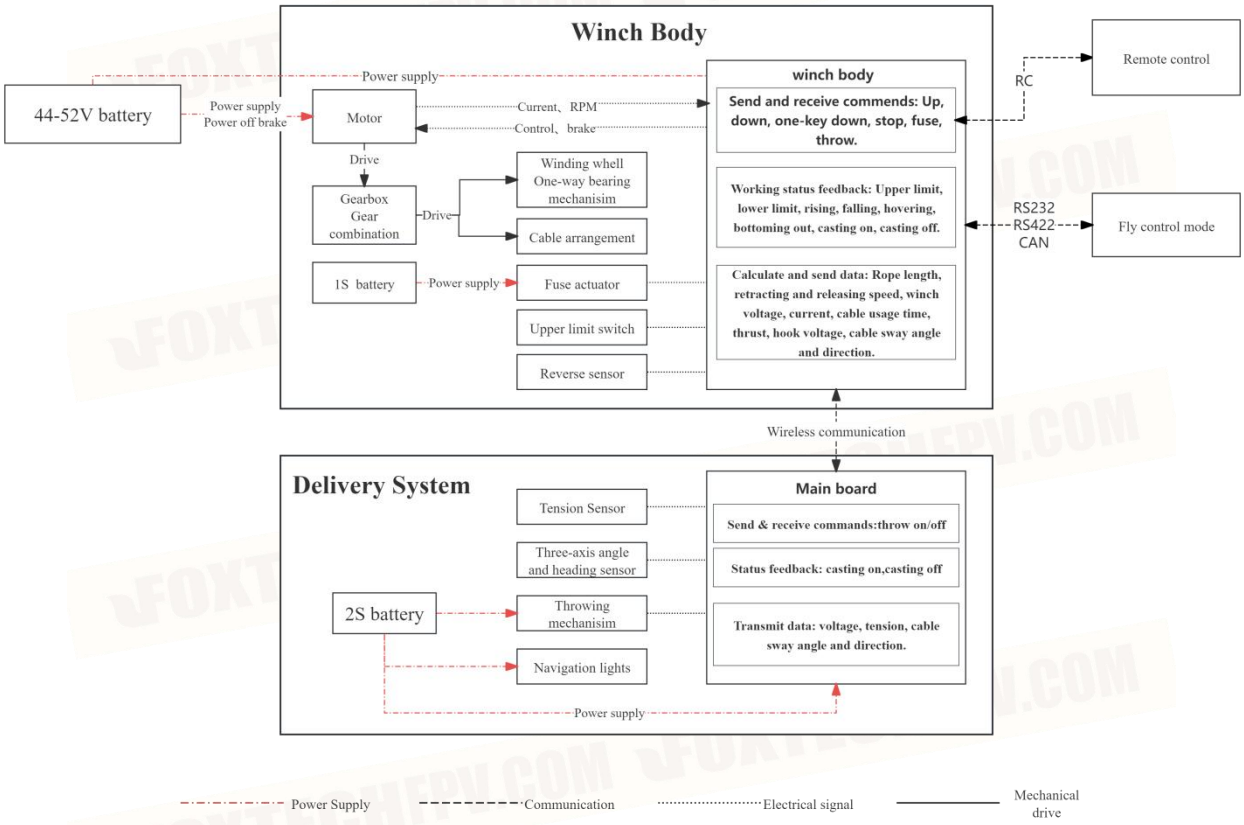

FIG 4-3-1 System Logic Operation Diagram

*Power supply: In the system operation logic diagram, 12S lithium battery can be directly powered.

*Power lithium battery function: To absorb the back electromotive force generated by the descent of the winch cable.

*Communication between the winch main-board and the flight control: the response mode is used for sending and receiving commands; the working status feedback is to upload data after the status changes; the calculation and sending data is uploaded in real time at 10Hz.

IV> Function Introduction

1.Features

The 150 Series Winch system has the functions of retraction and release limit, automatic cable arrangement, automatic unhooking, bottoming stop, one-click release, one-click fuse, slow rise to the top, fault alarm, and no-load release.

(1) Retract and release limit: supports upper and lower limit.

(2) Automatic line arrangement: the reel supports automatic line arrangement.

(3) Automatic unhooking: the unhooking device can automatically unhook when the cargo touches the ground.

(4) Electric control casting: the electric control unhooking device supports one-button casting.

(5) Ground Stop with Auto Unhook: the rope release automatically stops when the cargo touches the bottom.

(6) One-click release: supports one-button automatic release.

(7) One-click fuse: emergency one-button rope breaking function.

(8) Slow rise to the top: the cable rises slowly before reaching the top.

(9) Fault alarm: motor failure, the indicator light flashes yellow.

(10) No-load release prohibition: when there is no load, the descent command will be stopped after it is triggered to prevent the cable from being entangled when it is released without load.

2. Customized development

The 150 Series Winch system supports third-party customized development and can be integrated into third-party drone ground or remote controllers. The following functions can be developed through the protocol:

(1) Supported control methods: RS232/RS422 or CANBUS.

(2) Real-time information display: retractable rope length, retractable speed, power supply voltage, motor current, fuse battery voltage value, cumulative rope length used, cumulative fuse times, cumulative overload times, equipment working status; rope swing angle, rope swing heading, rope swing frequency, etc.

(3) Setting the fixed rope length for lowering/ascending: The lowering or ascension rope length can be set, and lowering/ascending can be performed with one-click.

(4) Setting the motor retractable speed: The lowering or ascension motor speed can be set.

IV. Control method

Ⅰ>Ground station of integrated flight control

If the user needs to control through the communication protocol, please contact the manufacturer to lead out the wiring before delivery, and obtain "150 Series Winch Communication Protocol.xlsx" from the manufacturer for development and configuration.

According to the communication protocol of the winch, the development and control on the host computer of the ground station requires one-to-one communication with the manufacturer. The manufacturer of the drone airborne winch system only provides the protocol, and the host computer development of the ground station needs to be completed by Party A, and our company provides technical support.

V. Product installation and connection

I> The installation of the winch body on the aircraft platform

The 150 Series Winch has a threaded mounting hole on the top. When installing, align the threaded hole of the winch with the mounting hole below the drone, as close to the center of gravity of the flight platform as possible, and use bolts to fix the winch to the drone to ensure that the two are firmly connected.

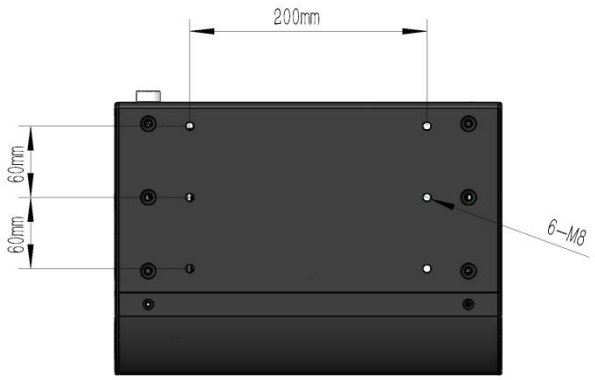

FIG 5-1-1 The installation of the winch body on the aircraft platform

*Users should adapt the tooling according to the flight platform to ensure the installation is coordinated.

*Do not install the winch at an angle or at a large angle (>10°). During use, the brake line and twist shaft will be over stressed and damaged, and the motor will be overloaded! If damage is caused, the manufacturer will charge for repairs.

II> Line connection and reset

1. Line connection

The plug(A) is connected to the winch body, and the plug(B) is powered by a 12S lithium battery.

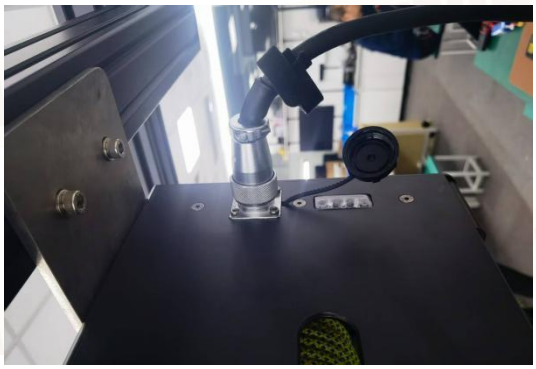

FIG 5-2-1 Aviation Connector Plug Insertion equipment（A）

FIG 5-2-2 Power line connect

FIG 5-2-3 Power line connect（B）

FIG 5-2-4 Indicator light diagram

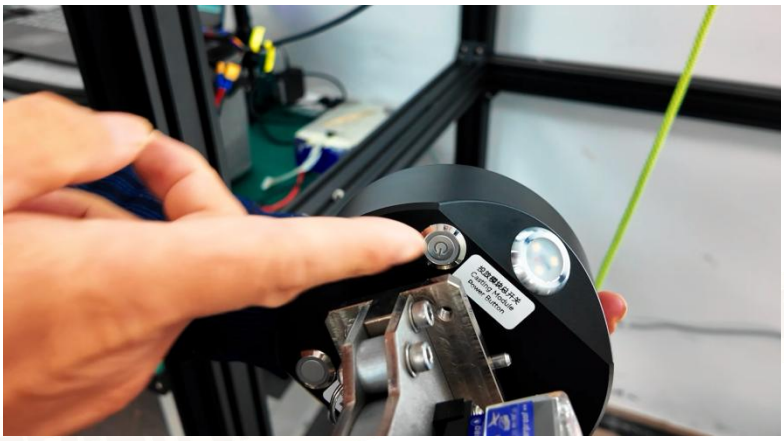

FIG 5-2-5 Open casting module switch

FIG 5-2-6 USB-CAN insert into the USB port

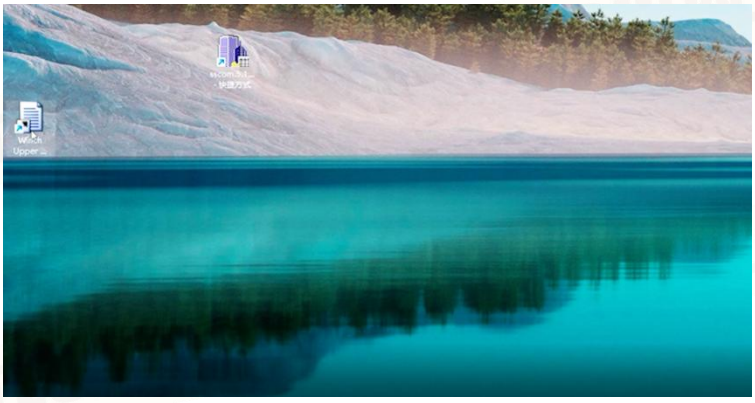

FIG 5-2-7 Install and Open Winch Upper software

Then turn on the computer, open the host computer software, and to perform operation control 150 Series Winch.

2. Reset the unhooker

Check and ensure that there is no cable entanglement in the limiter spring and unhooker to prevent the upper limit from failing when the rope is collected, causing damage to the equipment. Operate the rising command, and the cable will slowly rise until the unhooker is at the upper limit.

FIG 5-2-2 Ensure that the rope is not tangled & the unhooker is reset

*Be sure to draw power from the battery to absorb the reverse electromotive force generated by the lowering of the load. BEC power supply is not supported! Do not connect the positive and negative poles in reverse.

*After installing the product, check and ensure that there is no cable entanglement in the limiter spring and the unhooker to prevent the upper limit from failing when the rope is collected, causing damage to the equipment.

*After the equipment is powered on, the first rise has a cable slow rise protection. The cable needs to be raised to the upper limit. While checking the status of the equipment, release the cable slow rise protection after the equipment is powered on.

VI. Perform pre-flight cargo inspections

Place the device on an open ground. Before flying, the flight platform and heavy-load winch need to be inspected, and the flight environment and flight safety risks need to be assessed.

1. Before flying, check whether the connection between the device and the aircraft is secure;

2. Power on the winch, connect to the ground station software, and check whether all data are normal;

3. Voltage check: winch input voltage > 44V, fuse battery voltage > 4V, release module voltage > 7.8V;

4. One-click rise, one-click descent, and electric thrower on/off command check;

5. Fuse command check, check through the "one-click fuse check" command, at this time the fuse mechanism performs the fuse action, and does not fuse (the fuse battery is not powered);

6. Assess the flight environment and flight safety risks.

*** Before flying, it is forbidden to use "one-click fuse" to check the fuse function. "One-click fuse" will fuse the cable, and the fuse battery will not be able to restore voltage in a short time.**

VII. Payload winch system cargo mounting and inspection

The 150 Series Winch system can realize the air transportation task of cargo within 150Kg. Before the cargo is transported, it is necessary to weigh the cargo to ensure that it is within the safe lifting weight range. The 150 Series Winch is equipped with two types of hook release devices, a mechanical release device device and an smart auto release device (optional). The smart auto release device can realize one-click throwing of cargo.

I> Cargo mounting of the mechanical release device

1. Mounting before takeoff

i>Use a safety pin

The remote control executes the cable lowering command and manually applies traction to the cable to lower the cable to a sufficient length (leave about 3m in the winch), pull out the unhooking device safety pin, hang the cargo into the groove of the hook, and insert the safety pin.

FIG 7-1-1 Pull out the pin

FIG 7-1-2 Hang it into the groove

FIG 7-1-3 Insert the safety pin

* Before each mounting, the cable needs to be released to a sufficient length to prevent the load from causing brake lines and excessive force on the twisted shaft causing damage. (All forms of mounting need to be mounted according to the rope length of about 3m left in the winch. If the equipment is damaged due to failure to do so, the user shall bear full responsibility).

ii>without using the safety pin

If the safety pin is not used, the cargo needs to be hung in the groove of the unhooker. The unhooker and the cargo are kept taut and placed on the ground. After the flight platform takes off, the unhooker lifts the cargo. You need to visually check and confirm that the cargo is in the groove of the unhooker. If it is not in the groove, you need to manually hang the cargo in the groove.

FIG 7-1-4 Hang the cargo into the groove

*It is recommended to use a safety pin to maximize the safety of the goods

2. Mount after takeoff

i>Mounting at the departure point

After the flying platform takes off to the set height, lower the rope to the ground. Hang the cargo into the mechanical release device, insert the safety pin, and the flying platform rises until the cable is straightened. The remote control executes the rising command, and the cargo rises to the specified height.

FIG 7-1-5 Mounting at the departure point

*If the safety pin is not used, when the cable is in a slack state, hang the cargo into the groove. The flying platform will rise until the cable is straightened, execute the rising command, and the cargo will rise to the specified height.

ii>Off-site mounting

The flying platform starts from the starting point, reaches the destination and descends to a suitable height, operates the cable descent command, and lowers the cable to the ground. When the cable is loose, the ground personnel hang the cargo into the unhooking device, and then execute the cable rise command until the unhooking device lifts the cargo and retracts it to the upper limit, and then sets off to the destination.


FIG 7-1-6 Off-site mounting

II>Smart Auto Release device mounting

After the flight platform takes off to the set height, the rope is lowered to the ground. The staff transports the cargo to the vicinity of the Smart Auto Release device, presses the unhooking device reset switch once (0.5 seconds), opens the hook, hangs the cargo on the Smart Auto Release device, presses the device reset switch again (0.5 seconds), the unhooking device closes, the flight platform rises until the cable is straightened, executes the ascending command, and the cargo rises to the specified height.

FIG 7-2-1 lower the rope to the ground

FIG 7-2-2 open the hook

FIG 7-2-3 hang the cargo onto it

FIG 7-2-4 Closed hanging hook

FIG 7-2-5 drone lift the cargo

FIG 7-2-6 winch rises to the limiter

III>Indicator light check

After the suspension system lifts the cargo, observe the changes in the indicator light: when the cable is rising or falling, it is blue, indicating that the equipment is working normally;

when the cargo reaches the top or is hovering, it shows the load status of the motor.

A slow flashing green light indicates a light load, and a slow flashing yellow light indicates a heavy load.

If a slow flashing red light indicates an overload, please stop the operation immediately and reduce the lifting weight to prevent overloading.

*When the cargo is in the hovering state, the indicator light flashes slowly in red, indicating that the motor is overloaded, which may cause safety hazards during flight. Please be sure to reduce the load weight.
*If the red light flashes quickly during the ascent, the motor enters the overload protection and the cable will automatically lower. Please stop the operation and be sure to reduce the load weight.

VIII. Payload winch system cargo unloading

I>Mechanical Release device

1. Safety pin locked

The flying platform flies to the top of the unloading location and hovers. The one-click lowering command is operated, and the rope is automatically lowered until it stops at the bottom. The user removes the safety pin, takes out the cargo, and operates the one-button ascending command to retract the winch.

FIG 8-1-1 Lower the cargo

FIG 8-1-2 To the ground and auto-stops

FIG 8-1-3 Remove the pin and take out the cargo

FIG 8-1-4 Winch retraction

2. Without the safety pin

The flying platform flies to the top of the unloading site and hovers. Operate the one-click lowering command, and the rope automatically lowers until it touches the bottom and stops; after the cargo touches the bottom and stops, the flying platform slowly rises, and at the same time observes whether the device is successfully unhooked. If the unhooking device is not successfully unhooked, the flying platform needs to lower its height, slowly rise again and try again until the unhooking is successful. After the unloading is completed, operate the one-click ascending command, and the unhooking device rises till to the upper limit.

FIG 8-1-5 unload the cargo（mechanical release without the safety pin）

II>Smart Auto Release device

1. Smart one-click release

The flying platform flies to the top of the unloading site and hovers, and the intelligent one-click lowering command is activated. The cable is lowered until it touches the bottom and stops automatically, and the Smart Auto Release device is unhooked synchronously to complete the unloading. After the unloading is successful, the one-click ascending command is operated, and the cable and the Smart Auto Release device are retracted.

FIG 8-2-1 Smart one-click release

2.One-click casting

The flying platform flies to the top of the unloading location, lowers the Smart Auto Release device to the appropriate height, executes the cargo throwing command, and accurately throws the cargo into the designated area, completing the cargo unloading.

FIG 8-2-2 One-click casting

IX. Maintenance

The 150 Series Winch system is a drone mounting product with high safety requirements. The terms and precautions in the user manual must be strictly followed when using the equipment. Routine inspections should be carried out before testing, and regular inspections and maintenance should be performed to reduce risks and failures, effectively improve product reliability, and ensure product service life.

I>Check before use

To ensure safe use, it is recommended to check according to the following items and procedures before each use.

Step	Items	Content	Yes/ No
1	Installation Check	Ensure that the winch system is firmly installed with the machine body and there is no looseness, and the connection parts are not deformed. If you shake the winch by hand and find that there is a shaking gap between the connection part and the machine body, you need to reinstall it.	
2	Power on	The indicator light shows a slow flashing green light.	
3	Cable inspection	Operate the descend command and pull the cable outward by hand for several meters. Check the wear of the pulled-out part of the cable. If the cable is severely worn or fuzzy, or has obvious damage, please replace the cable.	
4		Make sure the connection between the cable and the hook is secure	
5		Make sure there is no obvious wear at the connection between the cable and the hook. If there is obvious wear, please cut off a part and fix it again. If it cannot be bound, please contact the manufacturer and operate under the guidance of the manufacturer.	
6	Twist shaft inspection	Visual inspection to ensure that there is no sand or other foreign matter in the twist shaft track.	
7		Operate the descending command, pull the cable outward with your hand, and listen for any abnormal transmission noise on the twist shaft.	
8	Voltage Check	Ensure that the input voltage of the winch is within the specified range.	
9		Make sure the fuse voltage is 4.2V, which is lower than 3.8V. Please replace the fuse battery and confirm the fuse voltage value again.	
10	Data Check	Ensure that all monitoring data are displayed normally.	
11	Operation Instructions	Operate the ascending command to check whether the ascending command is normal. Note that during the cable reeling process, you need to manually add a tightening force to the cable to ensure that the cables are arranged neatly without gaps.	
12		Operate the fuse check command to observe whether the fuse servo executes the fuse action to ensure that there is no abnormality in the fuse command.	

Sheet 9-1-1 check before use

II>Regular inspection and maintenance

It is recommended that users refer to the following standards and conduct regular inspections and maintenance to maintain the equipment in optimal condition and reduce safety hazards.

Periodic Inspection and Maintenance Checklist						
No.	Check Items	Per Use	Each Disassembly	100h/3 three months	300h/1year	Advice
1	Body and winch mounting screws	√	√	\	\	Self-check
2	Cable wear	√	×	√	√	Self-check/ Self-replacement
3	Cable connector	√	×	\	\	Self-check/ Self-replacement
4	Twist shaft foreign matter	√	×	√	√	Self-check
5	Twist shaft sleeve screws	×	×	√	√	Self-inspection/ Return to factory for replacement
6	Motor drive gear	×	×	×	√	Return to factory for maintenance/ Return to factory for replacement
7	Tension sensor calibration	×	×	×	√	Factory calibration
8	Voltage sensor calibration	×	×	×	√	Factory calibration

Sheet 9-2-1 Periodic Inspection and Maintenance Checklist

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

* The start time in the table shall be based on the first factory delivery time of the equipment.

* Bolt tightening inspection method: For threads that require thread glue, use a hexagonal screwdriver to tighten the bolts in a positive direction. If the bolts can be easily turned, remove the bolts and reapply thread glue to install them back to the original position; for threads that do not require thread glue, tighten the bolts.

* Foreign body inspection method for twisted shafts, see steps 6 and 7 of the pre-use inspection.

* Cable inspection method, see steps 3, 4, and 5 of the pre-use inspection.