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Leo 2 Multirotor Manual

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- Reading Tips
- Copyright Notice
- Disclaimer

Reading Tips

Blue Text: Suggestions and possible contents.

Orange Text: Content that needs close attention.

Red Text: Must be strictly implemented.

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- The dimension and weight listed in this manual are approximate values based on the design and repeated measurements.
- All documents have been carefully verified to make sure the accuracy. Related information is subject to the latest version released by the company.
- The company reserves the right to change product specifications without prior notice. Please pay attention to AheadX's official website

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AheadX GNC is a high quality UAV avionic. The company shall not be liable for personal injury, property loss, etc. (including direct or indirect damage) due to the following reasons:

1. The operator causes damage in the case of alcohol, drug abuse, drug anesthesia, dizziness, fatigue, nausea and other poor physical or mental condition. Any compensation for mental injury caused by the accident.
2. The product is not assembled or manipulated in accordance with the correct guidance of the manual

3. Personal injury or property loss caused by operator’s errors or subjective judgment
4. Knowing that the relevant equipment is in an abnormal state (such as water damage, oil damage, soil & sand damage and entry of other unidentified substances and incomplete assembly, main components with obvious failures, spare parts with obvious defect or missing), but still use the equipment and cause damages.
5. Any damage caused by flying the drone in magnetic interference zone, radio interference zone, no-fly zone, or the pilot flies the drone with following conditions such as in a shadow, poor light, blurred vision and vision obscured
6. Collision, overturns and force majeure as fire, storms, tornadoes, heavy rains, floods, tsunamis, earthquakes etc.
7. Direct or indirect liability for any illegal use, or other unauthorized purposes.
8. Third-party liability arising from the use of our software and hardware products ..
9. Any loss caused by obtaining or using our software or hardware and related manuals through unauthorized ways
10. Other losses that are not within the AheadX’s sphere of accountability

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- Product Overview

Product Overview

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- Function Description
- System Components

Function Description

AheadX Leo2 GNC (Micro Guidance Navigation Control System) as an upgraded version of Leo, provides a new generation of Micro Guidance Navigation Control System with high integration, high reliability and high performance price ratio for industry class UAVs. Support multirotor, fixed wing, quad plane, tilt rotors, unmanned vehicle, unmanned ship, etc.

Leo2 uses 4-redundant IMU design, seamless switching of IMU data sources through powerful data arbitration mechanism; The accuracy of attitude measurement can reach 0.05 degree; automatic switching of double redundancy compass with the standard configuration; able to be extended to 3 redundancy yaw measurement (with Dual GNSS antenna orientation), dual redundancy satellite receiver and dual redundancy airspeed measurement.

The industrial processor with capacity up to 1440 DMIPS, ensure efficient operation of the system. The power management adopts a wide-voltage isolation power supply scheme, and has multiple protection mechanisms such as input under-voltage protection, output short-circuit protection, and over-current protection. It has passed EN62368 certification to ensure the stable power supply of the system.

Leo2 uses MEMS sensors with temperature compensation from - 20 ℃ to 75 ℃, full metal shielding case. Taurus 2 uses double extended Kalman filter, Improved L1 guidance law, and ADRC controller as the core algorithms of Guidance Navigation Control, It has high control precision.

Leo 2 is equipped with advanced real-time motion planning algorithm - AxPlanner due to its powerful computing power, which can ensure that the UAV completes the transition between mission segments in the most energy-saving and dynamically accessible way, and ensures that it enters the measurement area with a stable attitude, improve the effect of taking pictures and imaging. AxPlanner solves the problem of adding a large number of auxiliary turning waypoints for task planning such as traditional aerial mapping and inspection.

Leo 2 integrates a centimeter-level GNSS system, which supports simultaneous operation of RTK and PPK ; supports dual antenna satellite orientation, and can still fly normally when the magnetic compass is interfered; dual-redundancy satellite receivers improve the reliability of satellite navigation.

Leo2 PNP and ADV version have built-in 20KM datalink. It can be extended to dual redundant data links, with a complete control authority management mechanism, and flexible switching of control rights between the main and backup datalinks, which is very suitable for team collaboration.

Compared with the first generation product, Leo2 has richer expansion interface, adapt to more application scenarios. Excellent internal shock absorption structure design allows Leo2 to adapt to a variety of aircrafts without external damper. With

the new avionics modules: navigation light module, airspeed module, and GNSS-compass module, Leo2 has great ease of use.

Three versions are available to meet the needs of different users.

PNP Version

Centimeter-level satellite positioning system
Built-in 20KM data link
Plug-in fly, qick installation

ADV Version

Centimeter-level satellite positioning system
Built-in 20KM data link
J30 interface

PRO Version

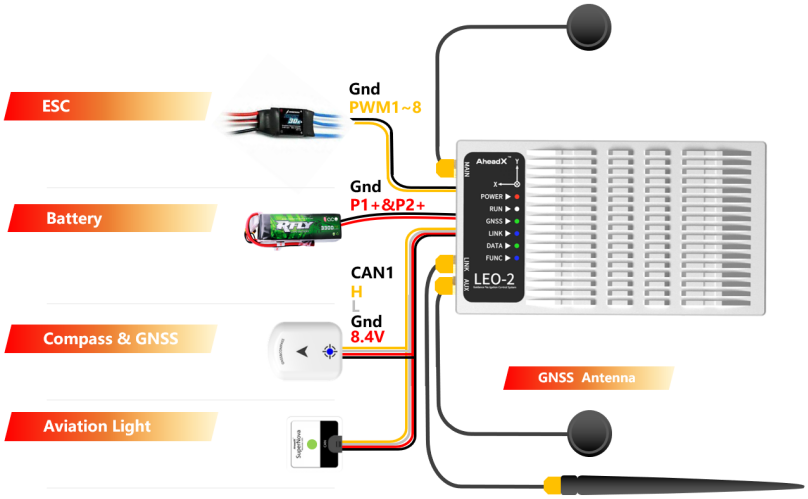
Centimeter-level satellite positioning system
Support access to various pods and sensors
PWM * 19 CH， UART * 6 CH
J30 interface

Features and applications

- Three versions are available to adapt to different application scenarios.
- Centimeter-level satellite positioning system, supports RTK&PPK working at the same time, supports dual satellite antenna orientation.
- Built-in 20KM data link can realize one station and multiple drones (Exclude Leo2-PRO).
- The built-in data processing and conversion module is used as the secondary processor, which supports the third party devices (such as gimbal cameras and radar systems) accessing easily (Leo2-PRO Only).
- Industrial-grade processors with a processing capacity of up to 1440 DMIPS are selected to ensure the efficient operation of the system.
- Wide-voltage isolation power supply scheme, with multiple protection mechanisms such as input under-voltage protection, output short-circuit, over-current protection, etc., and meets the EN62368 (World Product Safety Specification) certification standard.
- Working temperature -40 ~ 75 ℃, internal graphite hybrid cooling system design, stable and reliable operation of the equipment.
- Built in The latest AxFusion sensor fusion technology, the attitude measurement accuracy can reach 0.05 degree.
- The design of 4 redundancy IMU is adopted to realize seamless switching of IMU data source through powerful data arbitration mechanism;

- Excellent internal damping structure can effectively reduce the impact of vibration on inertial measurement unit.
- Leo2 is able to be connected to two AM1 high-precision airspeed modules with temperature compensation to improve the reliability through redundancy technology.
- Dual redundancy satellite receiver and three redundancy yaw with standard configuration.
- Support high-precision 200Hz position, attitude, speed, airspeed and other motion information output, support redundancy switch command, can be used as GPS / INS inertial navigation system.
- 8KV electrostatic protection.
- Rich interface, 19 PWM output, 6 serial ports. (Max configuration with Leo2-PRO)
- It can record airborne data, PPK data, POS data, etc. at the same time, and the recording time over 200 hours.
- Support 3-way voltage monitoring and rigorous low-voltage protection strategy.
- Support multirotor, fixed wing, quad plane, tilt rotors, unmanned vehicle, unmanned ship, etc.
- With the use of the software of AheadX Space Pro, it can realize the application of one station controlling multiple aircrafts.
- Support cloud management, and realize cloud monitoring, remote control, no fly zone query, differential base station sharing, and data access of CORS station.
- Support application scenarios such as block mapping, strip mapping, electricity/oil pipeline inspection, UAV operator training, pod monitoring, etc.
- Motion planning and terrain following flight functions make operations easier and more efficient.
- Strong remote technical assistance services, no matter when and where users are, they can request the official remote technical support from AheadX through the Internet at any time.
- 10 mission routes, up to 1000 waypoints in a single mission route, and the route merging function is supported. (9 Routes for VTOL and Fixed-wing version)
- Simulation training function. Leo2 can be used with the AheadX hardware in the loop simulation system to facilitate the daily simulation training of UAV pilots;
- Online upgrade function. Users can quickly obtain the latest version of firmware and ground station software through the Internet.

System Components



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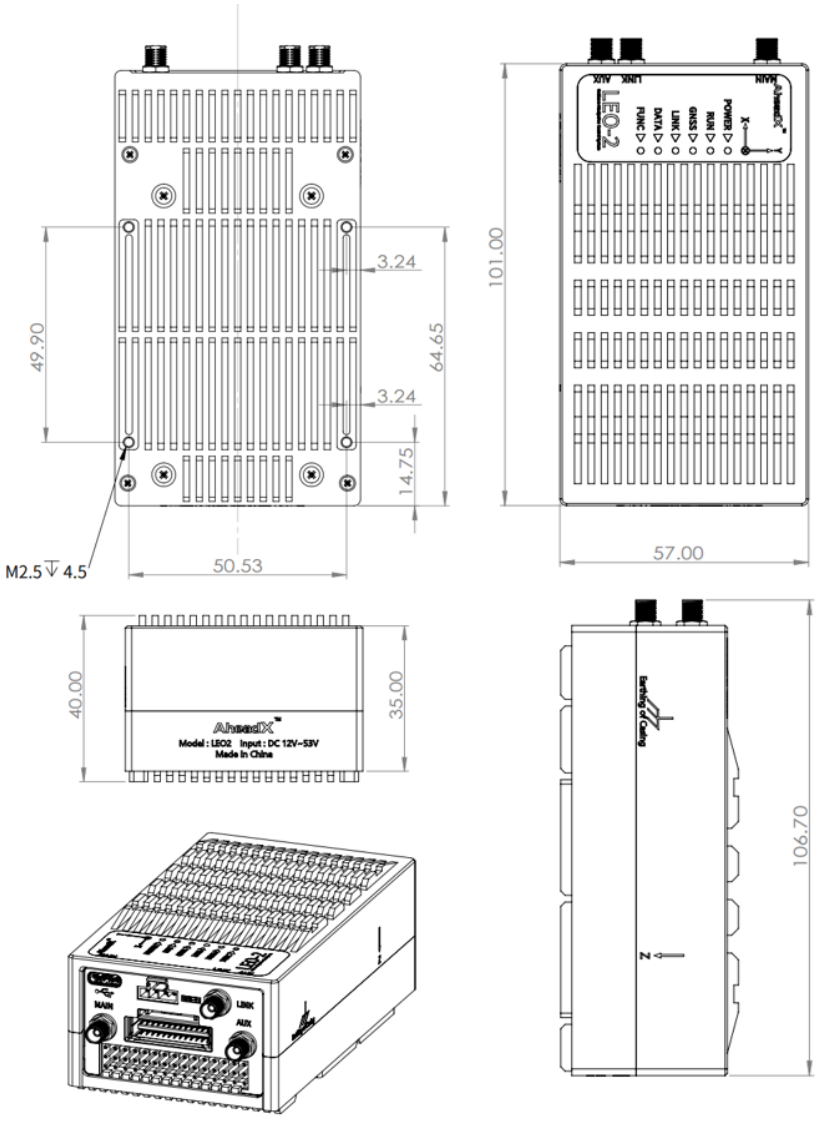
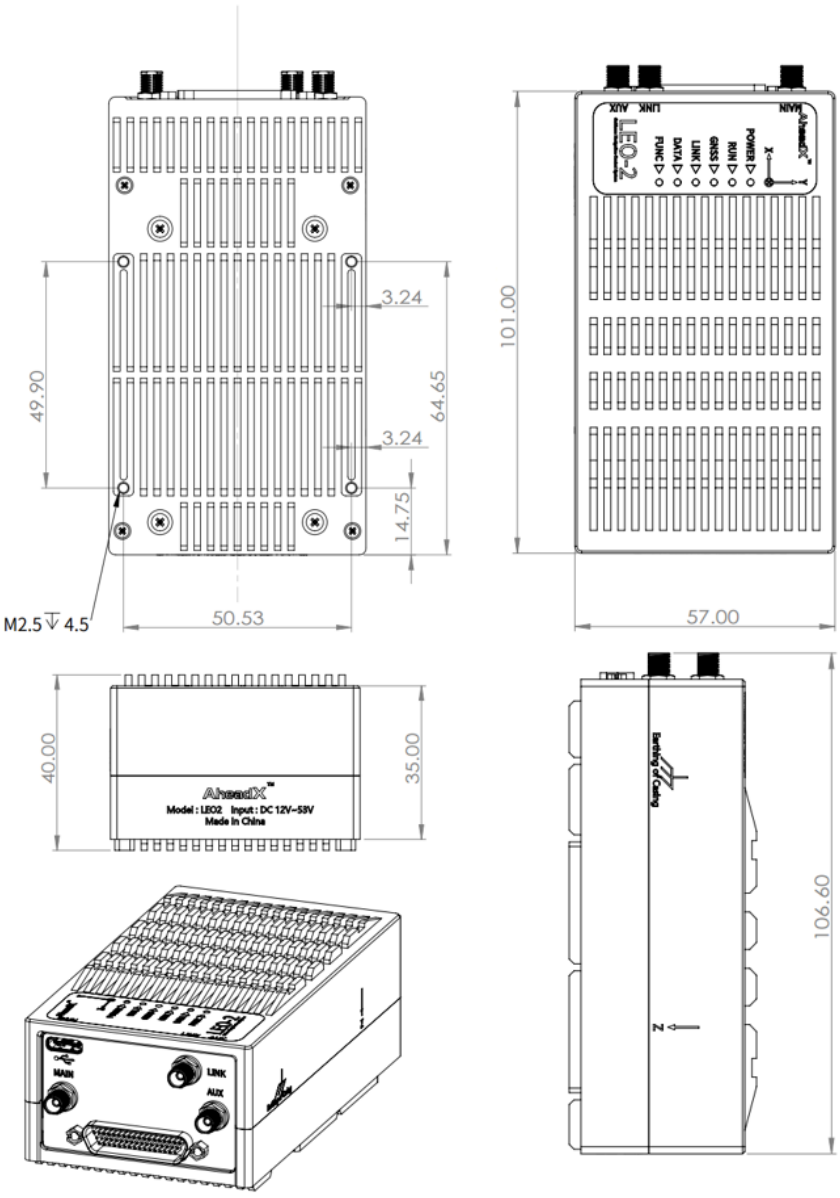
- Device Dimensions

Device Dimensions

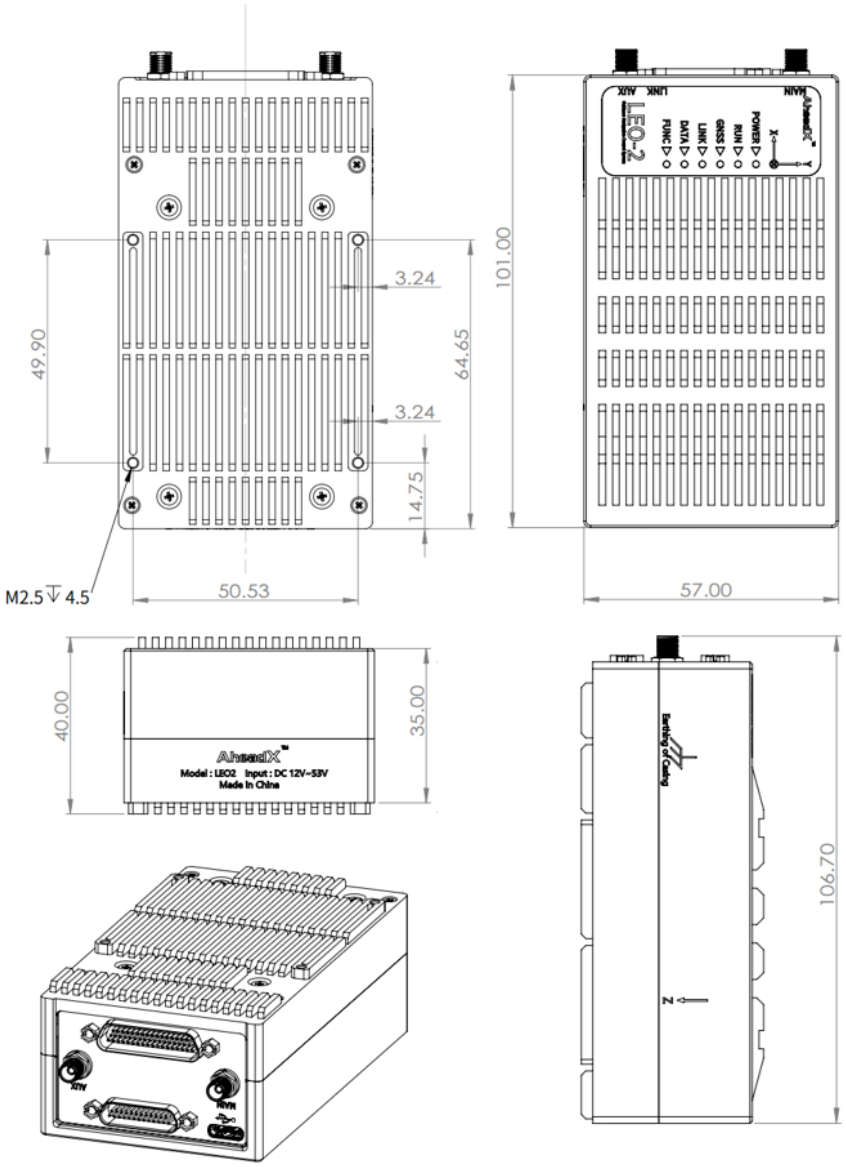
LEO-2 PNP



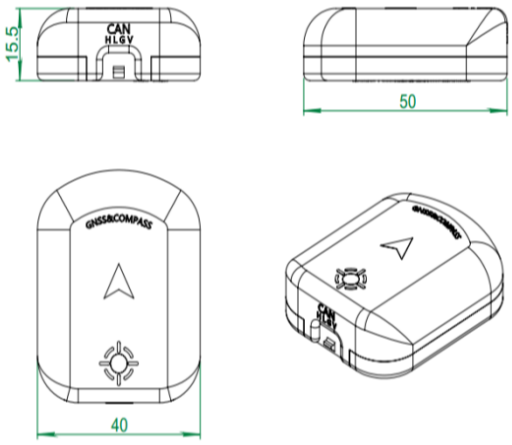
LEO-2 ADV


3.24
49.90
64.65
3.24
14.75
M2.5↧4.5
50.53
101.00
57.00
40.00
35.00
AheadX™
Model : LEO2 Input : DC 12V~53V
Made in China
106.60
MAIN
LINK
AUX

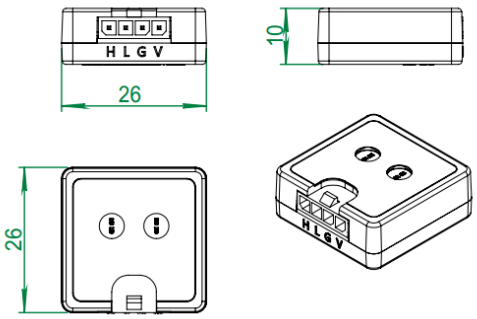
LEO-2 PRO



GNSS-compass Module



SuperNova (Aviation Light Module) (Multirotor only)



Airspeed Module (Fixed-wing and VTOL)

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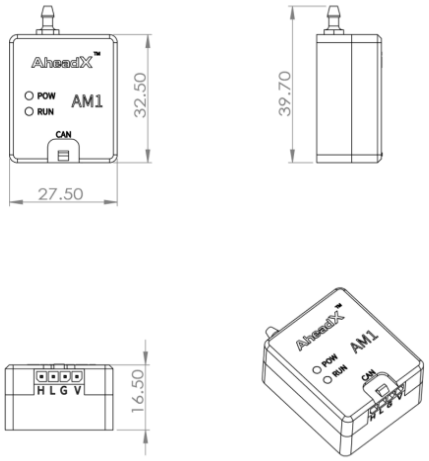

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- Leo2 Specification

Leo2 Specification

Index	MAX	Typical	MIN	Unit	Remark
Supply Voltage	53	25	12	V	GNSS-Compass, SuperNov and Airspeed Modules: -28V
Power Consumption	15			W	
Working Temprature (Enviroment)	75	25	-40	℃	
Attitude Accuracy	0.1	0.05		°	High accuracy positioned no magnetic interferenc
Yaw Accuracy		0.2		°	High accuracy positioned no magnetic interferenc
Anglerate Range	1000		-1000	°/s	
Acceleration Range	8		-8	g	
Position Accuracy		0.01		m	CEP
Speed Accuracy		0.02		m/s	
Altitude Range	10000		-400	m	
Airspeed Range	140		0	m/s	
Ground Speed Range	500		0	m/s	
PWM Control Channels		15		channel	
SBUS Input		1		channel	For backu RC receiv
SBUS Output		1		channel	
PWM Frequency	400		50	Hz	
Communication Port		1		channel	RS232 Interface

Voltage Measurement		3		channel	
Voltage measurement range	58		0	V	
RPM Measurement		1		channel	
RMP Range	65535		0	RPM	
CAN Communication Ports		2		channel	Support al AheadX CAN avionics
Extended Serial Port		2		channel	

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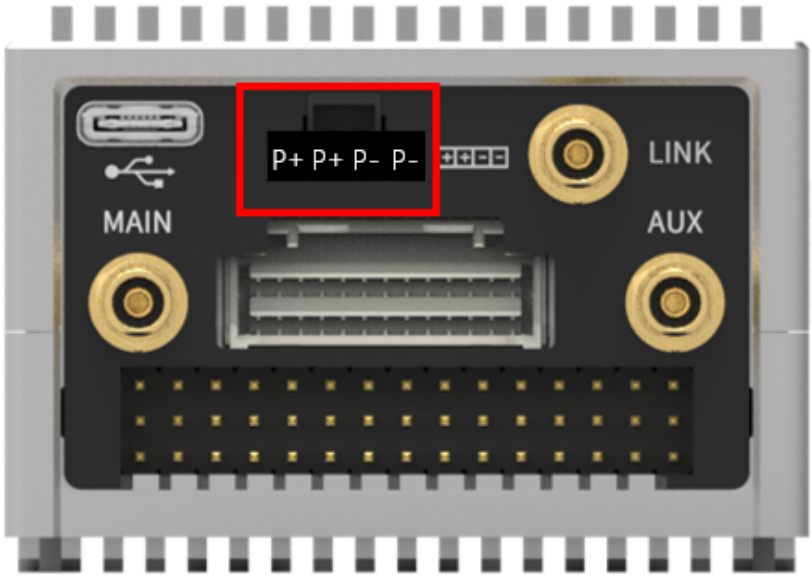
- Interface Definition - PNP
    - POWER
    - DATALINK ANTENNA
    - GNSS ANTENNA
    - PWM
    - SBUS Input
    - USB Type-C
    - Function Interface

Interface Definition - PNP

POWER



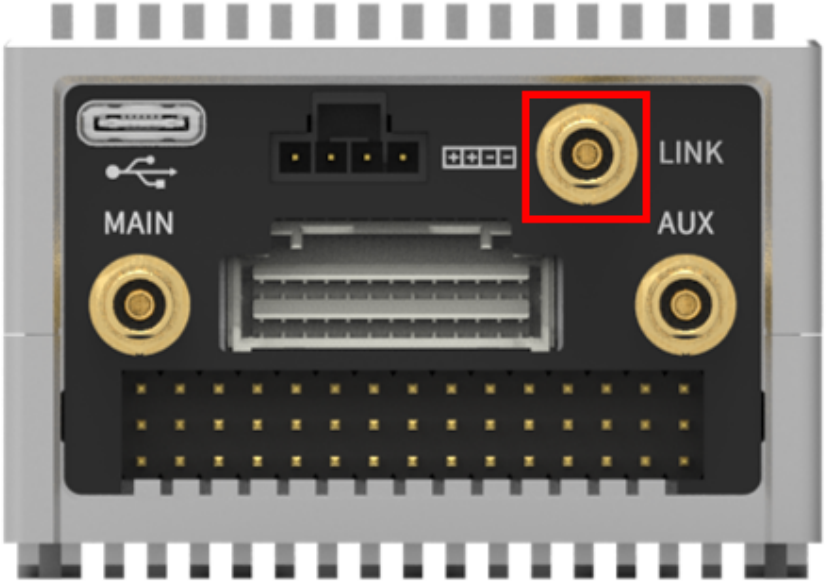
The power supply interface, and the power supply voltage is 12-53v.

P1+: Leo2 power supply positive pole, voltage monitoring channel 1 collects this pin.

P2+: Built-in datalink power supply positive pole.

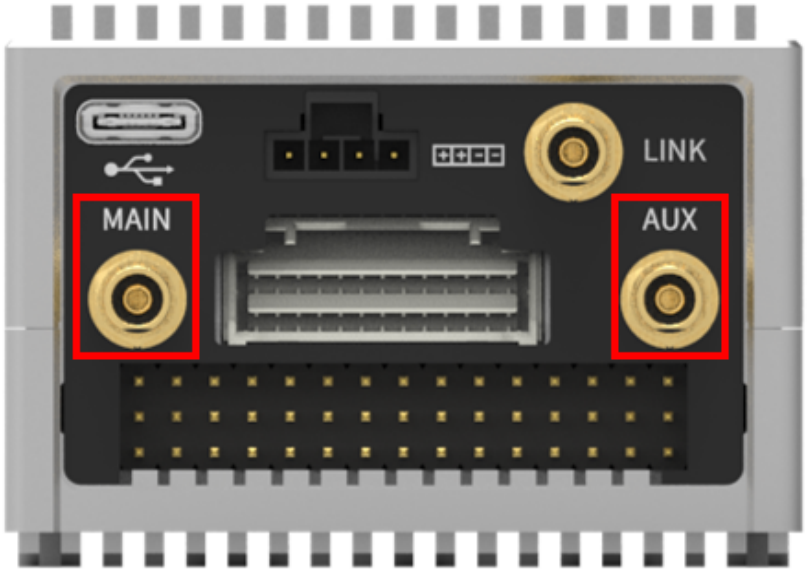
P-: Leo2 power supply negative pole.

DATALINK ANTENNA



Built-in datalink antenna, MCX-KK interface.

GNSS ANTENNA



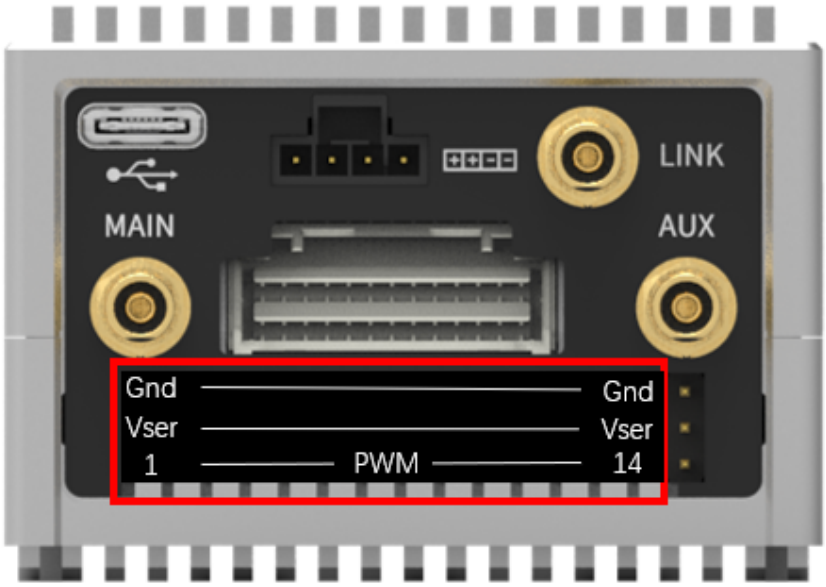
Built-in differential GNSS receiver module antenna interface, MCX-KK interface.

MAIN: Main antenna interface, work independently for positioning.

AUX: AUX: Auxiliary antenna interface, used in conjunction with the main antenna for orientation.

PWM

PWM pulse signal output interface.



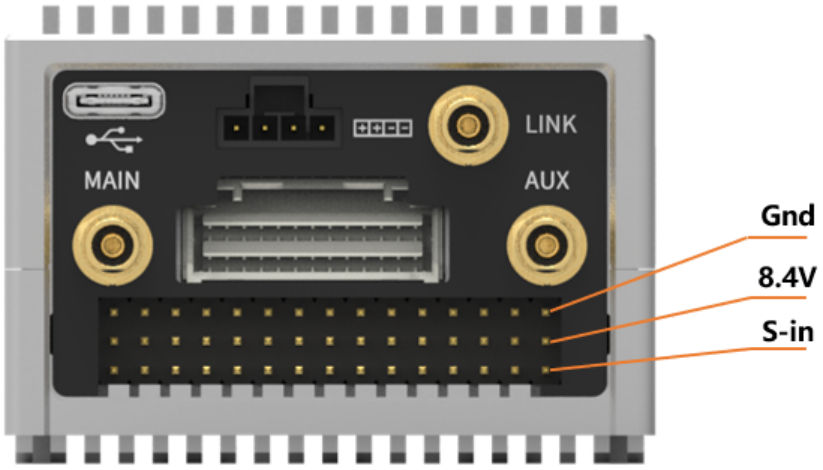
PWM1~14: PWM signal output.

Vser: External power supply of servo, voltage monitoring #2 collect this pin, interconnected.

Gnd: PWM digital ground, interconnected.

PWM1-14 interface Gnd connected, Vser connected.

SBUS Input



SBUS input interface, access to airborne RC receiver.

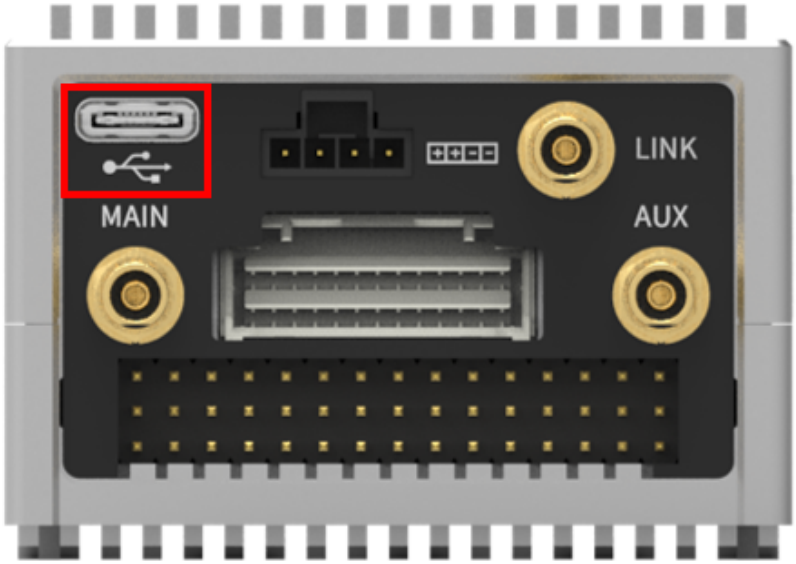
S-IN: SBUS input signal.

8.4V: 8.4V power output.

Gnd: Ground.

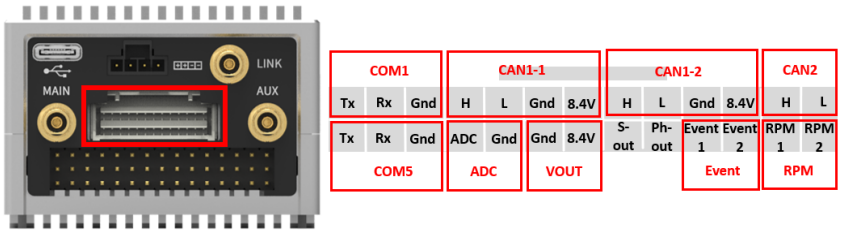
Please make sure that the receiver support 8.4v power supply before connecting.

USB Type-C



Connect computer through USB Type-C cable, it will be recognized as a USB disk, the onboard PPK data, log and POS data can be exported.

Function Interface



Index	Definations	Remarks
COM1 & COM5	Tx: Data Transmission. Rx: Data Reception. Gnd: Serial Communication Ground, which can be shared with Event and Ph-out interface signal ground.	RS232 communication interface. When P2+ is not powered, COM1 can be used to connect an external datalink.
CAN1-1 & CAN1-2	H：CAN1-H L：CAN1-L Gnd：CAN Ground 8.4V：8.4V Output	ONLY be used to connect aviation light module, airspeed module and GNSS-compass module.
CAN2	H：CAN2-H L：CAN2-L	Reserved for customized CAN devices.
ADC	ADC: Voltage #3 measurment. Gnd: A/D ground.	Range: 0-58V
Event	Event1: PPK data record trigger pin, falling edge trigger. Event2: PPK data record trigger pin, rising edge trigger.	PPK data recording trigger interface. Event signal ground can be multiplexed with COM1 or COM5 ground. Only supports 3.3V trigger level access.
RPM	Measurement interface for RPM (revolutions per minute), support 2 RPM measurement. RPM1：RPM-1 measurement signal. RPM2：RPM-2 measurement signal. Gnd：Digital Ground.	Multirotor version only support RPM1.
VOUT	8.4V：8.4V power output. Gnd：Ground.	The total output power of 8.4V is less than 10W.
S-out	SBUS output interface, can be connected to SBUS flight servos or task servos.	The total output power of 8.4V is less than 10W.
Ph-out	Camera trigger signal.	If it has to be connected with the Event pin, it must be configured to 3.3V level.

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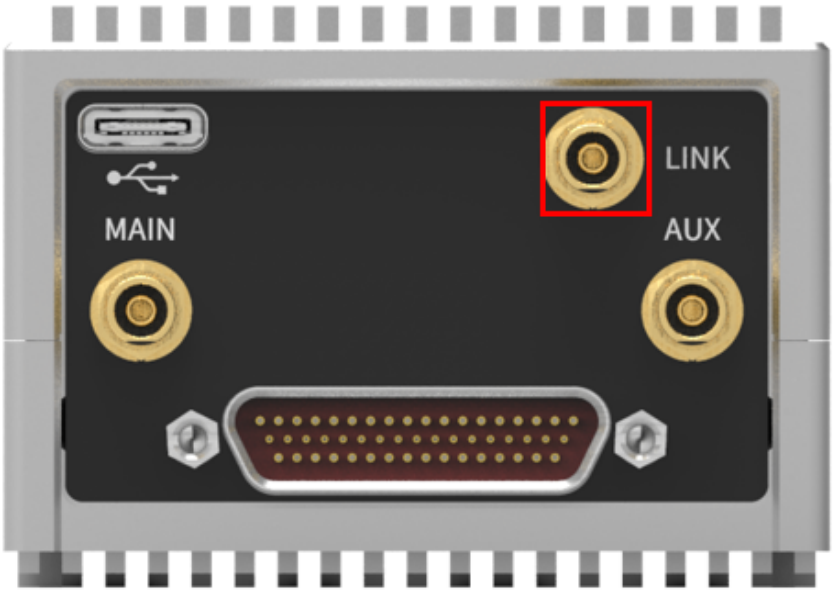
- Interface Definition
  - DATALINK ANTENNA
  - GNSS ANTENNA
  - USB Type-C
  - Main Interface (J30J-51PIN)

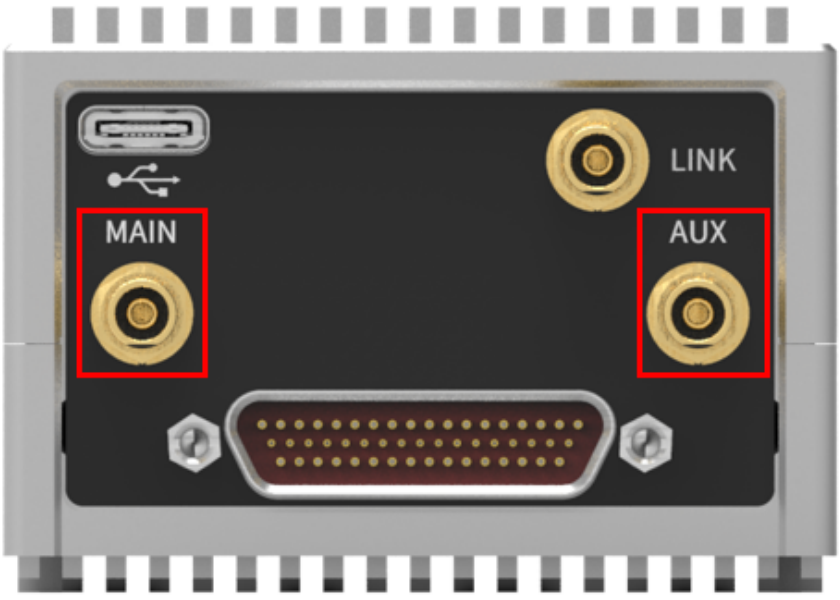
Interface Definition

DATALINK ANTENNA



Built-in datalink antenna, MCX-KK interface.

GNSS ANTENNA

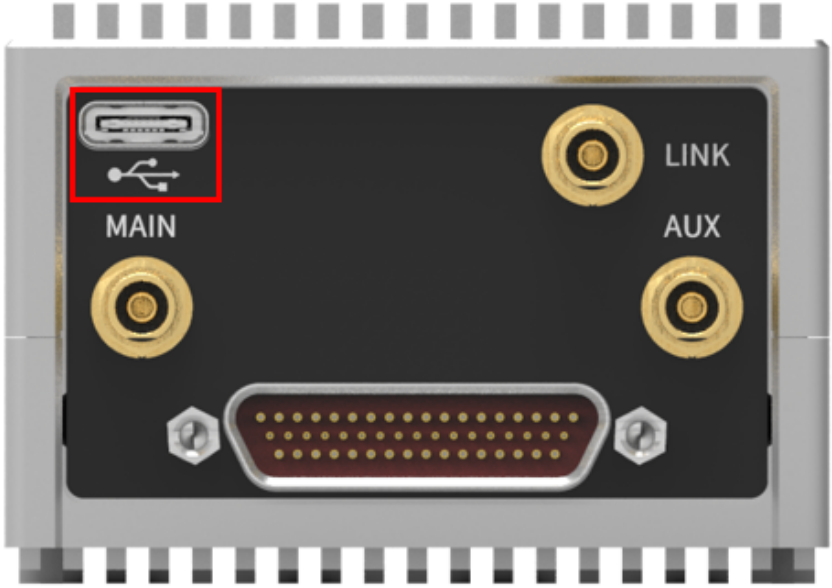


Built-in differential GNSS receiver module antenna interface, MCX-KK interface.

MAIN: Main antenna interface, work independently for positioning.

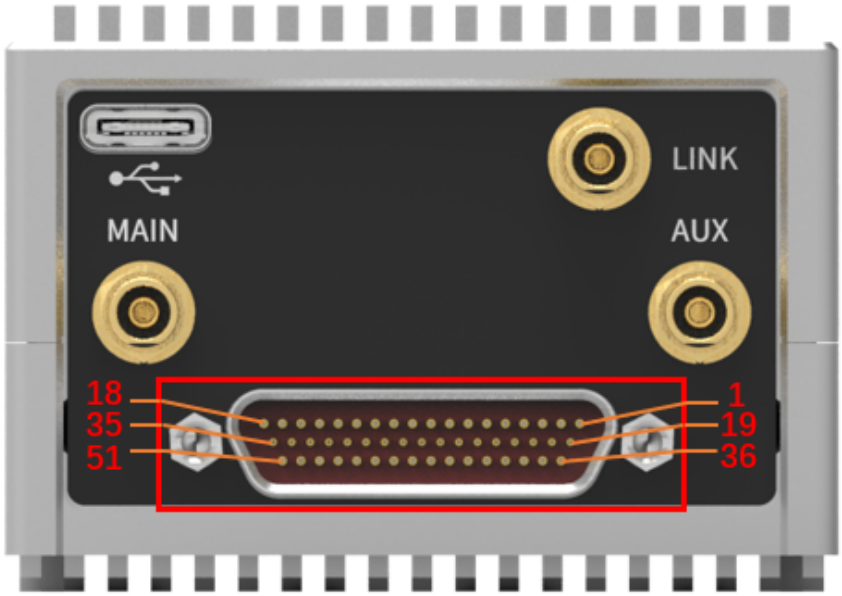
AUX: AUX: Auxiliary antenna interface, used in conjunction with the main antenna for orientation.

USB Type-C



Connect computer through USB Type-C cable, it will be recognized as a USB disk, the onboard PPK data, log and POS data can be exported.

Main Interface (J30J-51PIN)



Definitions:

Pin No.	Definitions	Remarks
1	P1+：Leo2 power supply positive pole, voltage monitoring channel 1 collects this pin.	Power Supply Range: 12V-58V P1+ and P2+ MUST input same voltage level.
2	P-： Leo2 power supply negative pole.	
3	P2+：Built-in datalink power supply positive pole.	
4	232/422: COM1 RS422 / RS232 switching pin	COM1 is set as RS232 by default, connect this pin with P1+ to switch COM1 into RS422.
5	8.4V: Power Output	ONLY be used to power aviation light module, airspeed module and GNSS-compass module. The total output power of 8.4V is less than 10W.
6	GND: Ground	
7	RX1+: COM1 RS232 Data Reception / RS422 Data Reception+	GNC datalink communication interface. Support RS232/RS422 switching by Pin-4 configuration.
8	RX1-: COM1 RS422 Data Reception-	
9	TX1+: COM1 RS422 Data Transmission+	
10	TX1-: COM1 RS232 Data Transmission / RS422 Data Transmission-	
11	GND: Digital Ground	
12	RX5+: COM5 RS232 Data Reception / RS422 Data Reception+	GNC functional serial port. Support RS232/RS422 switching by software configuration.
13	RX5-: COM5 RS422 Data Reception-	
14	TX5+: COM5 RS422 Data Transmission+	
15	TX5-: COM5 RS232 Data Transmission / RS422 Data Transmission-	
16	GND: Digital Ground	
17	CAN1-H: CAN1 Port H	ONLY be used to connect aviation light module, airspeed module and GNSS-compass module.
18	CAN1-L: CAN1 Port L	
19	PWM-1	
20	PWM-2	

21	PWM-3	
22	PWM-4	
23	GND: PWM Ground	
24	PWM-5	
25	PWM-6	
26	PWM-7	
27	PWM-8	
28	GND: PWM Ground	
29	PWM-9	
30	PWM-10	
31	PWM-11	
32	PWM-12	
33	GND: PWM Ground	
34	PWM-13	
35	PWM-14	
36	AD2: Voltage #2 Measurment.	
37	AD3: Voltage #3 Measurment.	
38	GND: A/D Ground	
39	CAN2-H: CAN2 Port H	Reserved for customized CAN devices.
40	CAN2-L: CAN2 Port L	
41	RPM1 / TX4	Measurement interface for RPM (revolutions per minute), support 2 RPM measurement. Able to be configured as COM4 (TTL) function serial port.
42	RPM2 / RX4	
43	Gnd: Digital Ground	
44	Event1: PPK data record trigger pin, falling edge trigger.	PPK data recording trigger interface. Only supports 3.3V trigger level access.
45	Event2: PPK data record trigger pin, rising edge trigger.	
46	Gnd: Digital Ground	
47	Ph-out: Camera trigger signal.	If it has to be connected with the Event pin, it must be configured to 3.3V level.
48	S-out: SBUS Output Interface	Can be connected to SBUS flight servos or task servos.
49	S-in: SBUS input interface, access to airborne RC receiver.	Please make sure that the receiver support 8.4v power supply before connecting.
50	8.4V: Power Output	

51	GND: Ground	

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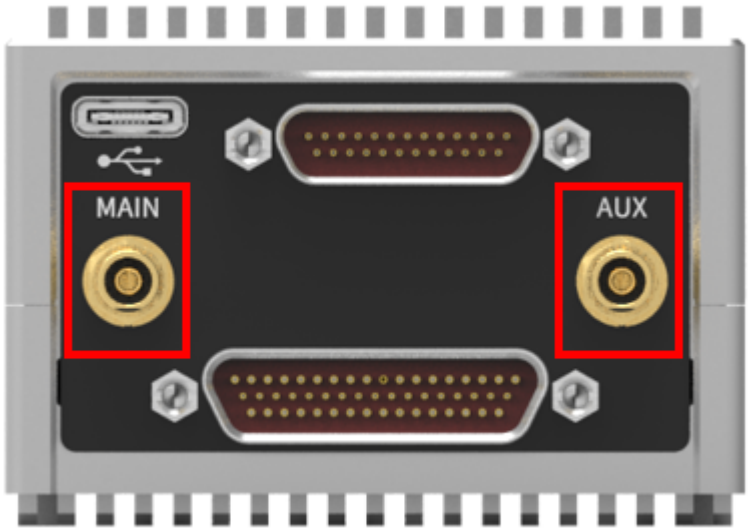
- Interface Definition
    - GNSS ANTENNA
    - USB Type-C
    - Main Interface (J30J-51PIN)
    - Function Interface (J30J-25PIN)

Interface Definition

GNSS ANTENNA



Built-in differential GNSS receiver module antenna interface, MCX-KK interface.

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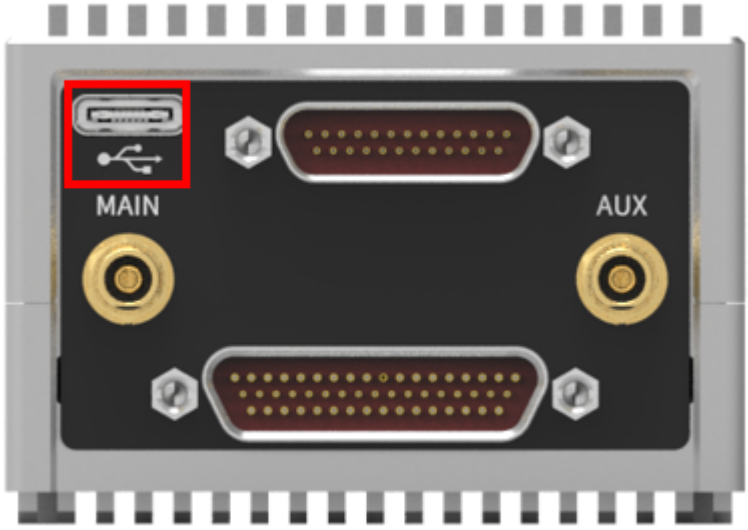
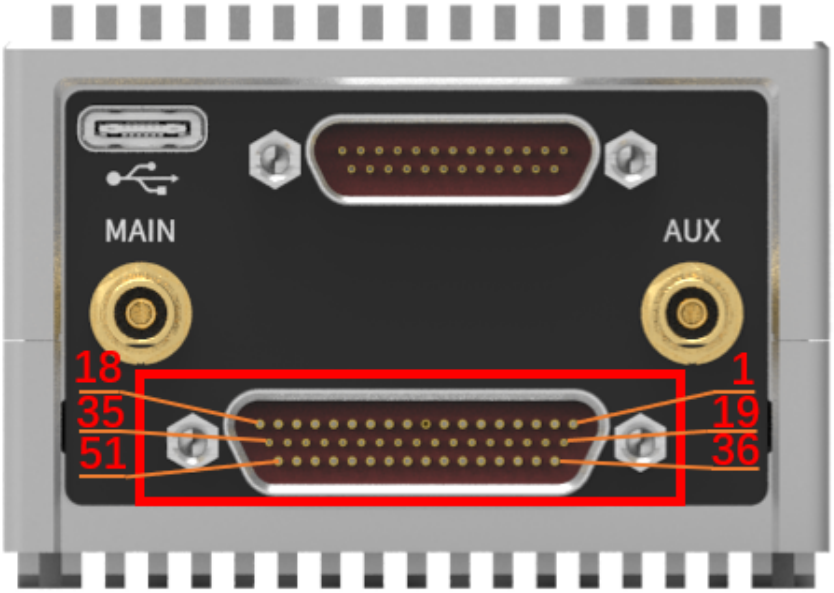
USB Type-C



Connect computer through USB Type-C cable, it will be recognized as a USB disk, the onboard PPK data, log and POS data can be exported.

Main Interface (J30J-51PIN)



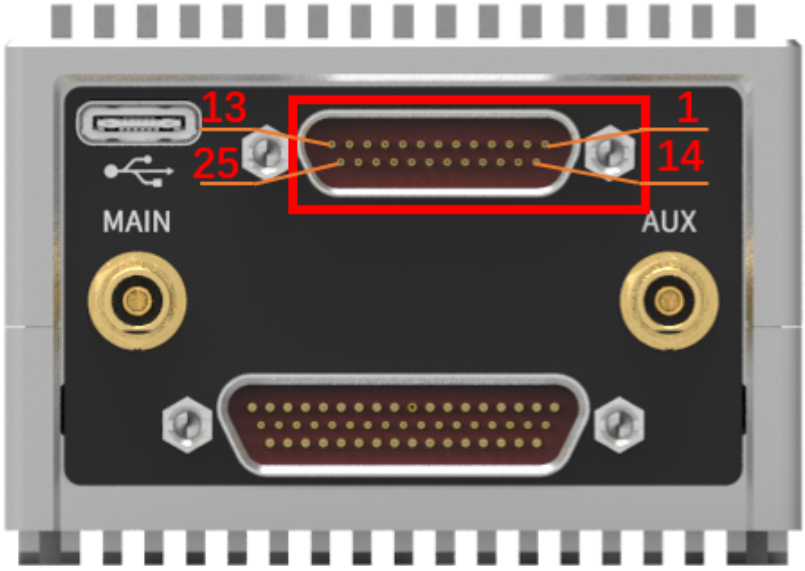
Definitions:

Pin No.	Definitions	Remarks
1	P1+：Leo2 power supply positive pole, voltage monitoring channel 1 collects this pin.	Power Supply Range: 12V-58V P1+ and P2+ MUST input same voltage level.
2	P-： Leo2 power supply negative pole.	
3	P2+：Can be connected to P1+ to improve power supply stability.	
4	232/422: COM1 RS422 / RS232 switching pin	COM1 is set as RS232 by default, connect this pin with P1+ to switch COM1 into RS422.
5	8.4V: Power Output	ONLY be used to power aviation light module, airspeed module and GNSS-compass module. The total output power of 8.4V is less than 10W.
6	GND: Ground	
7	RX1+: COM1 RS232 Data Reception / RS422 Data Reception+	GNC datalink communication interface. Support RS232/RS422 switching by Pin-4 configuration.
8	RX1-: COM1 RS422 Data Reception-	
9	TX1+: COM1 RS422 Data Transmission+	
10	TX1-: COM1 RS232 Data Transmission / RS422 Data Transmission-	
11	GND: Digital Ground	
12	RX5+: COM5 RS232 Data Reception / RS422 Data Reception+	GNC functional serial port. Support RS232/RS422 switching by software configuration.
13	RX5-: COM5 RS422 Data Reception-	
14	TX5+: COM5 RS422 Data Transmission+	
15	TX5-: COM5 RS232 Data Transmission / RS422 Data Transmission-	
16	GND: Digital Ground	
17	CAN1-H: CAN1 Port H	ONLY be used to connect aviation light module, airspeed module and GNSS-compass module.
18	CAN1-L: CAN1 Port L	
19	PWM-1	
20	PWM-2	

21	PWM-3	
22	PWM-4	
23	GND: PWM Ground	
24	PWM-5	
25	PWM-6	
26	PWM-7	
27	PWM-8	
28	GND: PWM Ground	
29	PWM-9	
30	PWM-10	
31	PWM-11	
32	PWM-12	
33	GND: PWM Ground	
34	PWM-13	
35	PWM-14	
36	AD2: Voltage #2 Measurment.	
37	AD3: Voltage #3 Measurment.	
38	GND: A/D Ground	
39	CAN2-H: CAN2 Port H	Reserved for customized CAN devices.
40	CAN2-L: CAN2 Port L	
41	RPM1 / TX4	Measurement interface for RPM (revolutions per minute), support 2 RPM measurement. Able to be configured as COM4 (TTL) function serial port.
42	RPM2 / RX4	
43	Gnd: Digital Ground	
44	Event1: PPK data record trigger pin, falling edge trigger.	PPK data recording trigger interface. Only supports 3.3V trigger level access.
45	Event2: PPK data record trigger pin, rising edge trigger.	
46	Gnd: Digital Ground	
47	Ph-out: Camera trigger signal.	If it has to be connected with the Event pin, it must be configured to 3.3V level.
48	S-out: SBUS Output Interface	Can be connected to SBUS flight servos or task servos.
49	S-in: SBUS input interface, access to airborne RC receiver.	Please make sure that the receiver support 8.4v power supply before connecting.
50	8.4V: Power Output	

51	GND: Ground	

Function Interface (J30J-25PIN)



Pin No.	Definitions	Remarks
1	Fu_Rx3+: RS232 Data Reception / RS422 Data Reception+	Serial port-3 from function processor. Support RS232/RS422 switching by software configuration.
2	Fu_Rx3-: RS422 Data Reception-	
3	Fu_Tx3+: RS422 Data Transmission+	
4	Fu_Tx3-: RS232 Data Transmission / RS422 Data Transmission-	
5	GND: Digital Ground	
6	Fu_Rx4+: RS232 Data Reception / RS422 Data Reception+	Serial port-4 from function processor. Support RS232/RS422 switching by software configuration.
7	Fu_Rx4-: RS422 Data Reception-	
8	Fu_Tx4+: RS422 Data Transmission+	
9	Fu_Tx4-: RS232 Data Transmission / RS422 Data Transmission-	
10	Fu_CAN2_H	Reserved
11	Fu_CAN2_L	
12	GND: Digital Ground	
13	5V: Power Output	The limit of power output is 1w. It is strictly forbidden to supply power to any radio, servo, motor and other high power consumption equipment.
14	Fu_Rx5+: RS232 Data Reception / RS422 Data Reception+	Serial port-5 from function processor. Support RS232/RS422 switching by software configuration.
15	Fu_Rx5-: RS422 Data Reception-	
16	Fu_Tx5+: RS422 Data Transmission+	
17	Fu_Tx5-: RS232 Data Transmission / RS422 Data Transmission-	
18	GND: Digital Ground	
19	FU_PWM_1:	For Task Servos
20	FU_PWM_2:	
21	FU_PWM_3:	

22	FU_PWM_5:	
23	GND: Digital Ground	
24	FU_AD1:	Range: 0-58V
25	FU_AD2:	

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- Indicators

Indicators

Leo2		
Indicator	**Description**	**Status**
● ——	POW keep on	Power supply OK
● -----	RUN fast flash (5HZ)	Working
● – – –	GNSS slow flash (1HZ)	Satellite Fixed, low accuracy position
● ——	GNSS keep on	Satellite Fixed, high accuracy position
● -----	LINK fast flash	Receiving data
● – – –	DATA slow flash (5HZ)	Flashing once means to record PPK data once.
● – – –	FUNC slow flash (1HZ)	Build-in datalink powered on, but not paired (Leo2-PNP & Leo2-AVD). The function processor working (Leo2-PRO).
● -----	FUNC fast flash (5HZ)	The function processor upgrading (Leo2-PRO).
● ——	FUNC keep on	Build-in datalink working (eo2-PNP & Leo2-AVD).
	FUNC off	Build-in datalink issue or not powered (Leo2-PNP & Leo2-ADV). The function processor issue (Leo2-PRO).
● —— ● – – – ● – – –	POW keep on, RUN off, GNSS and LINK slow flash (0.5HZ)	Updating firmware

SuperNova- Aviation Lights definition		
Indicator	**Description**	**Status**
● – – –	Yellow slow flash	Satellite not fixed
● – – –	Green slow flash	Satellite fixed and flight mode is standby or attitude RC
● – – –	Blue slow flash	Satellite fixed and flight mode is position RC
● ●	Red and yellow lights flash alternately	Magnetic compass disturbed
● - - - - -	Yellow fast flash	Lost RC and GCS connection
● – – –	Red slow flash	Attitude over 15° in Standby mode
● - - - - -	Red fast flash	Voltage low
● ●	Blue and yellow lights flash alternately	Leo2 low temperature

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- Redundancy Scheme

Redundancy Scheme

Default Hardware Redundancy:

1. 4-redundancy IMU
2. Dual redundant GNSS receivers
3. Triple redundancy yaw measurement

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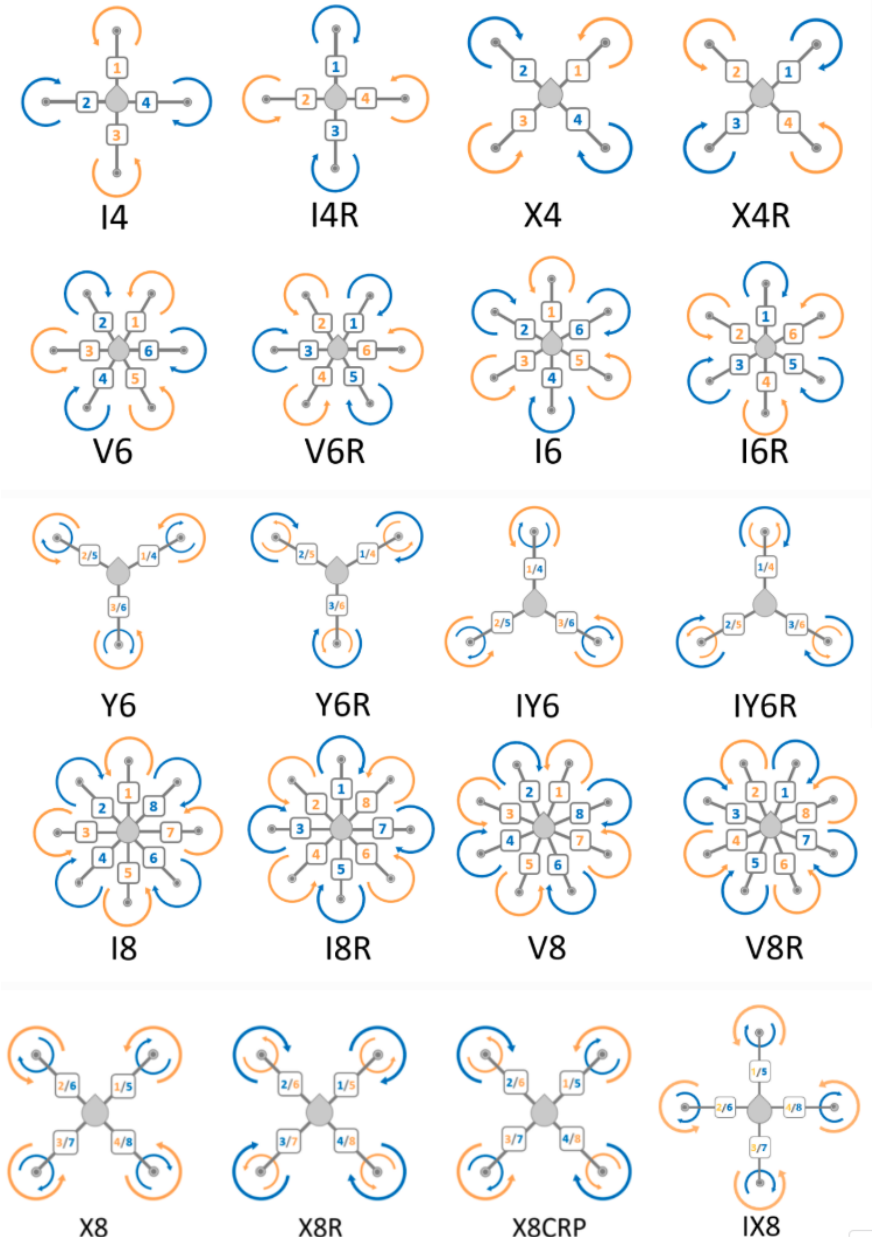
- Preparation
  - 1. Multirotor Drone
  - 2. Datalink and RC
  - 3. Power Supply
  - 4. Related Software

Preparation

You need to prepare the following equipment to work with GNC:

1. Multirotor Drone

Prepare a multi-rotor drone that meets the following layout.



2. Datalink and RC

Datalink

RS232 interface, baud rate 115200 and transparent transmission, AheadX DL900 datalink is recommended.

LEO2-PNP and LEO-ADV have integrated data link internally.

Radio Transmitter and Receiver

RC Requirements

1. Support SBUS or SBUS2, 11 channels at least (For example: FUTABA T8FG/T14SG).
2. At least two configurable 3-stage switchers; at least two configurable 2-stage switchers; and at least two configurable slide lever.
3. Set RC into normal speed mode (70Hz), do not use high speed mode (140Hz). The normal mode fully meets the RC control requirements of all drones. High speed mode may cause transmission instability. Please refer to the manual of the RC used for switching between normal mode and high-speed mode.

RC Connection

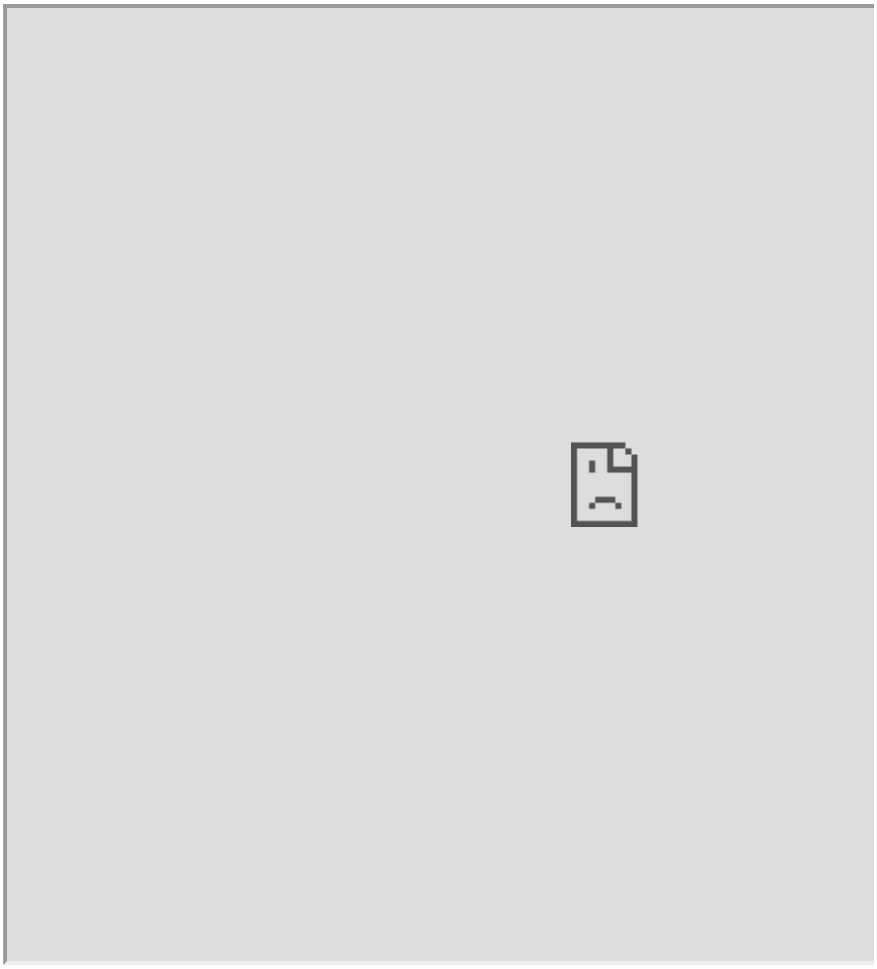
GNC support 2 mode of RC connection:

1. The receiver is directly connected to GNC S-IN interface. It is generally suitable for close range radio control within visual range.
2. RC Receiver is connected to AheadX Space software (GCS) via SBUS-USB converter. The control distance of RC is determined by the communication distance of the datalink used. Before connecting the RC, it can be used only after configured.

Futaba Configuration Example：

For example as Futaba 14SG, Click to read detailed configuration steps.

Multirotor RC configuration video:



Other RC Communication Standard:

If other brands of RC is used, the range requirements of SBUS are as follows:

CH1 (Roll); CH4 (Yaw): Left 364 - Mid 1024 - Right 1684;

CH2(Pitch); CH3 (Lifting): Down 364 - Mid 1024 - Up 1684;

CH5: Not in use;

CH6: Not in use;

CH7 (RC mode switch): Stage 1 (Position RC mode) 511; Stage 2 (Empty) 1024; Stage 3 (Attitude RC mode) 1541;

CH8: Not in use;

CH9 (Headless mode): Stage 1 (Enable headless) 511; Stage 2 (Disable headless) 1541:

CH10 (Open parachute, disabled by default): Stage 1 (Open parachute) 511; Stage 2 (Close parachute) 1541.

3. Power Supply

The input voltage range of GNC is 7~53V, support 2S~12S Li-Po battery.

GNSS-compass module and aviation light module are able to be powered by CAN ports from GNC (8.4V), if they need independent power supply, the input voltage range is 7~28V.

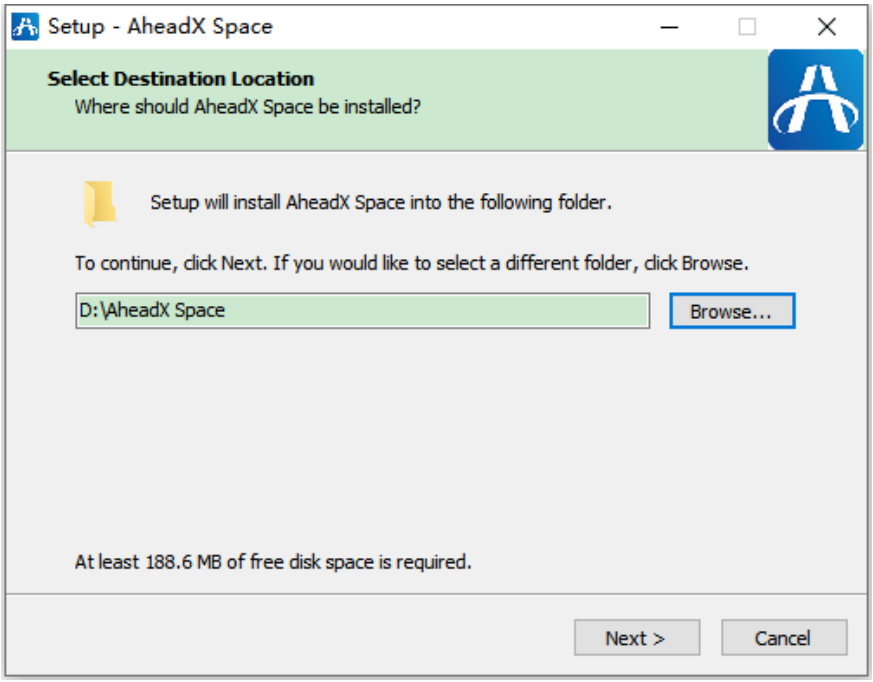
4. Related Software

Download the latest version of AheadX Space (GCS), AheadX Master (Parameters configuration), and Firmware updating tool.

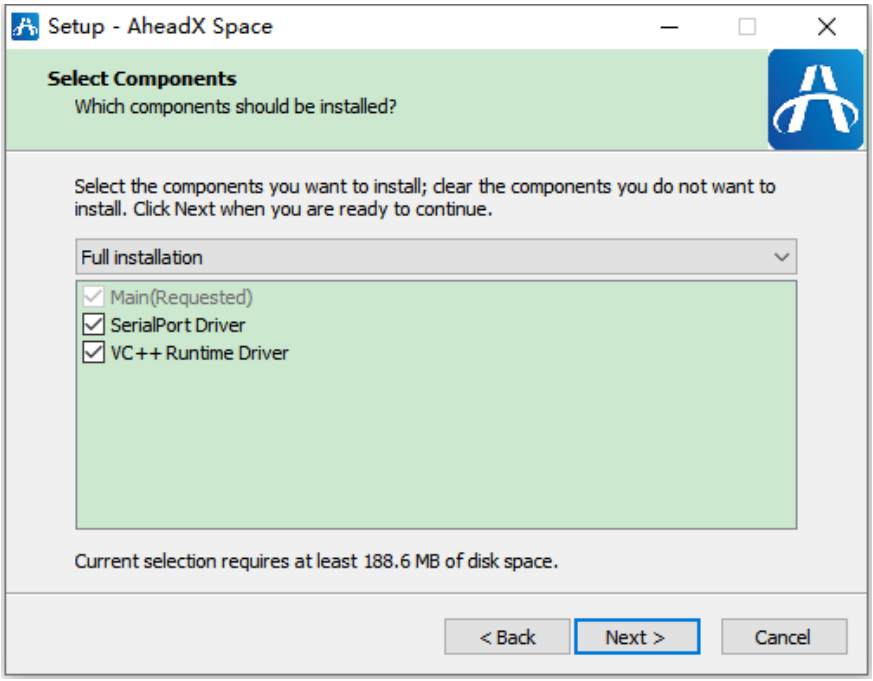
Download AheadX Space

Download AheadX MasterEasy

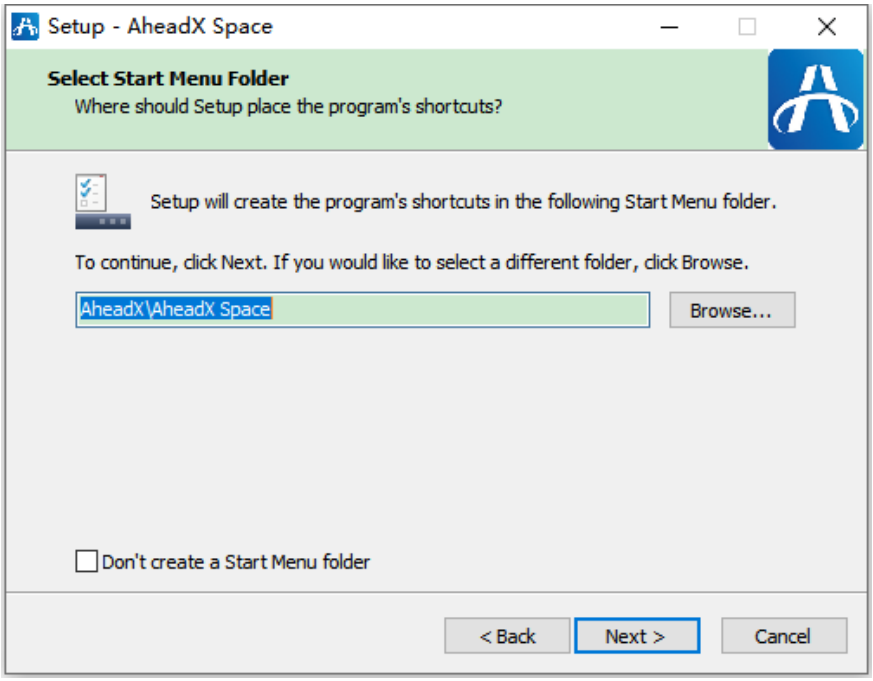
Double click to start software installation, select install location. In order to avoid auto log recording function being forbidden by system firewall protection, do not install the software in your system driver.



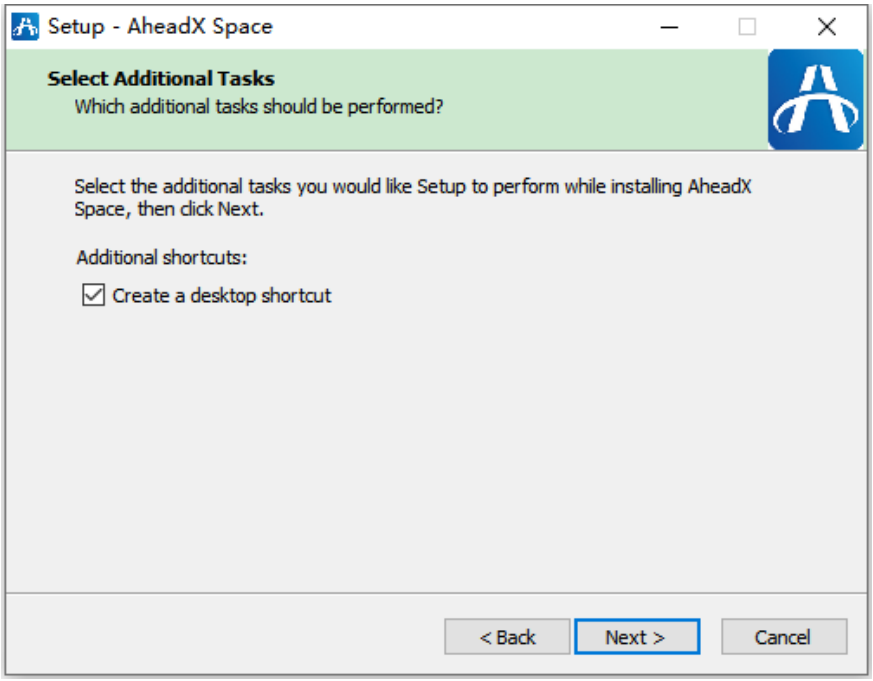
Go next


Setup - AheadX Space
Select Components
Which components should be installed?
Select the components you want to install; clear the components you do not want to install. Click Next when you are ready to continue.
Full installation
Main(Requested)
SerialPort Driver
VC++ Runtime Driver
Current selection requires at least 188.6 MB of disk space.
< Back
Next >
Cancel

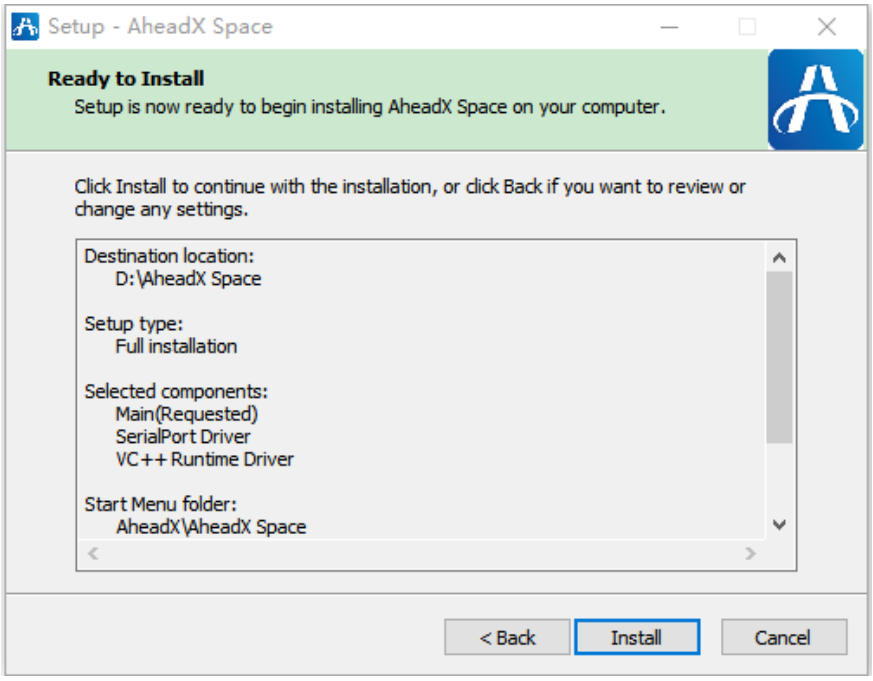
Next


Setup - AheadX Space
Select Start Menu Folder
Where should Setup place the program's shortcuts?
Setup will create the program's shortcuts in the following Start Menu folder.
To continue, click Next. If you would like to select a different folder, click Browse.
AheadX\AheadX Space
Browse...
Don't create a Start Menu folder
< Back
Next >
Cancel

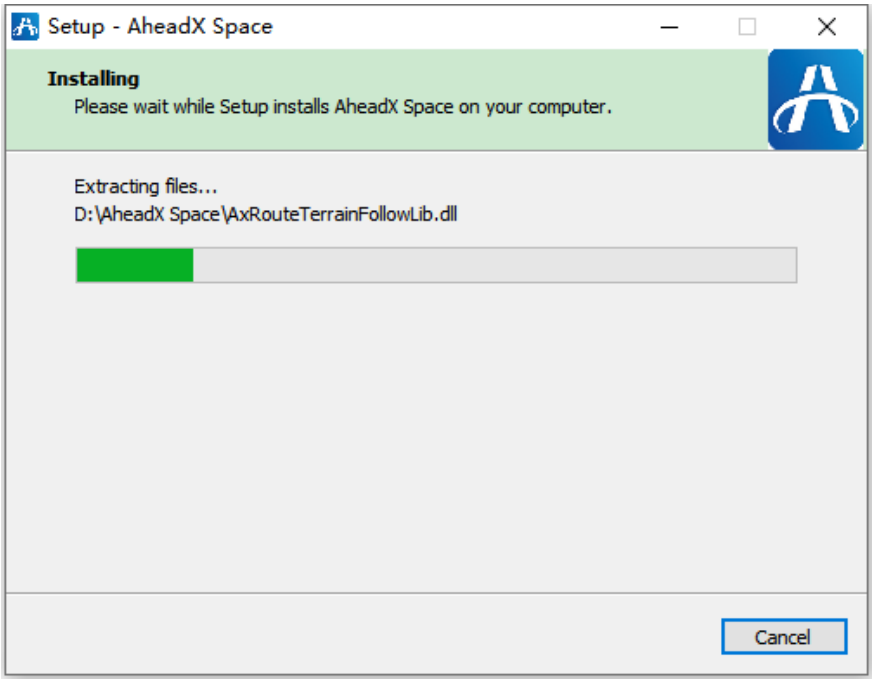
Next



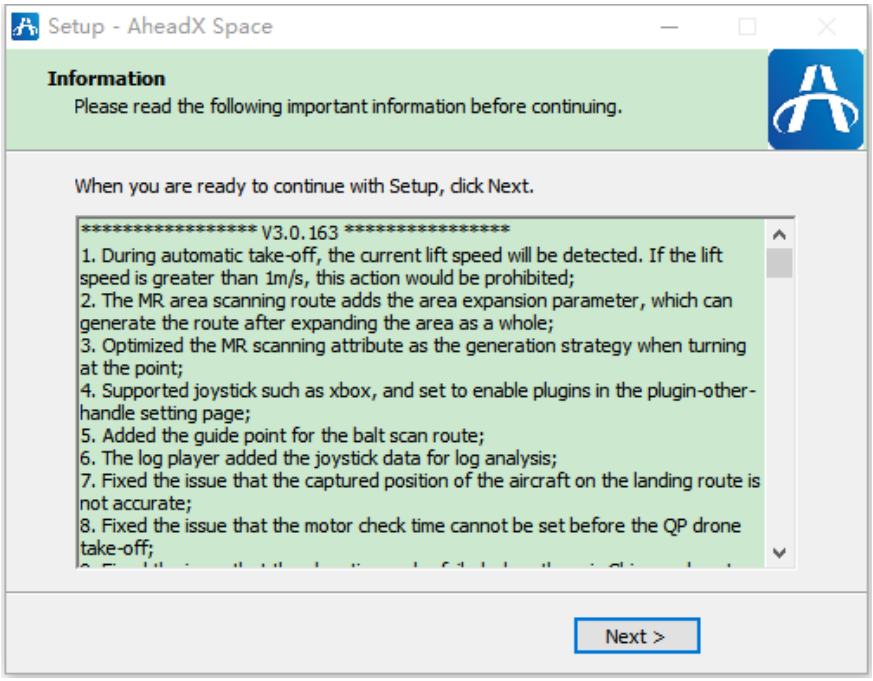
Start installation



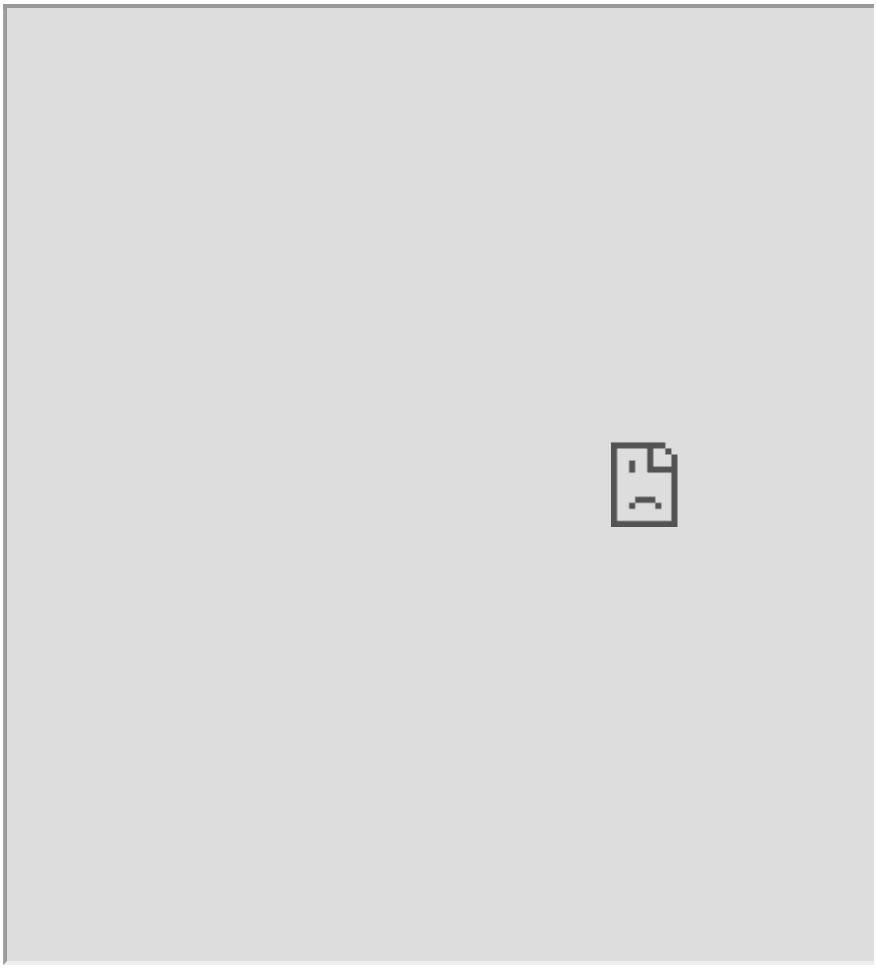
Wait for process complete



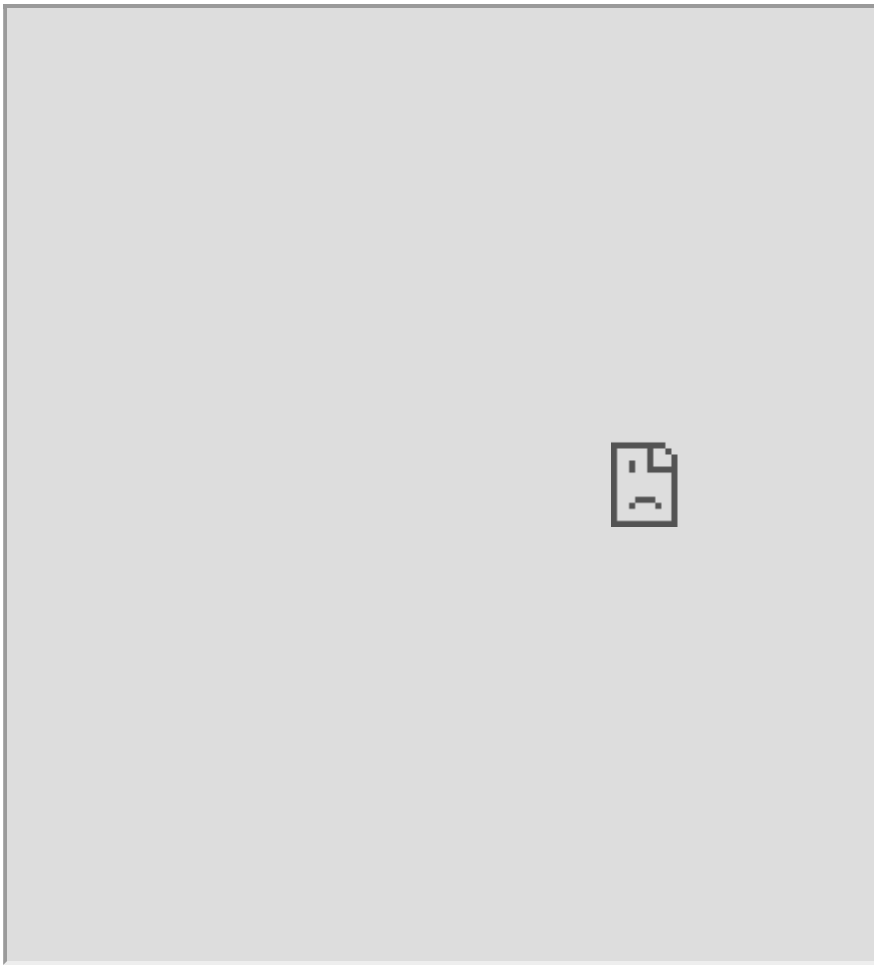
Read release note carefully after installation



GCS Software Installation Video



AheadX Master Installation Video



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- Redandency Scheme

Redandency Scheme

Default hardware redundancy:

1. 4-redandency IMU
2. Dual redundant magnetic compass

Redundancy expansion: Access AheadX DG3 differential positioning and orientation system

1. Dual redundant GNSS receivers
2. Triple redundancy yaw measurement

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- Desktop Connection - PNP
  - Power Connection
  - GNSS-compass Connection
  - Aviation Light Connection
  - System Connection
  - GCS Communication

Desktop Connection - PNP

Power Connection

Please make essential test on desktop before installation.

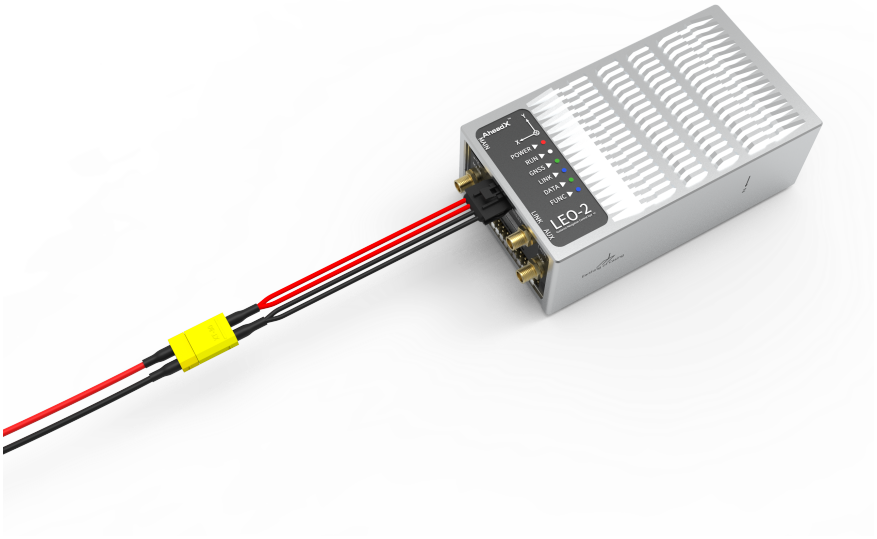
Find power cable from the box, as shown in the picture below:

Weld the power plug as required:

During welding, please pay attention to the positive and negative poles of the power supply. It must be consistent with the battery. If the welding is reversed, the device will be damaged directly.

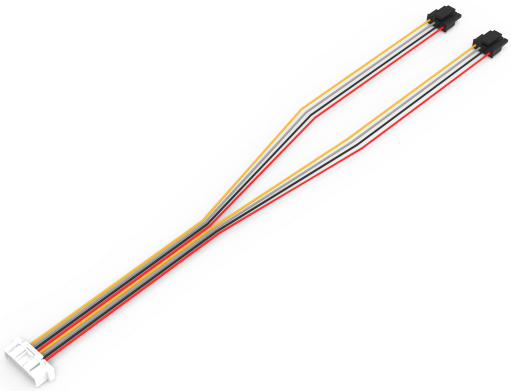
After welding, connect the power cable to the "POWER" interface of device. When inserting, it is necessary to hear the "click" sound of the lock catch, so that the connection is firm.

Then connect 7-53v power supply to the device, the POW led will keep being on, and the RUN led will flash, proving that the device is working, as shown below:

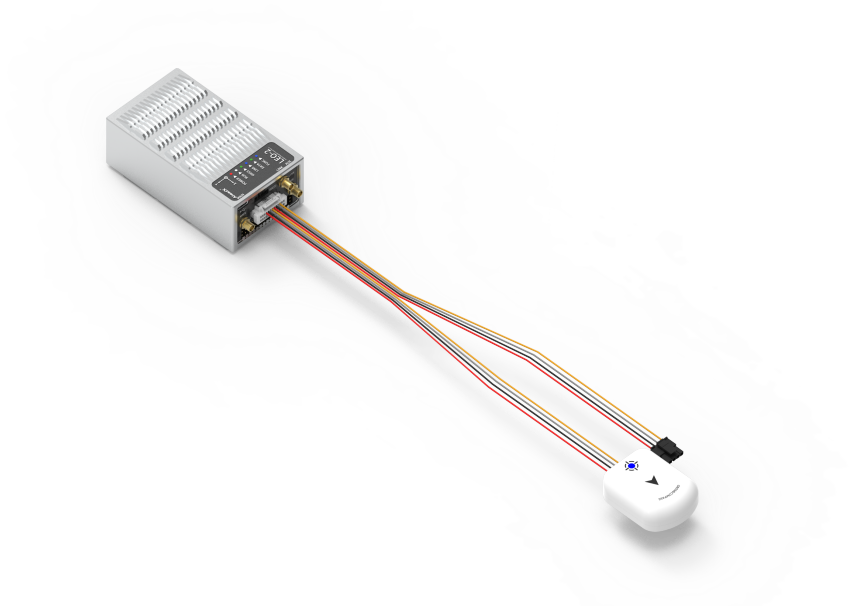


GNSS-compass Connection

Find function interface cable from the box



One end with buckle is connected to GNSS-compass module, the other end is connected to Leo2, as shown below

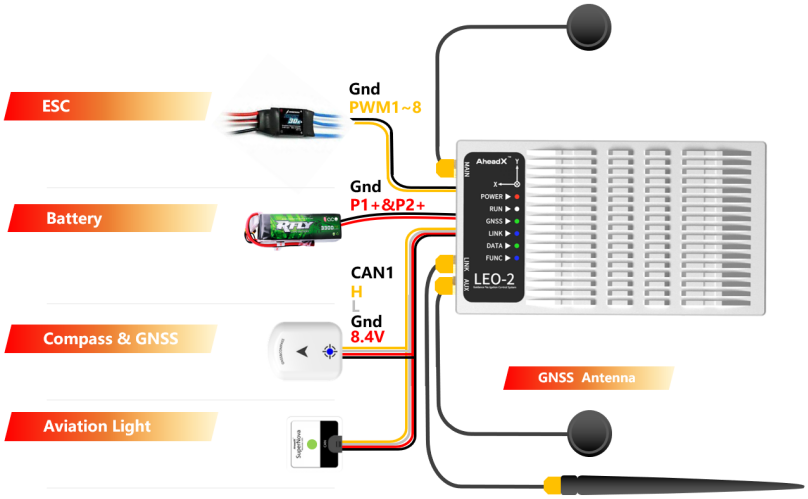


Aviation Light Connection

Same way as GNSS-compass module, connect to the Leo2 main body.

System Connection

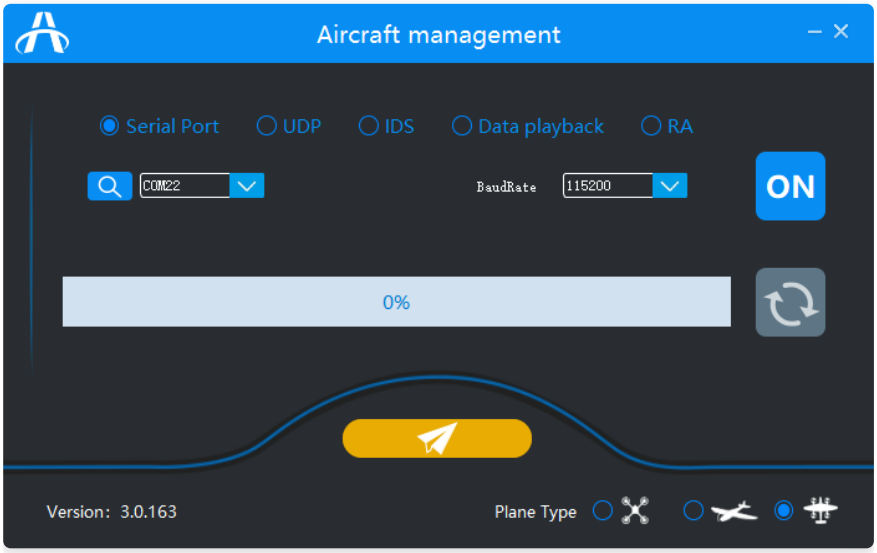
When the desktop connection is completed, as shown in the following figure:



机载端

GCS Communication

Connect the ground terminal of datalink to the computer through micro USB cable, and open the software of AheadX Space GCS.



Select the serial port corresponding to the datalink, and click the 'ON' button, After successful connection, click , after the progress bar is completed, click to start up GCS software.

When the device can be identified and the telemetry can be shown, indicating that the Taurus2 is connected successfully.

Datalink(ground terminal)

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2020-10-10 16:45:48

- Start Installation
  - LEO-2 Main Body
  - GNSS-Compass
  - Aviation Light Module
  - Multirotor's ESC Connection
  - System Connection

Start Installation

LEO-2 Main Body

Wiring Requirement

Due to the need to connect with other avionics equipment, cable welding or plug connection will be involved. In order to ensure reliability, the following points should be paid attention to:

1. Use **high temperature , high strength, silver plated cable** as far as possible. In any environment, it is strictly forbidden to have cable **inner core broken, outer skin damaged, welding resistance too high** and so on.
2. The connector with self-locking structure should be selected for the connection plug. In order to Improve connection reliability, **fasten and glue** the key points.

Electromagnetic Compatibility

The installation position of GNC shall be far away from the following equipment:

1. Keep away from high-power magnetic equipment such as motor, ESC and gimbal;
2. Keep away from high current power supply wire, power distribution circuit board and other components which are easy to produce electromagnetic interference;
3. Keep away from radio transceiver with high power radiation capability;
4. Keep away from engine to avoid dual strong interference of magnetic and vibration;
5. Keep away from the equipment with magnetic screw and large metal structure which may produce constant deflection interference to magnetic compass.

Installation Suggestions:

1. No power supply wire, magnetic screw, etc. within **10cm** range of Taurus2; no motor, gimbal and other magnetic moving equipment within **15cm** range; Taurus2 should be away from the engine **30cm** or farther away;
2. A bracket can be used to lift the satellite compass module away from the magnetic interference source of the aircraft, so that the system can still operate normally even if the interference problem of the internal compass in GNC cannot be effectively solved.

In case of servo shaking and poor GNSS positioning quality, check and shield the following equipment:

1. High power radio transmitting equipment with poor shielding effect, power supply wire, magnetic equipment, etc;
2. If the PWM control signal is interfered by electromagnetic field for the high-power radio transmitting equipment and transmitting antenna with poor shielding effect, abnormal conditions such as rudder shaking may occur, which may cause control hidden trouble;
3. If the airborne electromagnetic environment is not good, anti-interference equipment such as magnetic ring, shielding net can be considered.

Structural Interference

If it is necessary to install the damper structure, it may cause the GNC to follow the shaking due to the vibration of the body. In the motion stroke of damper structure, do not produce collision or other contact, so as to avoid unpredictable motion interference. In the motion interference of sudden impact, GNC can't judge whether it is caused by flight motion or structure interference, and the flight fault caused by this is man-made reason.

Installation

Taurus2 only supports horizontal installation to ensure that the internal damper structure works in the best state.

We strongly suggest that Taurus2 should only be installed horizontally (the Yaw angle can be changed), and too large installation inclination angle will lead to the internal damper structure working in a non optimal state. The following four installation angles are supported by default:

During installation, the silk screen coordinates of the GNC shell shall be consistent with the coordinates shown in the figure.

To fine tune the angle, follow the following rules:

1. If possible, the GNC should be installed in the forward direction as far as possible (the X forward arrow points to the nose direction, and the Y forward arrow points to the right), so that the installation angle does not have to be adjusted.
2. If it is necessary to adjust the angle for installation, the installation angle must be accurately known as the software correction value. If the value does not correspond to the installation, it may lead to poor flight effect and even cause flight accidents.
3. The installation angle adjustment follows the Euler angle transformation principle and the right-hand principle (thumb points to the positive direction of the rotation axis, and the bending direction of the four fingers is the positive rotation direction). The reference coordinate system is the airborne coordinate system, and the rotation coordinate system is the GNC body coordinate system, that is, each rotation rotates around the coordinate axis marked on the GNC outer shell.

4. The installation angle parameters are set in strict order: First rotate the yaw axis (that is, rotate around the Z axis, where the parameter can only be non negative number 0 ~ 360); Then rotate the pitch axis (i.e. rotate around the y-axis, where the parameter range can be - 90 ~ + 90. However, it is recommended that the installation angle range should not exceed - 5 ~ + 5); Finally, rotate the roll axis (i.e. rotate around the x-axis, where the parameter can be - 180 ~ + 180. It is also recommended that the installation angle range should not exceed - 5 ~ + 5).

After installation, how to configure the installation parameters will be described in the following parameter setting section.

GNSS-Compass

The GNSS-compass module support GPS / GLONASS (or Beidou). When installing the module, try to keep away from the following equipment:

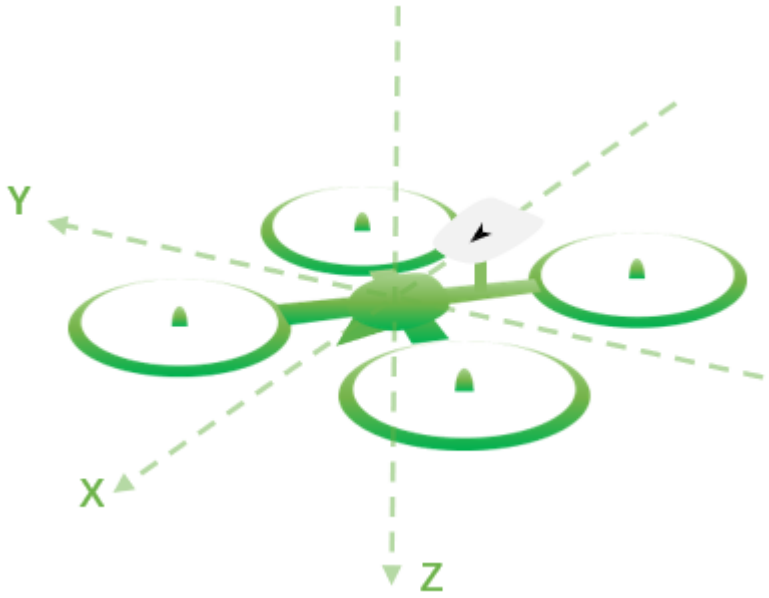
1. Keep away from high-power electrical equipment such as motor, ESC and gimbal;
2. Keep away from high current power supply wire, power distribution circuit board and other components which are easy to produce electromagnetic interference;
3. Keep away from radio transceiver with high power radiation capability;
4. Keep away from engine to avoid dual strong interference of magnetic and vibration;
5. Keep away from the equipment with magnetic screw and large metal structure which may produce constant deflection interference to magnetic compass.
6. Avoid using radio equipment in the frequency range of 1.2Ghz~1.25Ghz and 1.55Ghz~1.65GHz.

Pay attention to the following matters during installation:

1. It is suggested that the GNSS-compass module should be raised through the support rod, and should not be installed in the cabin or other enclosed space;

2. The surface of the GNSS-compass module can not be covered with metal materials such as copper foil, or microwave absorbing materials such as carbon fiber, or the signal quality will be greatly affected, and the aircraft will not be able to accurately locate and orient;

3. Please note that the GNSS-compass module must be installed horizontally (silk screen facing up), and the arrow direction should be consistent with the nose direction. Otherwise, the heading measurement will be abnormal, which will **affect the flight safety** .



Installation Diagram of GNSS-Compass Module

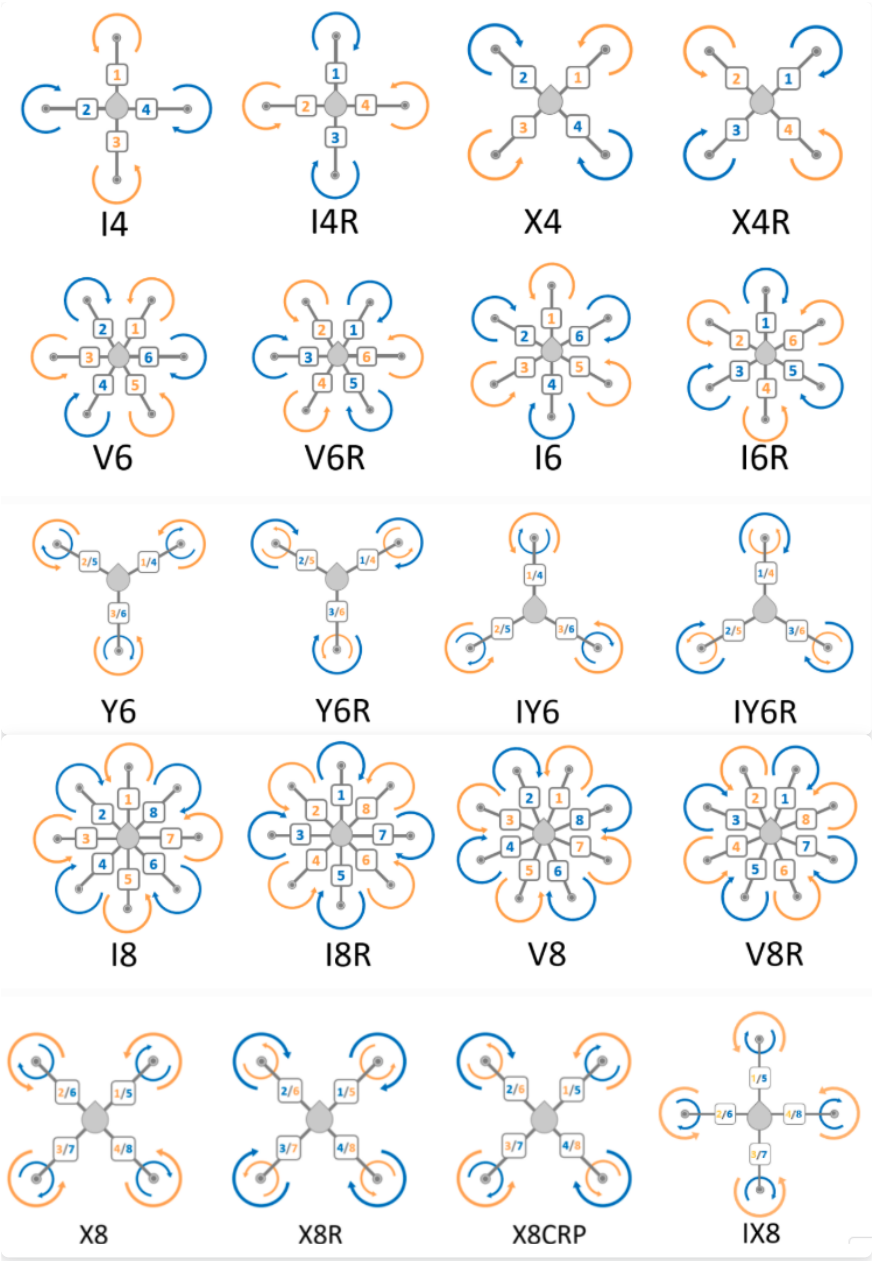
After installation, how to configure the installation parameters will be described in the following parameter setting section.

Aviation Light Module

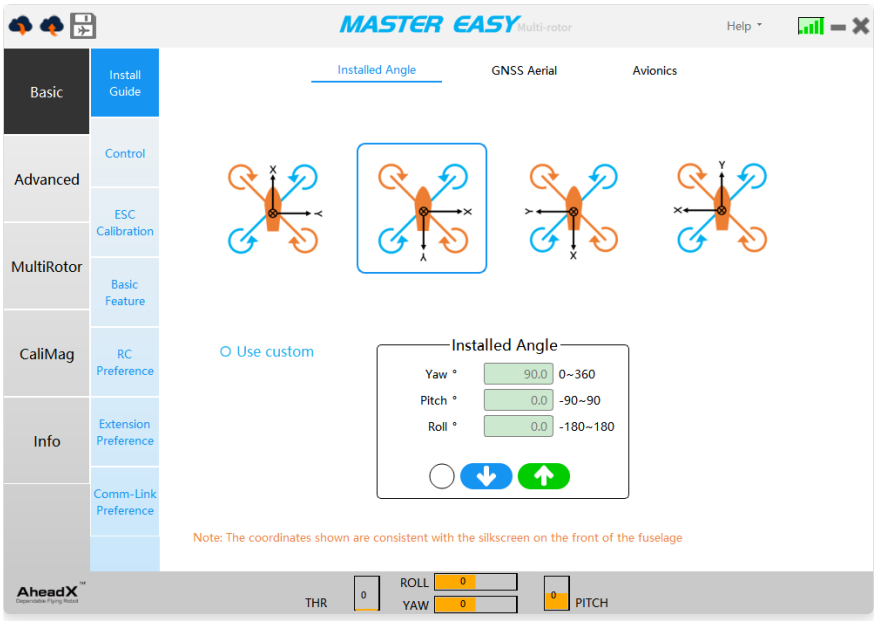
The aviation light module can be used as status light and navigation light. The multirotor UAV is used as the status light by default. It is generally installed in the tail of UAV, and it is easy to observe.

Multirotor's ESC Connection

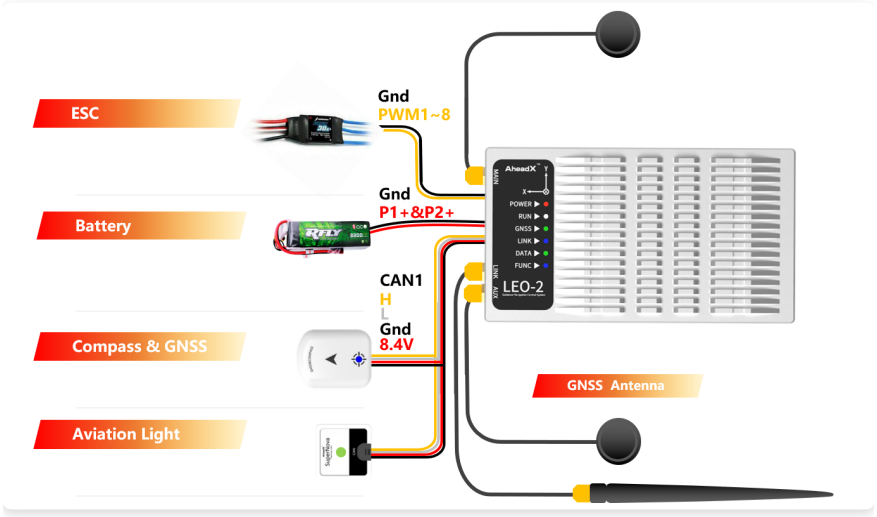
The number in the figure below represents the number of Taurus2 PWM output. Connect the ESC signal to Taurus2 PWM channel 1 to channel 8 as shown in the figure below.



Please connect the PWM signal according to your airframe, as shown in the following figure:



System Connection



Airborne

When the RC receiver is directly connected to the GNC S-IN interface, the control distance of RC is affected by itself, which is generally suitable for the application of short distance remote control within the visual range.

The RC receiver can access the software of AheadX Space through SBUS to USB converter. The control distance of RC is determined by the datalink used. Under ideal conditions, the effective control distance of RC can be increased to over 10km after using DL900.

Ground

The ground terminal of DL900 datalink can be connected in the following ways:

1. A stable and reliable micro USB cable is used to connect PC and datalink;
2. USB to RS232 cable is used to connect the 5pin interface of datalink, and external power supply is used to improve the stability of power supply.

After the system connection is completed, as shown in the figure below:

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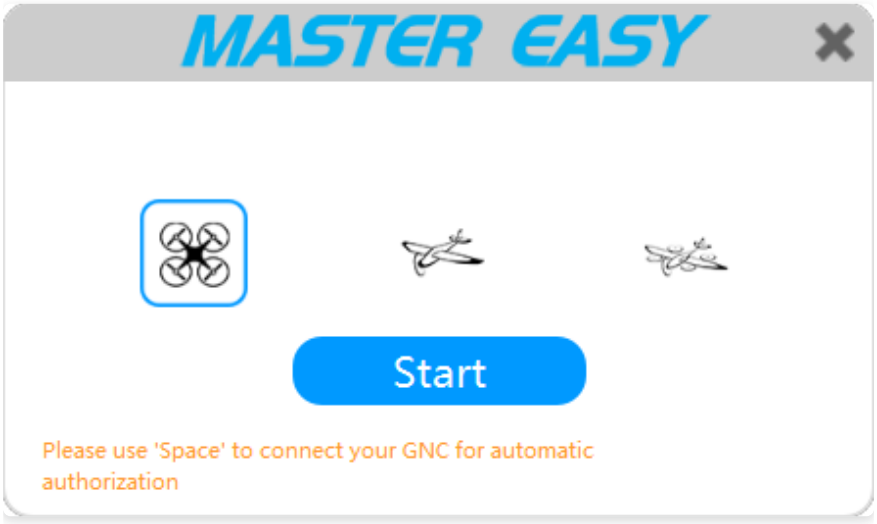
- Installation Parameters
  - ESC Calibration
  - Compass Calibration

Installation Parameters

Master Easy Connection

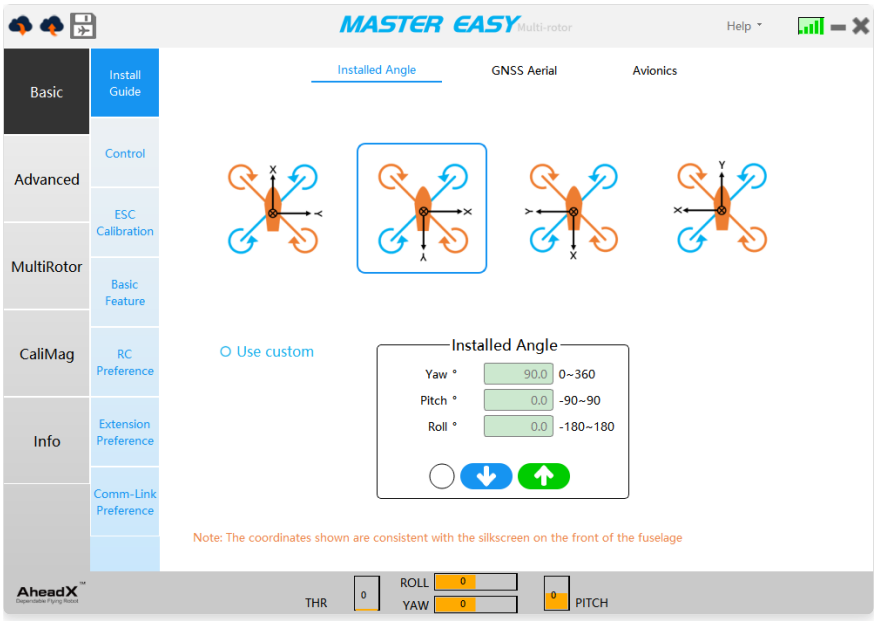
After installation, power on all equipment except power system. Open the software of AheadX Space GCS, select the serial port corresponding to the datalink, and click the 'ON' button, After successful connection, click , after the progress bar is completed, click to start up GCS software.

Open Master Easy parameters software, the software will automatically identify the device version and authorize itself, After waiting for the prompt in the lower left corner that the authorization has been automatically obtained, click the enter button.



Installation Orientation

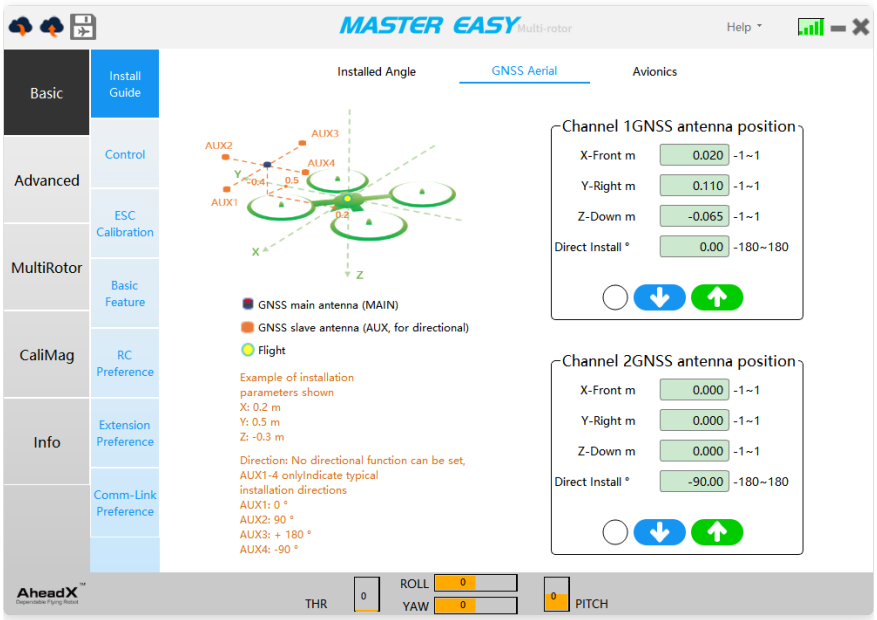
The coordinates in the figure below are consistent with the screen printing on the front of the GNC. Select the same option as the actual installation mode, click button to send.



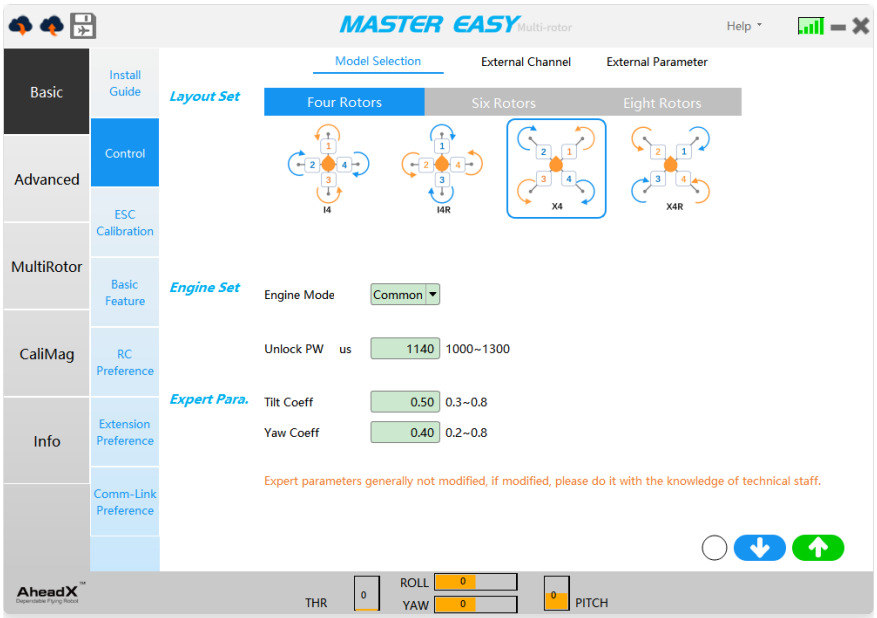
GNSS Position Adjustment

Taurus2: Write XYZ calibration data to channel 1 GNSS antenna position as shown in the figure below (The GNSS-compass module is the GNSS main antenna of channel 1), click to send.

Leo2: Write XYZ calibration data and direction value to channel 1 (MAIN and AUX antenna) as shown in the figure below; and Write XYZ calibration data to channel 2 GNSS antenna position (The GNSS-compass module is the GNSS main antenna of channel 2), click to send.



Control Channel Assignment



Layout Set:

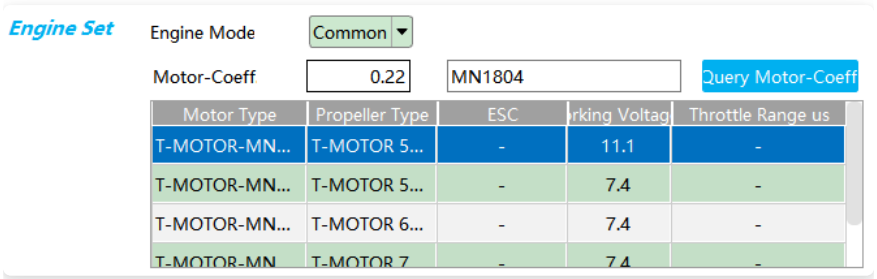
According to the diagram, select the layout settings consistent with the actual UAV.

It is forbidden to modify the layout set when the drone is powered on and the propeller is installed!

Power Setting:

Power Mode: The default is common, which is suitable for most power systems. If 'common' can not achieve better flight effect, Users can try to specify the power model as shown in the figure below, input the power model, click to query the power coefficient, the software will pull the corresponding model power parameters from the cloud, and select the power parameters consistent with the actual use.

The query of dynamic coefficient needs to be connected to internet.



Unlock Pulse Width： Motor starting pulse width, minimum speed in flight, reference settings 1140-1200.

Expert Parameters

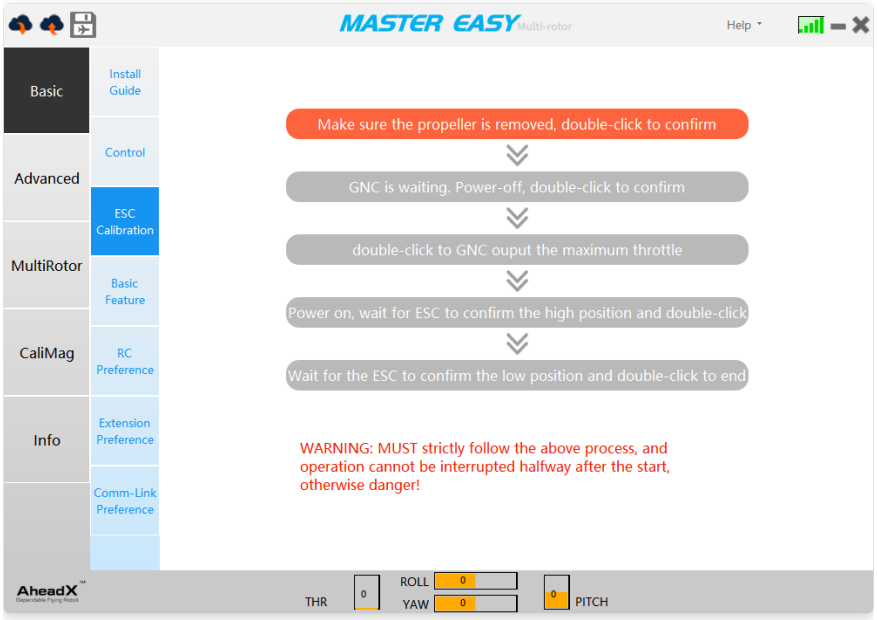
Use the default. If you need to modify it, please do it under the guidance of AheadX technicians.

After parameter adjustment, click to send, click to save.

ESC Calibration

Power up the GNC separately, open Master Easy software, operate as graphic shown.

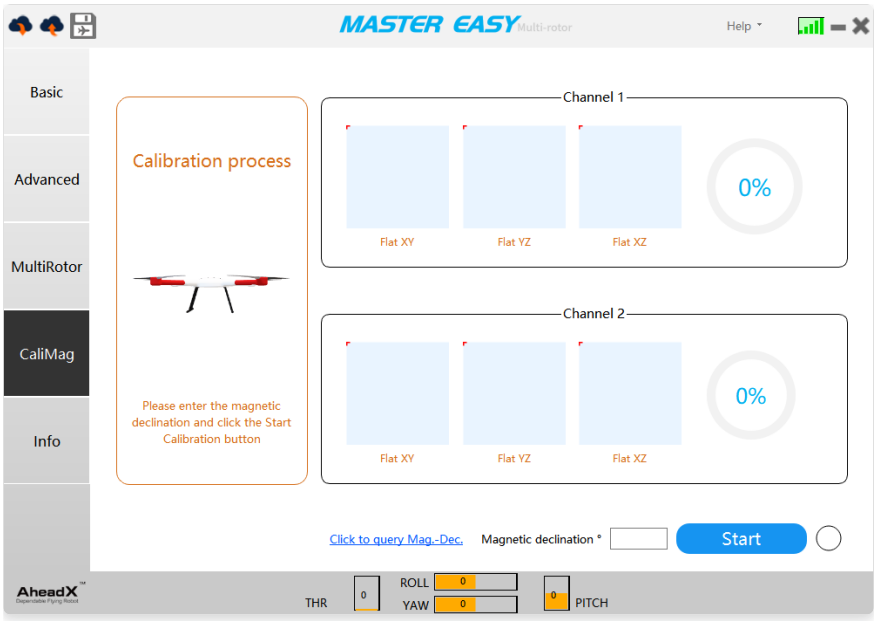
Please note that the ESC calibration process is applicable to HobbyWing series. If other brands of ESC are not applicable, please refer to the relevant third-party user manual.



Compass Calibration

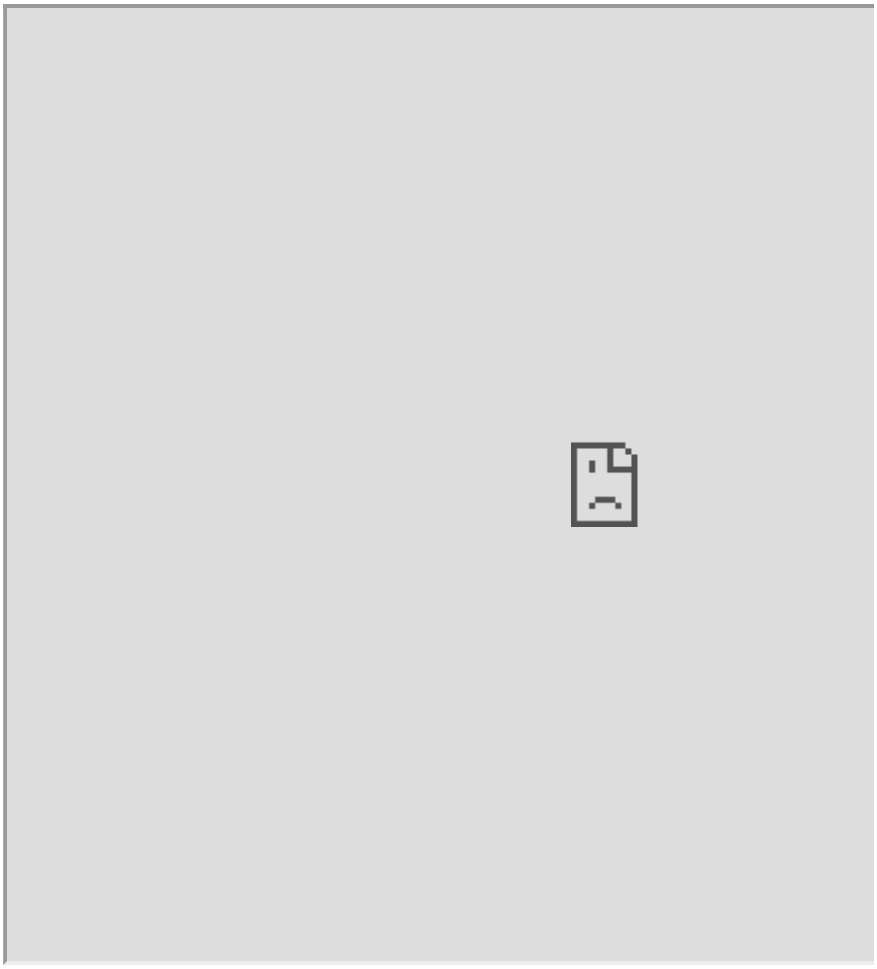
Use Master Easy to make compass advanced calibration of GNC, Please do this operation when installing the UAV for the first time or when the magnetic compass has abnormal conditions that cannot be accurately checked.

Please strictly follow the software calibration process prompts to complete the operation.



When GNC performs advanced calibration of magnetic compass, it will calibrate the internal magnetic compass and GNSS-Compass module at the same time.After completing the advanced calibration, it is necessary to carry out pre takeoff inspection - magnetic compass status check.

Magnetic Compass Calibration



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- Reading Tips
  - Flight Inspection Wizard
    - Task Register*
    - Manual Check
    - Sensor Status
    - Compass Status
    - RC Status
    - Actuator Inspection
    - Flight Preference
    - Protections

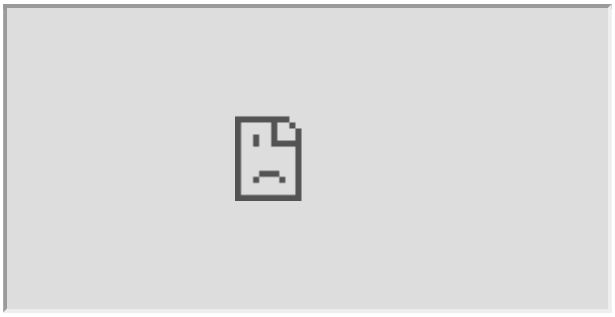
Reading Tips

This wizard will use the combination of automatic detection and manual detection to help you check the aircraft before flight and improve the operational reliability of the aircraft.

The content in the wizard can not cover all the details and objective emergencies of the aircraft, so the wizard does not fully guarantee the operation effect of the aircraft.

Flight Inspection Wizard

Please refer to flight inspection wizard teaching video



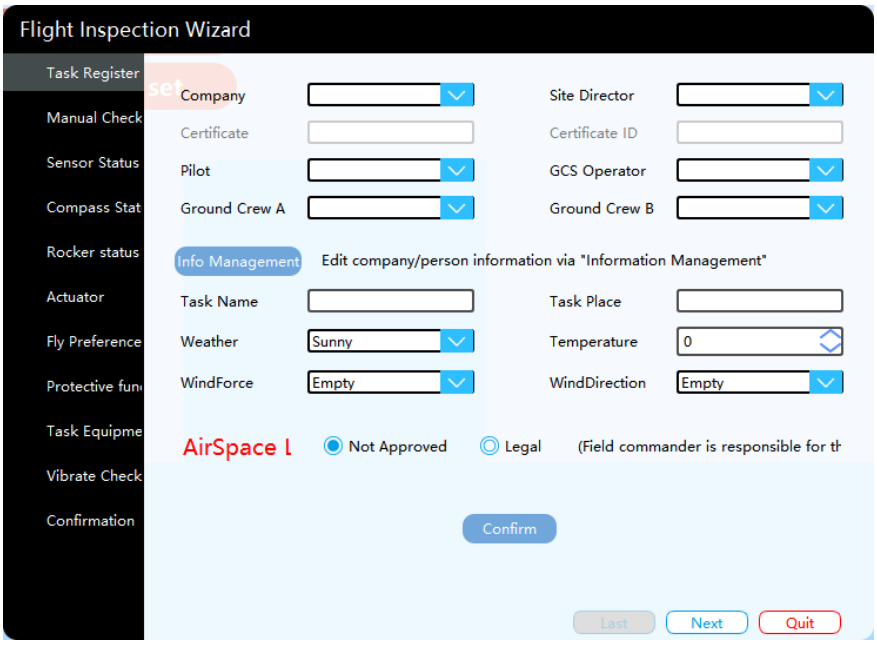
After starting the software of AheadX Space and connecting GNC successfully,

Click the icon on the left side of the main interface to start software and hardware check before takeoff.

The '*' marking inspection items shall be implemented according to the task conditions, and other inspection items shall be completed before takeoff.

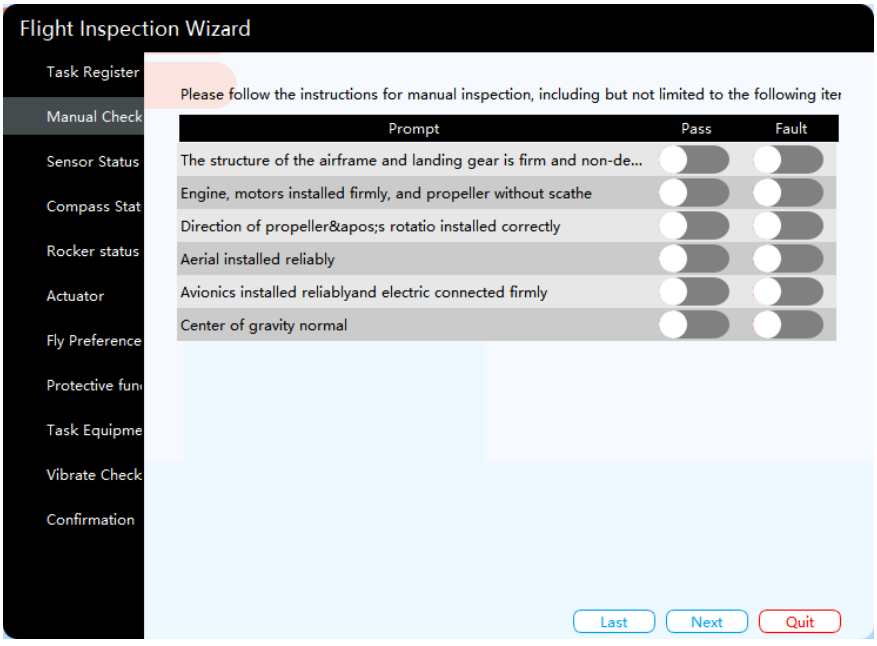
Task Register*

This page is used to register people and task information. Click "information management" to register the team member information, which will take effect after saving. After the task division is selected, it can be set as the default value, and the team information will be automatically loaded next time.

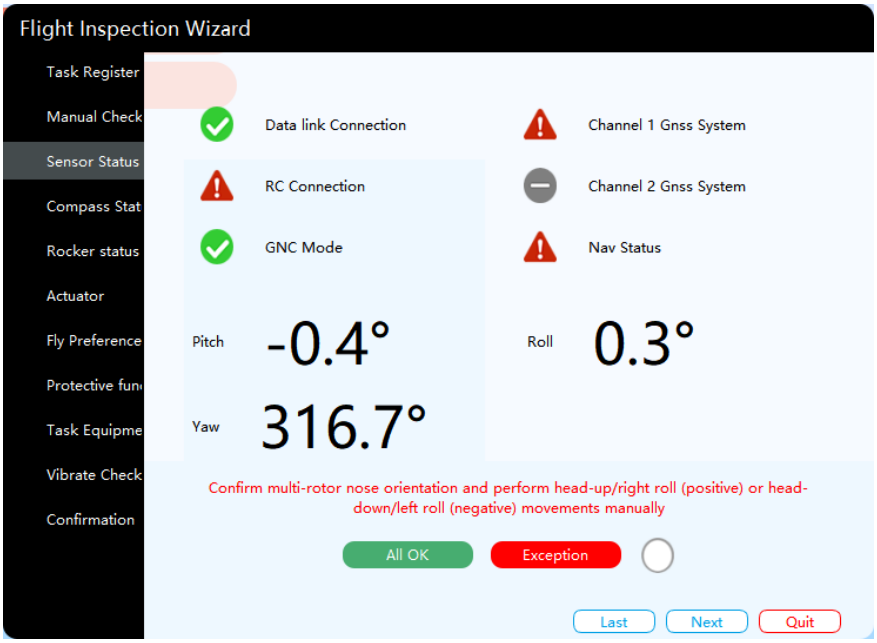


Manual Check

This step requires the cooperation of ground crew for detailed inspection.



Sensor Status

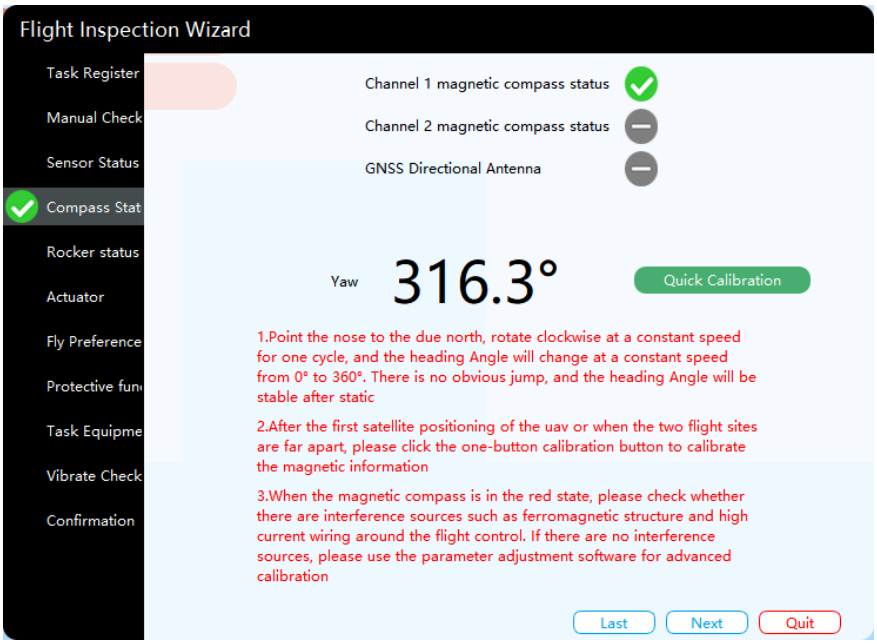


The page will automatically detect the current GNC status, if there is a red alarm sign, troubleshoot in time.

Manual detection is still needed:

Attitude Inspection: Lift the aircraft to make pitch / roll change. Observe the corresponding value change. The head up / right roll is positive. If the actual change is inconsistent with the value, please check whether the GNC installation angle is configured correctly;

Compass Status



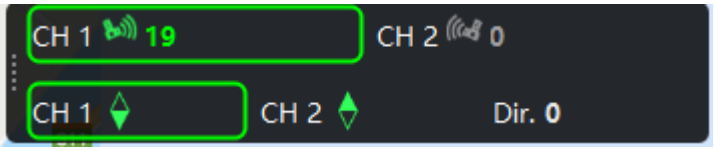
Entering the inspection interface will automatically refresh the magnetic compass information. If the Yellow sign appears, "Quick Calibration" can be carried out. If the magnetic compass sign is red, please check the interference source first. If

there is no interference, please carry out advanced calibration of magnetic compass.

Taurus 2 is the dual redundant magnetic compass by default, and the magnetic compass of channel 1 and channel 2 should be checked at the same time.

1. Compass Selection

Heading angle shows the magnetic compass data currently in use. Find the information below HUD as shown in the figure below, right click the position to select magnetic compass.



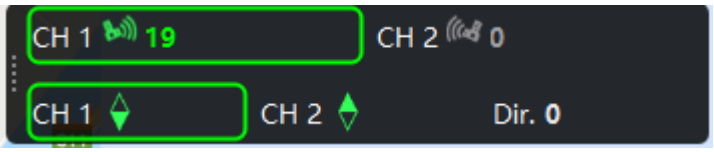
2. Yaw Inspection

1. When the aircraft is stationary, confirm whether the current heading angle value is stable and consistent with the actual heading (0 ° corresponds to due north, 90 ° to due east, 180 ° to due south and 270 ° to due West). Generally, the heading difference should be kept within 5 °;
2. Rotate the aircraft at a constant speed of 90 ° and observe whether the heading angle value changes by 90 ° and whether the change direction is consistent with the actual situation. Rotate again at a constant speed of 90 ° and check until the aircraft rotates to the original position.

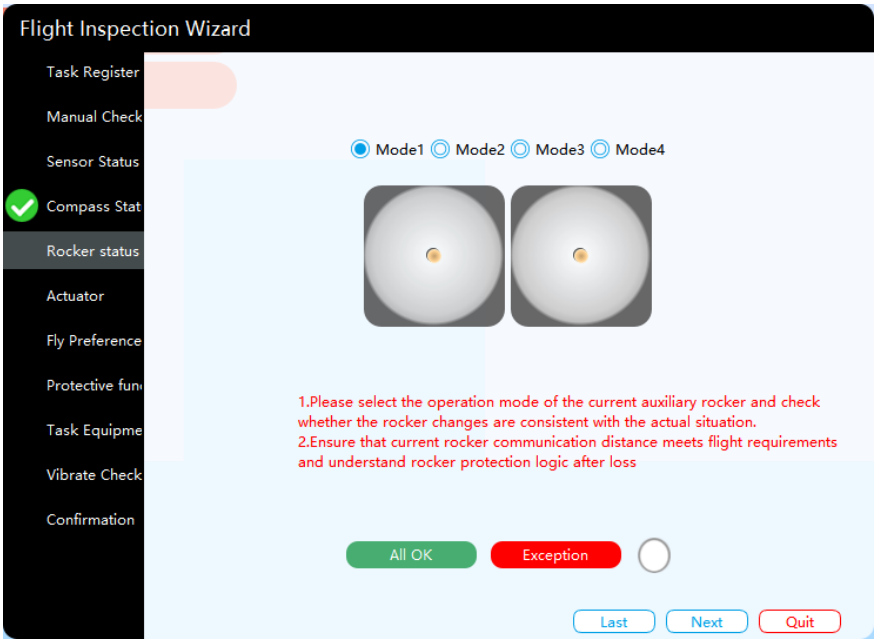
Check the magnetic compass of channel 1 and channel 2 respectively.

3. Redundancy Configuration

Right click the position in the figure below to select the double redundancy mode.



RC Status

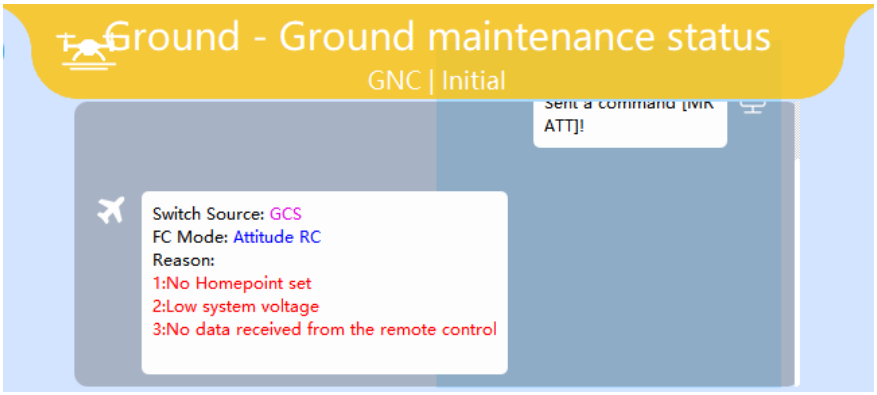


1. Channel Range Checking

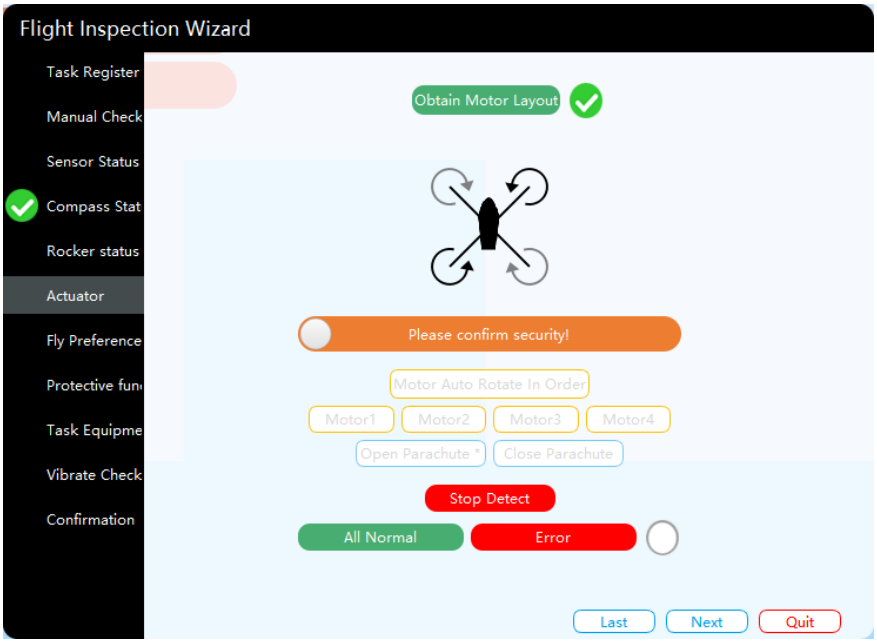
After selecting the display mode corresponding to the RC, observe whether the actual position of the channel is consistent with the display.

2. Mode Switch Checking

Toggle the mode switcher and observe whether the remote control mode status pops up in the figure below is consistent with the expectation.

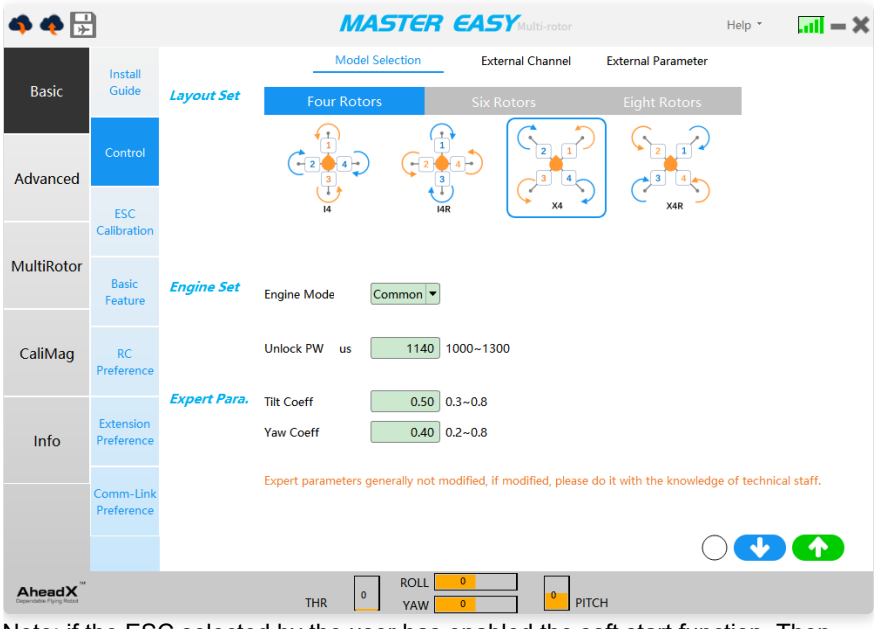


Actuator Inspection



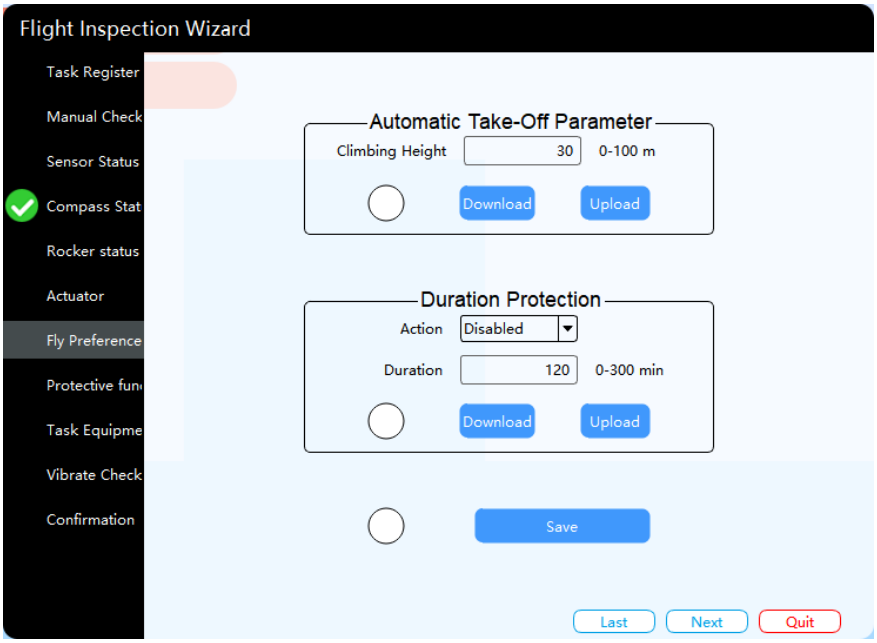
Click the obtain motor layout button to display the current flight layout diagram. After confirming the safety of personnel and equipment, drag the sliding bar button to the right to start the inspection of the actuator of motor and parachute (if included).

When you click the button, the rotor will rotate according to the pre rotation speed in the preparation for take-off stage. If the motor does not rotate or the rotation speed is too slow, increase the minimum pulse width by 10 in the figure below until it is appropriate.



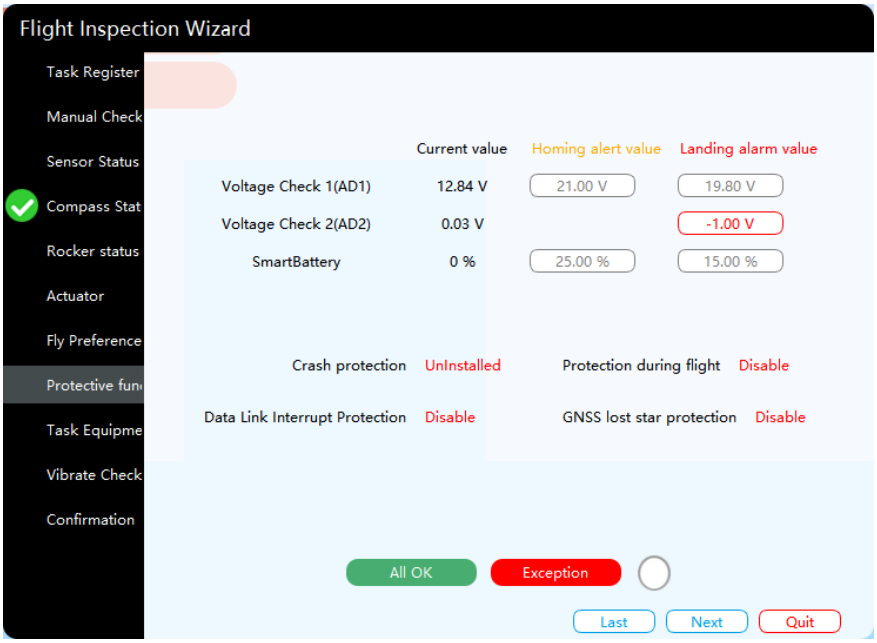
Note: if the ESC selected by the user has enabled the soft start function. Then simply increasing the minimum pulse width can not make it spin in the actuator inspection. At this time, the user needs to configure the ground station option to increase the rotor spin time (2000-3000 ms is recommended). The configuration method is shown in the figure below. After the configuration, the ground station software needs to be restarted.

Flight Preference



After entering the check page, the parameters will be automatically downloaded once. If the parameters are not saved after uploading, the change will be invalid after the GNCler is restarted.

Protections



Opening this interface will automatically refresh the current GNC protection parameters. After checking, click all normal buttons to pass the check. If the protection parameters are set incorrectly, please enter AheadX Master parameter adjustment software for configuration.

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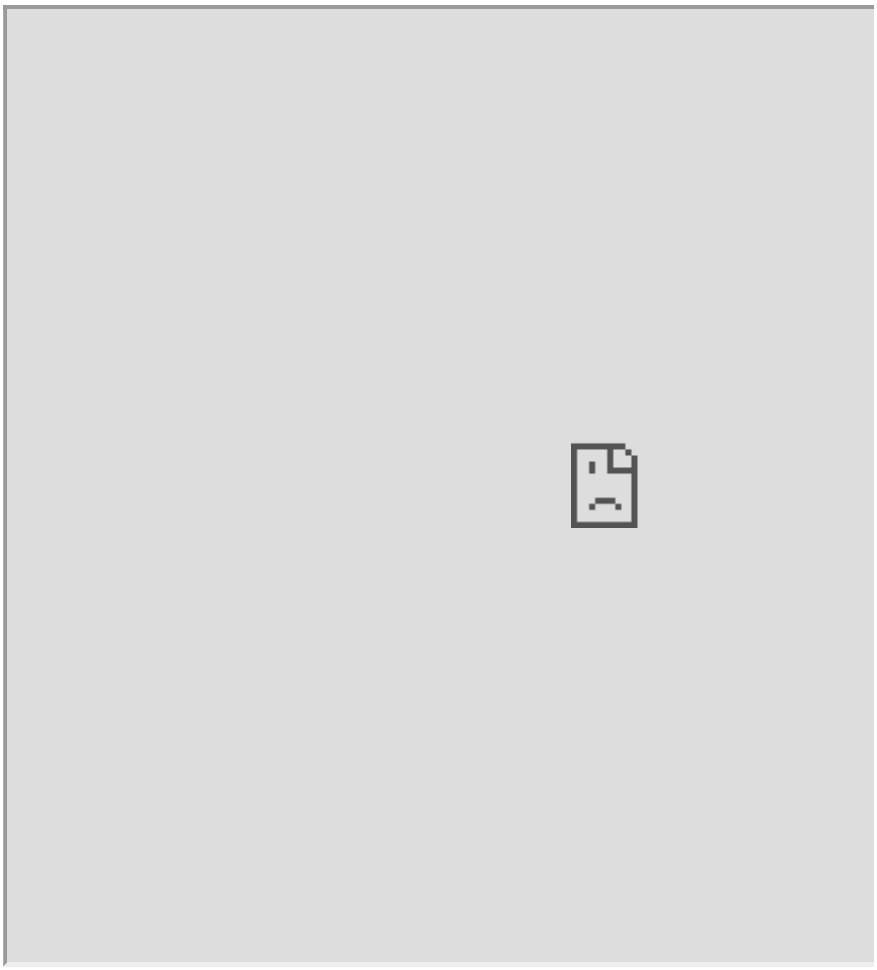
- The First Flight
  - Inspection Before Flight

The First Flight

Inspection Before Flight

Be sure to perform the pre flight inspection wizard before taking off

Please refer to the pre flight inspection teaching video bilibili



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- Multirotor RC Flight
  - Operation Steps
  - Normal RC Flight Procedures

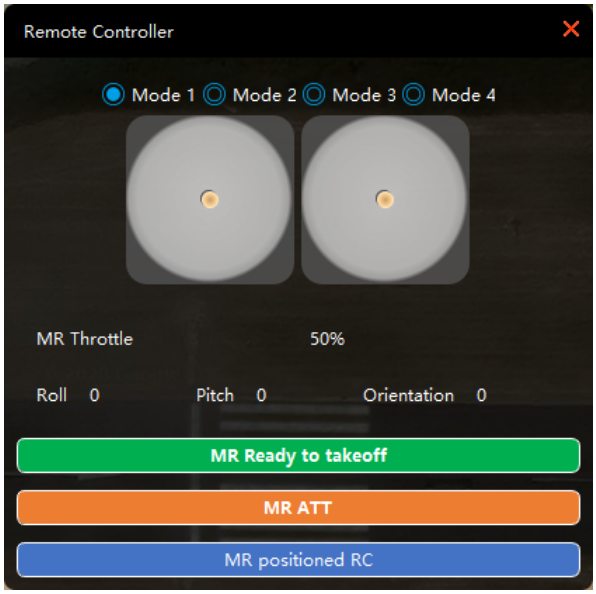
Multirotor RC Flight

Before RC flight, confirm following contents:

1，RC transmitter and receiver synchronized.

2，The RC status in the lower right corner of the GCS is green

3，Right click in the map area of the GCS, open the **Joystick** panel, and check whether the response in the panel is consistent with the action of the RC channel, so as to verify the correctness of the RC configuration.



There will be certain risks during the first flight. Please stay away from the aircraft. In case of any accident, please use the "Standby" button at any time (Four-click within 2 seconds) to stop all motors.

Operation Steps

1, Make sure the aircraft is in "Standby" mode.

2, The mode gear of the RC (CH-7 switcher) is switched to the attitude mode.

3, Use the RC transmitter to unlock the aircraft. Then, the motor will spin at idle speed.

4, Slowly push the throttle over 60% and the aircraft will leave the ground. Try to use aileron or lift slowly to control the aircraft. If the flight is unstable, the parameter has to be tuned.

For details, please refer to the multirotor tuning chapter:

Normal RC Flight Procedures

There are two ways to give control right to RC

1, Under 'Standby' mode, use RC to unlock:

2, Under 'Standby' mode, double click

in the Joystick panel of AheadX Space.

Please refer to RC flight operation video

Multirotor RC Flight Video

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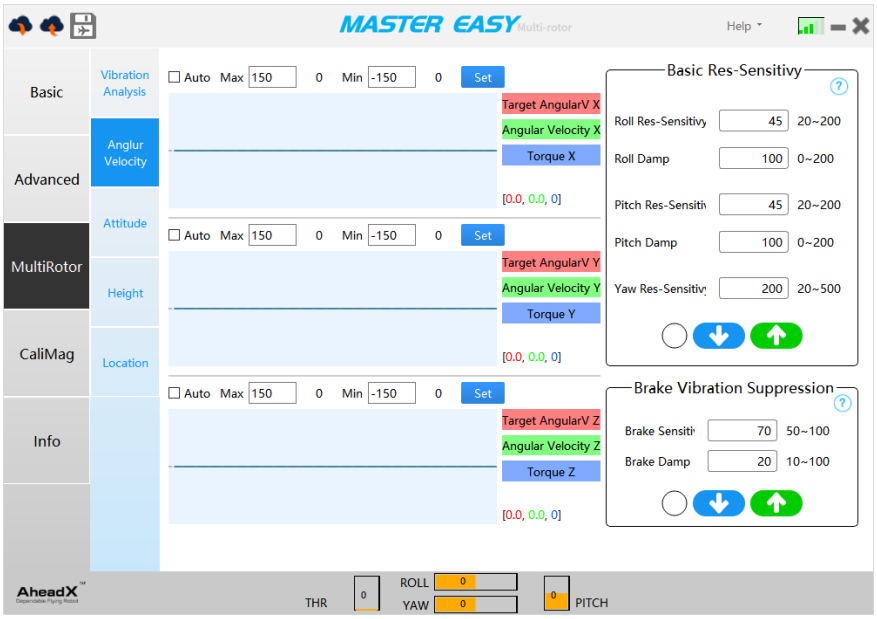
- Flight Parameters Tuning

Flight Parameters Tuning

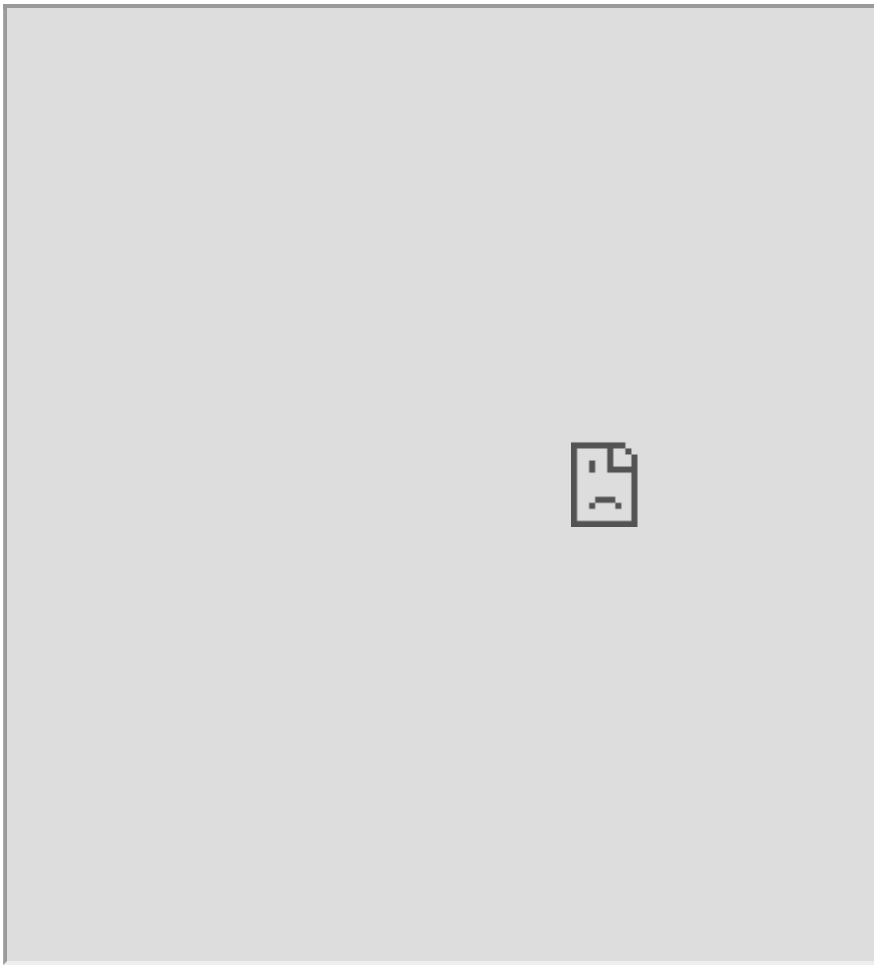
The default flight parameters are suitable for most of the multirotor aircraft. If the flight is unstable and can not meet the flight requirements, please adjust the following flight parameters in the Anglur Velocity page of Master Easy software.



Response Sensitivity Adjustment: The RC stick to the center after quick action, If the aircraft attitude response is slow, the parameter value can be increased by 1-5 units. If the value is too high, the attitude adjustment is violent. If there is high frequency and large amplitude oscillation, reduce the parameter quickly.

Damping Sensitivity Adjustment: If the aircraft hovers with a small amplitude of high frequency jitter, try to reduce the value. If the fast stroke and back to center, the posture adjustment is severe, try to increase the value. If the value is too high, the oscillation with higher frequency and smaller amplitude will be produced, which can be adjusted by 10 units.

Multirotor Flight Parameters Tuning Video



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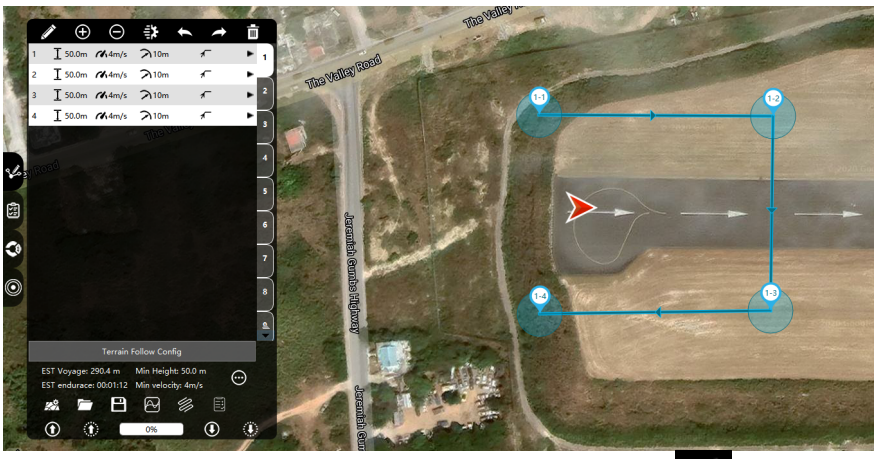
- Route Flight
  - Fast Route Planning
  - Detailed Manual Route Planning
  - Route Drawing and Modifying

Route Flight

Fast Route Planning



In the ground station, click on the left side of the main interface to pop up the route editing panel, click on and a cross will appear cursor, move the cursor to the map and click to start planning the route. After the planning is completed, click the right mouse button to exit the editing state. At this time, you can modify the waypoint attributes in the route edit panel. After the modification is complete, click the button to upload the route to the GNC.

The waypoint parameters are defined as follows:

Lifting Mode:

1. Immediately ascend and descend: the aircraft will adjust to the target altitude according to the maximum ascent and descend rate in the set parameters.
2. Ramp up and down: the aircraft will fly along the straight line between the previous waypoint or the current position and the waypoint and adjust the altitude. If the line up and down rate exceeds the maximum ascent and descent rate in the aircraft setting parameters, the aircraft will follow Set parameters to adjust altitude to avoid exceeding aircraft performance.

Turning Mode: (Multirotor only)

1. Coordinated Turning: The drone will turn through roll and yaw control, which is close to the fixed-wing turning method.
2. Turn at the Point: The UAV only uses yaw control to achieve a turn. After reaching the target point and maintaining the hovering time, it starts to adjust its heading and align and fly to the next target point.

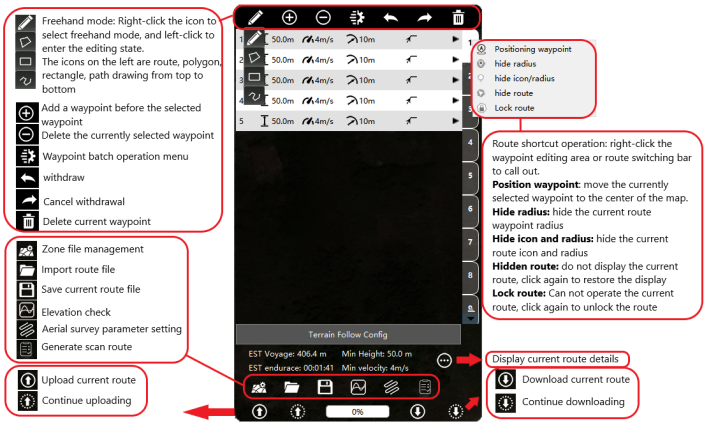
Height Difference Protection: This parameter is not effective.

Waypoint Action: After you choose to take a photo once, the drone will take a photo once it reaches the waypoint.

Flight Segment Mission: You can choose isochronous/equal distance photo or turn off, the drone will perform corresponding actions after reaching the waypoint until the next flight segment task is triggered.

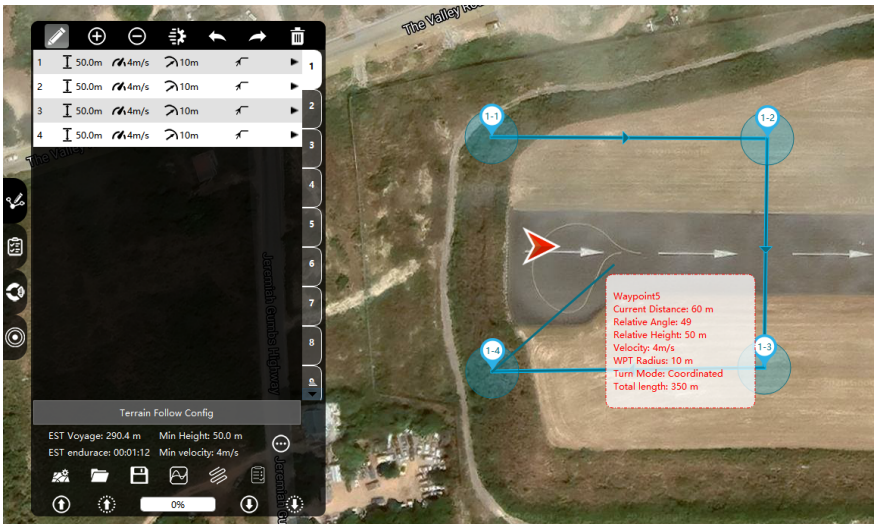
Detailed Manual Route Planning

Plan and edit mission routes, manage them and upload and download them.



Route Drawing and Modifying

Route Drawing: Select the route drawing mode and enter the edit state, drag the zoom map to the expected planning area, click the draw route button, and you can plan a single mission route on the map by clicking the left mouse button. The drawing information will be activated at this time prompt. After drawing the last waypoint, click the right mouse button anywhere on the map to end the planning.



Route Position Adjustment: Select and double-click any waypoint on the map, and the overall adjustment box will appear. Move the mouse to the box and hold down the left button to pan the route as a whole. Move the mouse to the round point on the corner of the adjustment box, and the mouse will change to Rotate sign, hold down the left mouse button to rotate the route, the rotation center is the geometric center of all waypoints (the rotation center of the landing route is the converted landing point).

Add Waypoint：

Select a waypoint on the map or in the route details list, click the Add a waypoint button, it will automatically add a waypoint before the selected waypoint, and the serial numbers of the selected waypoint and all the waypoints after it will increase by one. The new waypoint is added between the current point and the previous point by default. You can manually drag the new waypoint to the desired position. Add before the first waypoint, the default position is in the center of the screen.

Delete Waypoint：

Select a waypoint on the map or in the route details list, and click the Delete Waypoint button, the selected waypoint will be deleted, and the serial numbers of all the waypoints after the selected waypoint will be reduced by 1.

Delete Route：

Click the "Delete Route" button, all waypoints of the current route will be cleared.

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- Autonomous Flight
  - Takeoff
  - Execute Route
  - Home Mode
- Auto Landing

Autonomous Flight

Before taking off, please confirm whether the route to be executed is within a reasonable range, and do not exceed the maximum range of the aircraft.

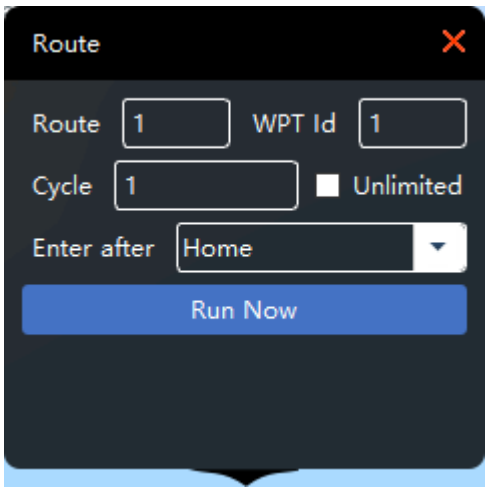
Takeoff

Double-click 'Takeoff' button , After taking off, the aircraft will climb to the set altitude for hovering and wait for further command.

After double clicking the take-off button, the aircraft will enter the takeoff preparation stage first, and the motors will unlock and pre spin for 3 seconds. During this period, user can click ‘Cancel’ to enter the flight standby mode (Attention: if you click the 'Standby' button directly, it will still take off automatically after 3 seconds). After clicking ‘takeoff immediately’, the aircraft will enter the automatic takeoff mode. If there is no operation within 3 seconds, it will enter automatic takeoff mode after 3 seconds.

Execute Route

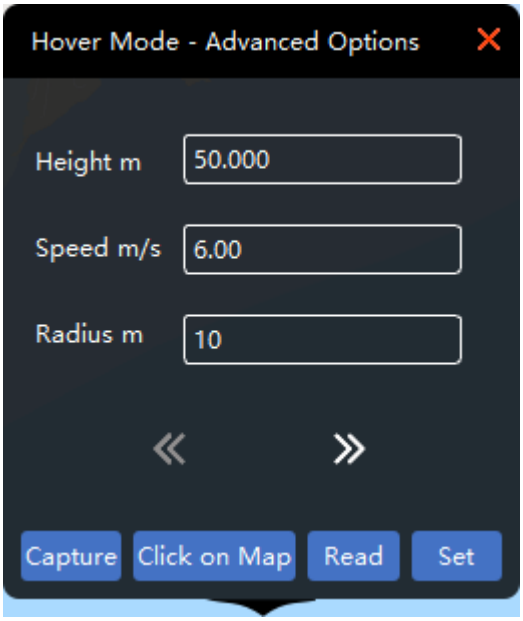
Click route button, pop up sub menu:



After inputting the route number, waypoint ID, cycle number and end mode, double-click the blue "Run Now" button.

Home Mode

Double click to execute home mode command, Click the blue button below to call out the sub menu:



The detailed information of home point can be set here.

Auto Landing

Double click 'Land' button , The aircraft will perform a regular home landing. If the current altitude is lower than the altitude of homing climb, climb to the altitude first and then fly to the landing point; otherwise, keep the current altitude and fly to the landing point to land.

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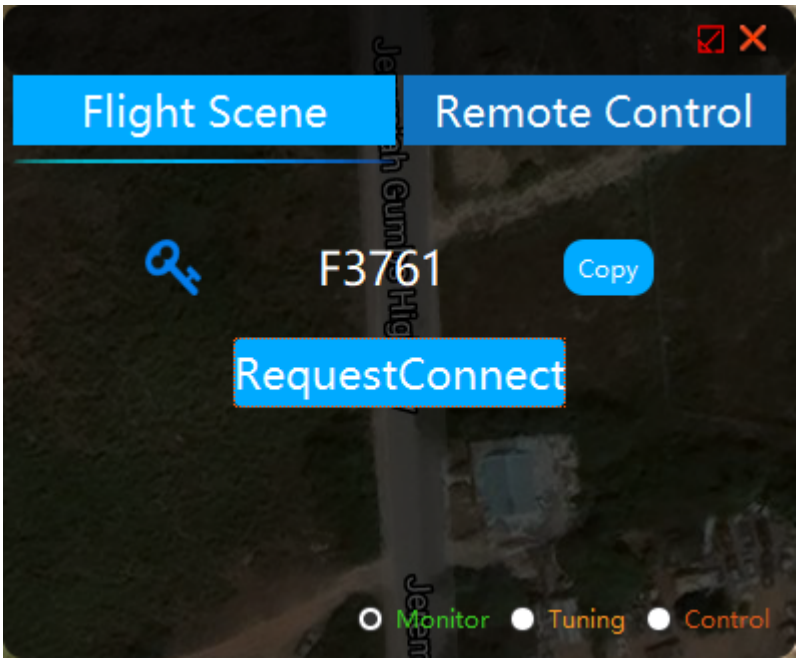
- Remote Assistance

Remote Assistance

The remote assistance function requires users to register and log in to the AheadX Galaxy cloud management system account. It can realize remote monitoring, tuning and control. The user registration interface will pop up when the ground station is started for the first time. Enter the account and password to log in. If you have not registered or forgotten the password, click the link at the bottom or log in cloud.AheadX.com

After successful login, the login interface will be minimized to the upper left corner.

Right click the map area to open the remote control panel.



Flight Scene

The field personnel will send the secret code to the remote personnel, and click the request connection button to wait for the remote personnel to access.

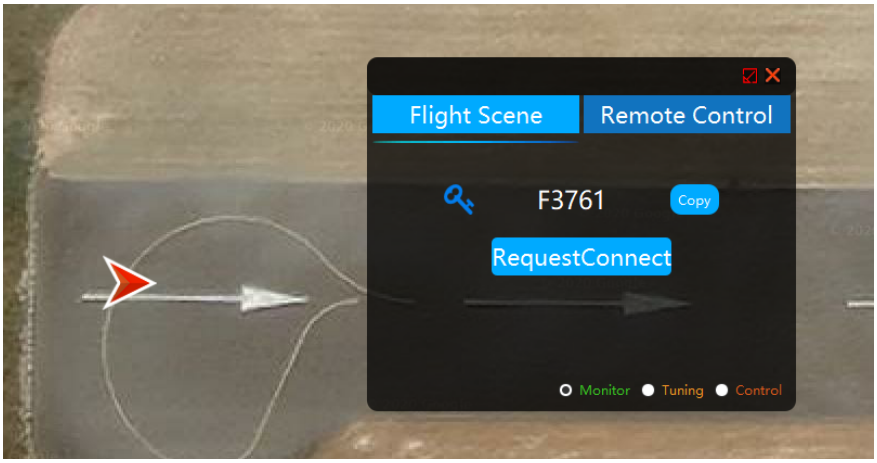
: Click this button to refresh the secret key

Monitoring: the default state is monitoring state, at this time, the remote people can only view UAV data, and cannot modify parameters or GNC.

Tuning: at this time, the remote people can view the UAV data and tune the parameters, but can not control the flight.

Control: at this time, the remote end has all permissions (the flight site can still carry out emergency intervention manually through RC).

Remote Access



The remote personnel input the secret code provided by the field personnel, click the connection button and wait for access.

Mini Panel

After the connection, click

No connection or network issue

Monitoring

Remote control terminal status display, UAV under control

The flight site status shows that the UAV is under control

Remote Assistance

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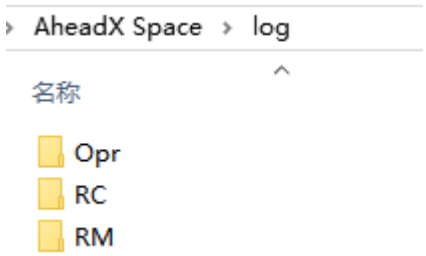
- Flight Log Management
  - Log Storage
  - Log Replay

Flight Log Management

Log Storage

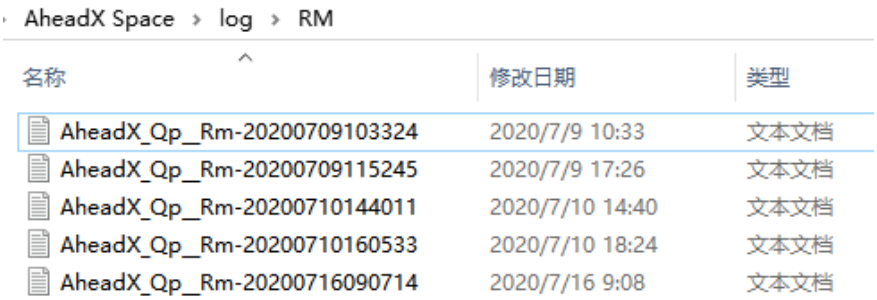
The log files are stored in the root directory of AheadX Space under the AheadX space\log path



Opr: Operation log;

RC: GCS command log;

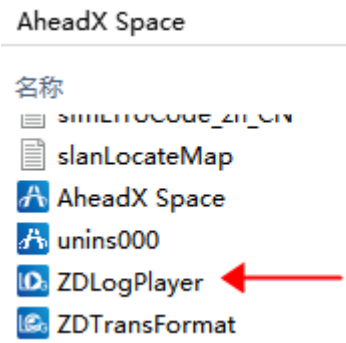
RM: Telemetry log.



The log naming standard is: AheadX / GNC type / log type / year, month, day, hour, minute, second / .log

Log Replay

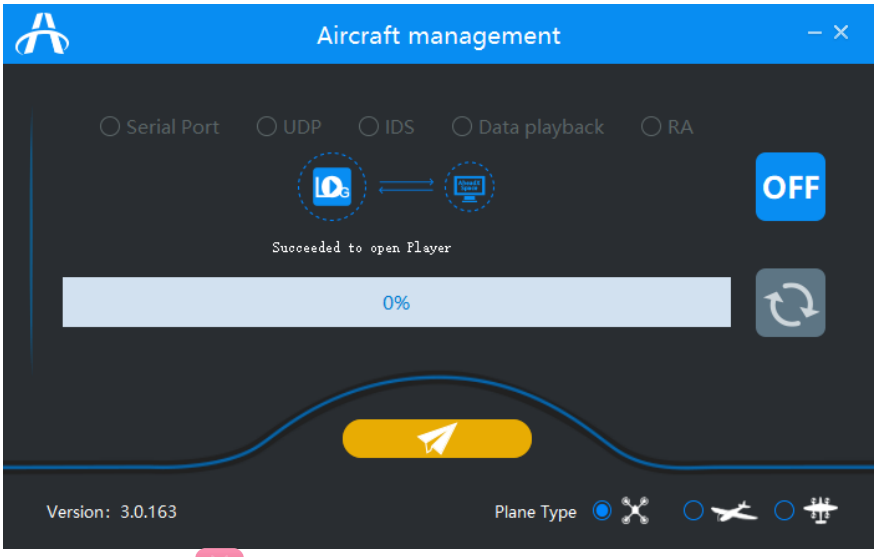
Users can use the log player tool for replay to analyzing flight data



In the AheadX Space root directory, open ZDLogPlayer.exe , select to open the log file or drag the log file into the player interface. The log file supports the .Log file automatically recorded by AheadX Space, and also supports exporting airborne data (PDR files).

Hot keys	功能
Space	Pause / Play
Direction key←→	Back / forward 1 frame
Ctrl + Direction key←→	Back / forward 10 frame
Direction key↓↑	Flight mode jump

Use zdlogplayer to load and play the log file, open AheadX Space, and select data replay in the aircraft management interface. At this time, it will automatically switch to the corresponding aircraft type, and click to enter the software to play the corresponding log file.



Log Management

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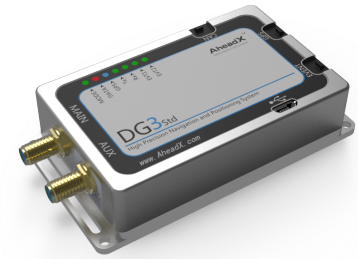
- Required Devices

Required Devices

In order to improve the accuracy of GNC and mapping, you may need the following equipment:

AheadX DG3 Differential Positioning and Orientation System



AheadX DG3 is a high-performance industrial GNSS airborne differential positioning product launched by AheadX. The product has the advantages of low power consumption, small size, light weight and easy to use. The product adopts high-performance industrial GNSS satellite board, the positioning accuracy can reach centimeter level, the dual antenna version can realize high-precision orientation, and the orientation accuracy can reach 0.2.

The product has built-in industrial embedded processor, which can store satellite data in the internal memory and output real-time satellite positioning information to GNC. It can realize real-time differential positioning (RTK) and post differential (PPK) data recording at the same time. It is widely used in UAV high-precision flight, mapping and other fields.

AheadX Ubase RTK/PPK Base Station

Ubase is high-precision positioning equipment for UAV surveying and mapping applications. It adopts integrated magnesium aluminum alloy bottom shell, Linux operating system and high-performance multi frequency receiving antenna. It supports BDS, GPS, GLONASS multi constellation system;

Built in WiFi, Bluetooth, 3G/4G connection function, can expand rich application scenarios;

Built in 16G large capacity storage;

The base station mode and mobile station mode can be switched to meet the multi-purpose of UAV surveying and mapping;

Support RTK, PPK working at the same time.

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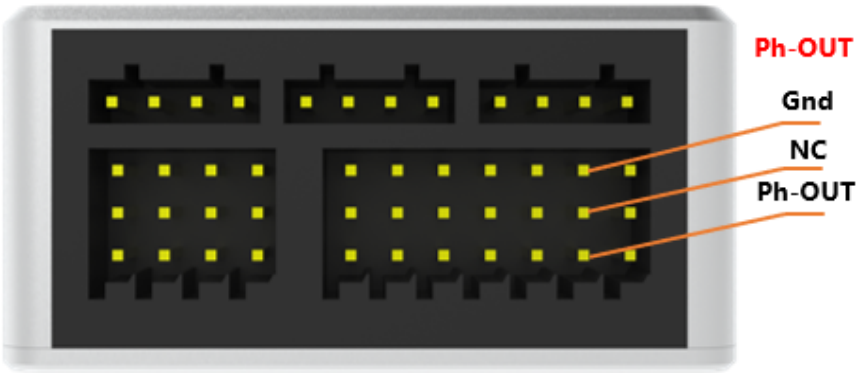
- Parameter Configuration

Parameter Configuration

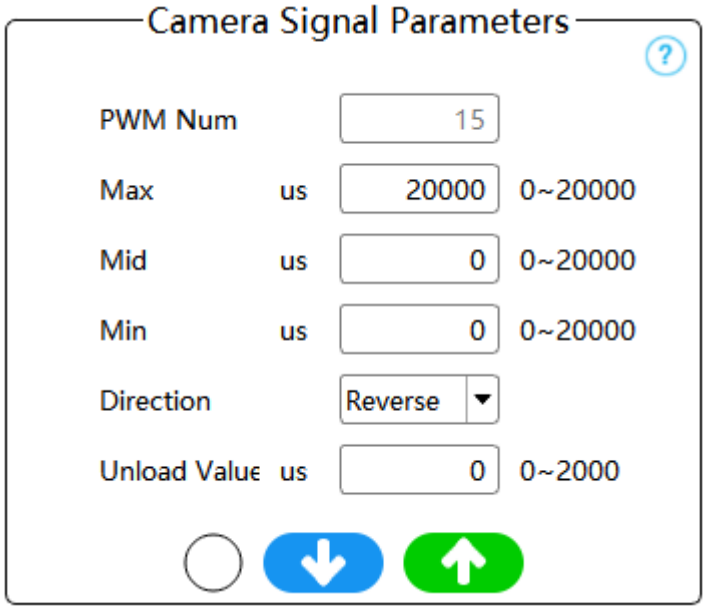
Camera Connection



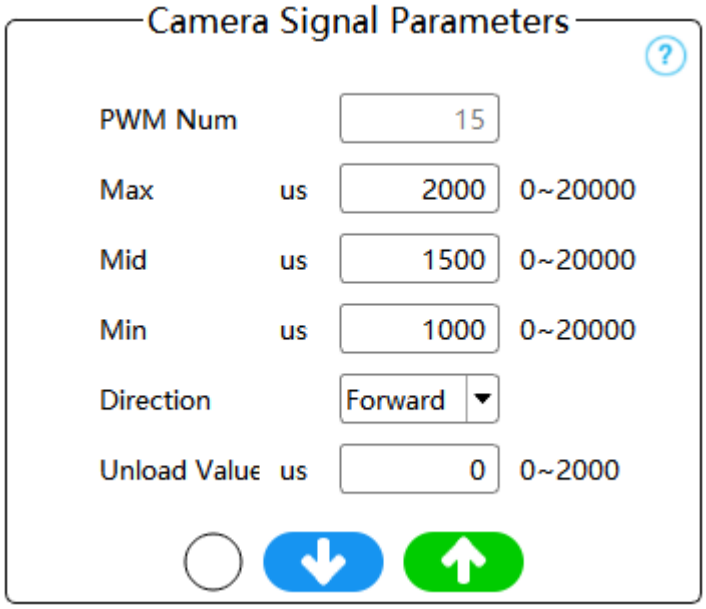
Connect the camera shutter signal to the PH-OUT pin. The default is rising edge trigger.

Trigger Mode Adjustment

H-L Level Trigger: connect Master Easy parameter software and open the interface of basic configuration control distribution, as shown in the figure below:



Special PWM Trigger:



Exposure Delay: Compensate for the time from the GNC sending out the photographing signal to the time when the camera takes the image. The POS point data will delay this time and record the information.

Hold Time: The time to hold the shutter action. Set the appropriate holding time to prevent the camera from taking more or missing shots, which is generally set to 100-300 ms.

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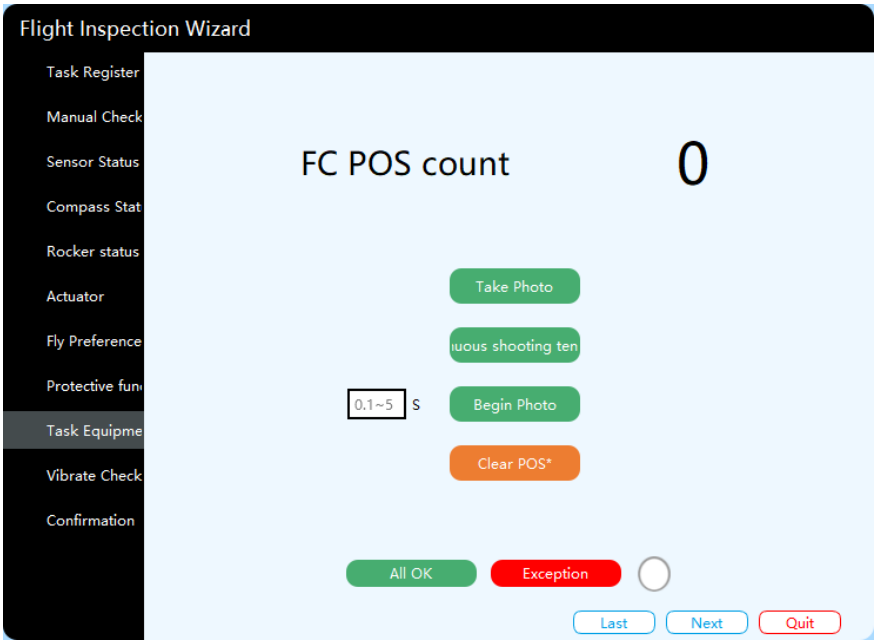
- Devices Connection

Devices Connection

Camera Inspection:

Connect AheadX Space software and open the Pre-takeoff inspection wizard panel, as shown in the following figure:



Carry out manual photographing to check whether the actual number of photos taken by the camera is consistent with the GNC record value. It is recommended to clear the last POS record data before each operation. **Take Photo** button only takes single picture once.

10 x Take Photos: Automatically execute ten consecutive photographing actions with an interval of 500ms;

Take Photos Timely: Continue to take photos according to the set interval time, and click to stop again;

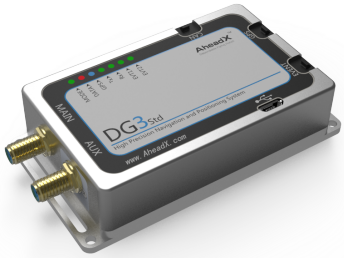
Clear POS: Four click to clear POS data.

Related Devices Configuration

If you have purchased AheadX DG3 and Ubase base station

Please refer to the following documentation

AheadX DG3 Differential Positioning and Orientation System



UBase Base Station

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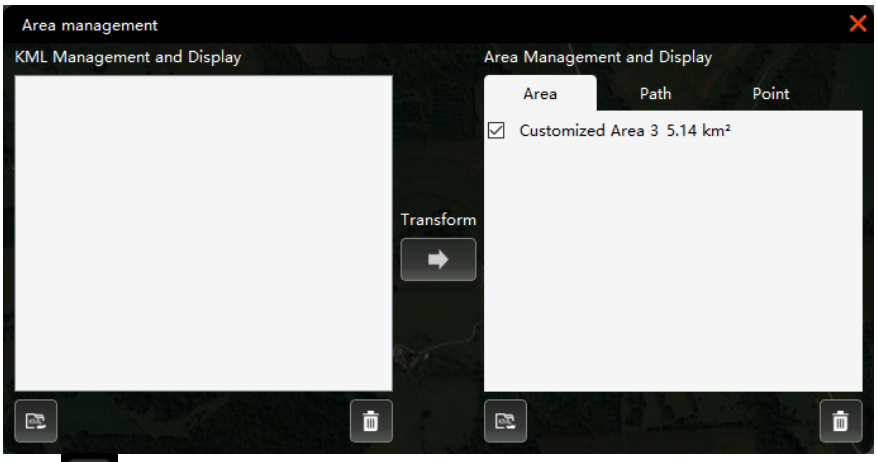
- Scanning Route Planning

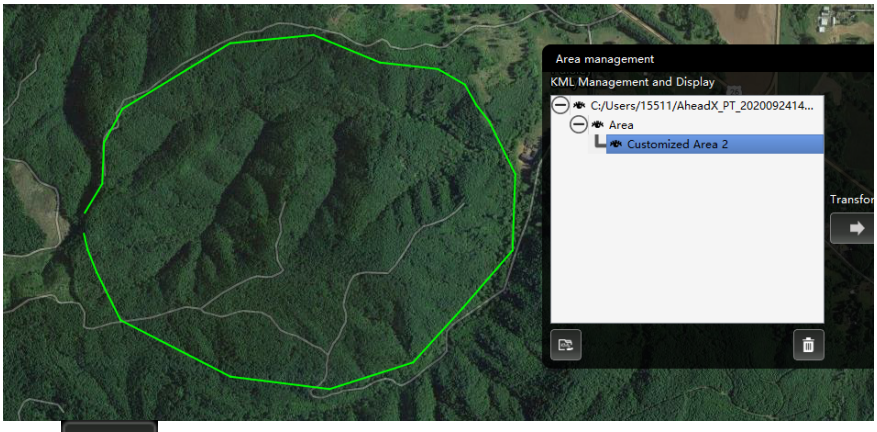
Scanning Route Planning

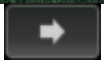
KML&KMZ Files Import

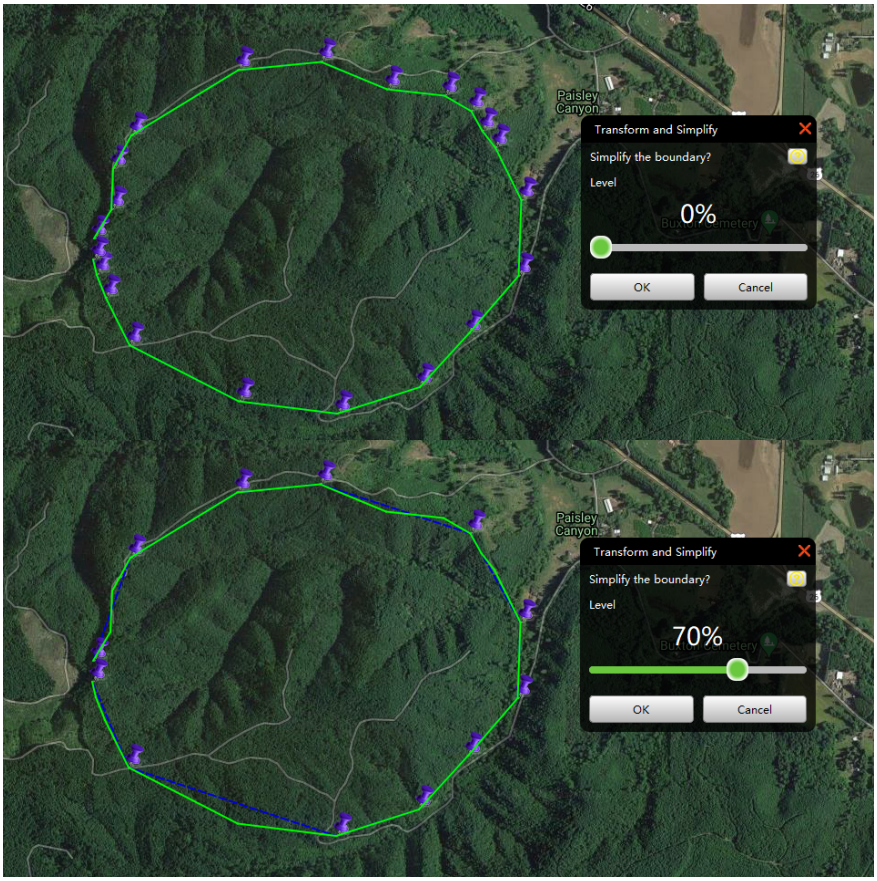
Click the left side of the main interface . The route editing panel pops up, and click the lower left corner of the panel! icon to call out area management interface.



Click button to import KML&KMZ zone file. After importing, click the selection area of KML's lowest level file, as shown in the following figure:



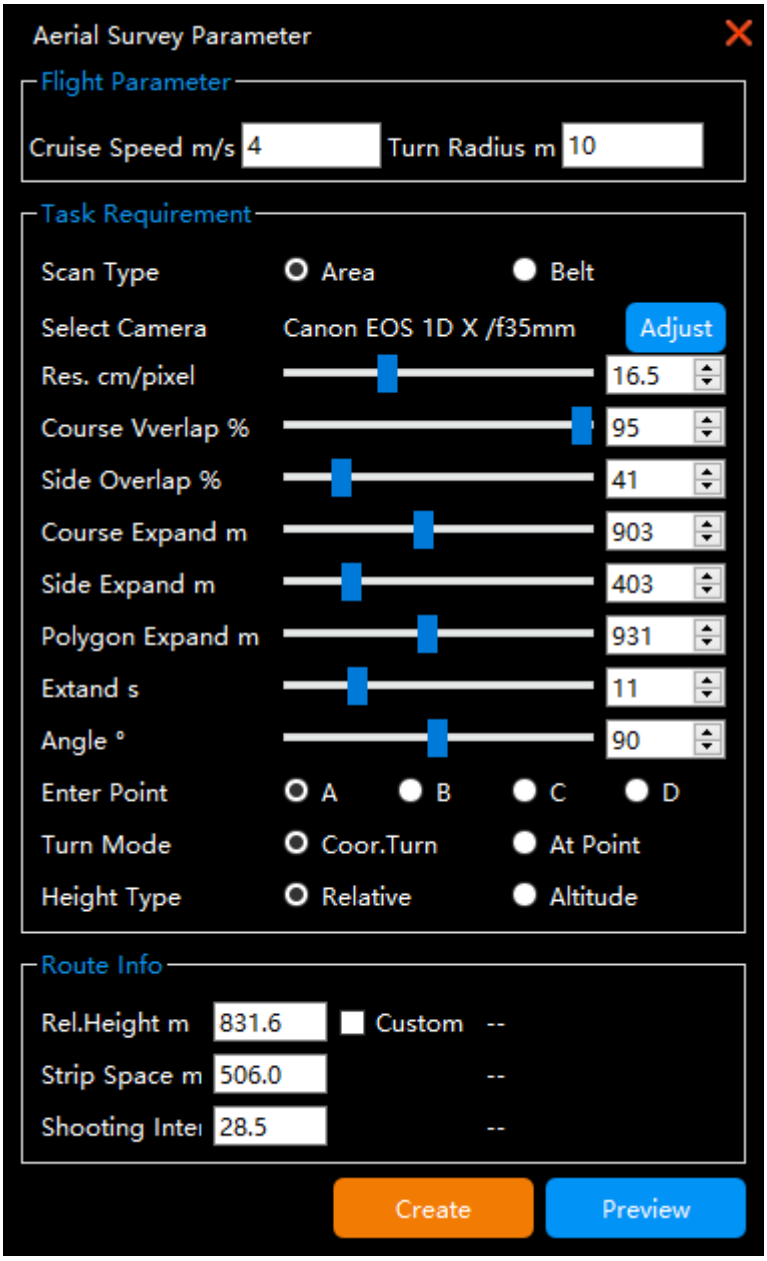
Click  button to call out the conversion interface to convert and simplify the file to facilitate the generation of scanning route. For files with more points, it can be appropriately simplified, as shown in the following figure:



After simplification, click the confirm button to close the interface.

Generate Scanning Route

After selecting area on the map, click icon under the route edit panel. The aerial mapping parameter panel will pop up, as shown in the following figure:



UAV Information:

Click read to get the related GNC parameters. If the aircraft is not connected, it can be set manually (if it is not filled in according to the actual aircraft performance, there may be flight risks).

Task Requirement:

Support block mapping and strip mapping.

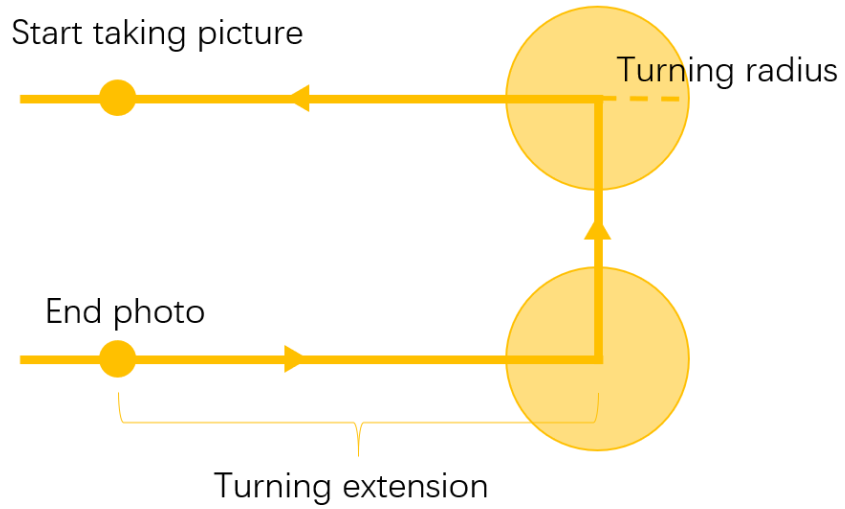
Block Mapping Parameters

Camera selection: Click the adjust button to select the camera used and the corresponding camera installation method. If it is not included in the list, user can manually add it.

Resolution, heading/side overlap rate: Please fill in according to actual task requirements.

Expansion: Increase the area of scanning.

Turning extension time: The product of this time and the flight speed increases the extra distance for the turn.



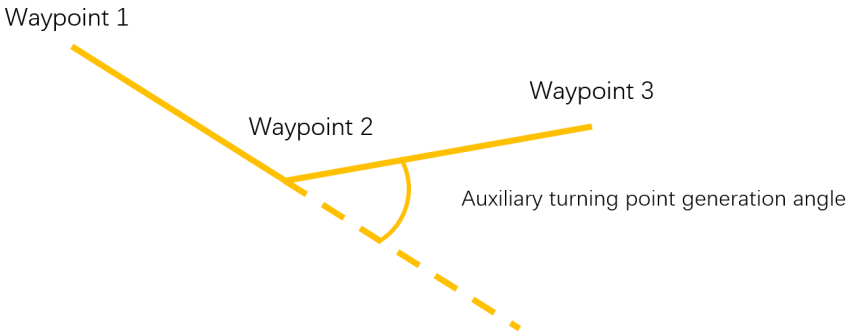
Scanning angle: modify the angle of the UAV scanning route, after modification, it can be previewed in real time.

Enter location: Confirm the entry location according to the ABCD point displayed in the map area.

Height type: You can choose to fly by relative height or altitude. When flying by altitude, you need to set the actual altitude of the drawing.

Strip Mapping Parameters

Auxiliary turning point generation angle: As shown in the figure below, if the angle is greater than this angle, auxiliary turning points will be generated.



Air strip coverage: the width of air strip that needs to be covered during scanning.

Air strip distribution: Left/Right: The coverage is one side of the path file; Middle: Covers both sides with the path as the center.

Motion planning: Enable the drone to automatically turn at the position where the auxiliary turning point was originally needed to ensure the attitude level of the drone when taking pictures and improve the image quality (**The function is supported by the GNC firmware 2.14.0 and later**).

Other parameters are the same as block mapping parameters.

Route Information:

Relative/Altitude: When the camera parameters are determined, the related parameters (resolution, interval) will follow the change when the altitude is modified (the related parameters will no longer change after checking the selection).

Strip space: The vertical distance between scanning routes is determined by camera parameters, resolution, and side overlap rate.

Photo interval: The distance between the camera points (POS points) is determined by camera parameters, resolution, and heading overlap rate.

Select the survey area and click the preview button to generate a preview route. At this time, you can adjust the surveying and mapping parameters in real time and view the total length of the route, flight time estimate, and estimated photo information.

After the adjustment is completed, click the Generate button to generate the scan route.

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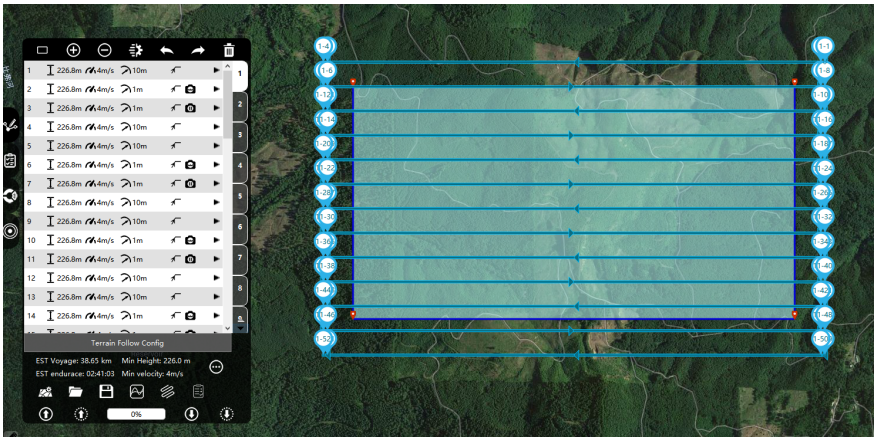
- Terrain Follow Flight

Terrain Follow Flight

Route Planning

Open the route editing panel, draw the route manually or generate the scan route through the aerial mapping parameter panel.



Terrain Follow Flight Configuration

Flight height: When the height of waypoint 1 is a relative altitude, the default ground height is the height of waypoint 1, otherwise the default value is 300m.

Climb/descent limit per 100 meters: The maximum climb and descent altitude of the UAV every 100 meters forward. This parameter cannot exceed the UAV's maximum climb/descent capability, otherwise there will be a greater flight risk.

After setting the parameters, click the 'Apply to Current Route' button to generate a terrain follow route in the current route list.

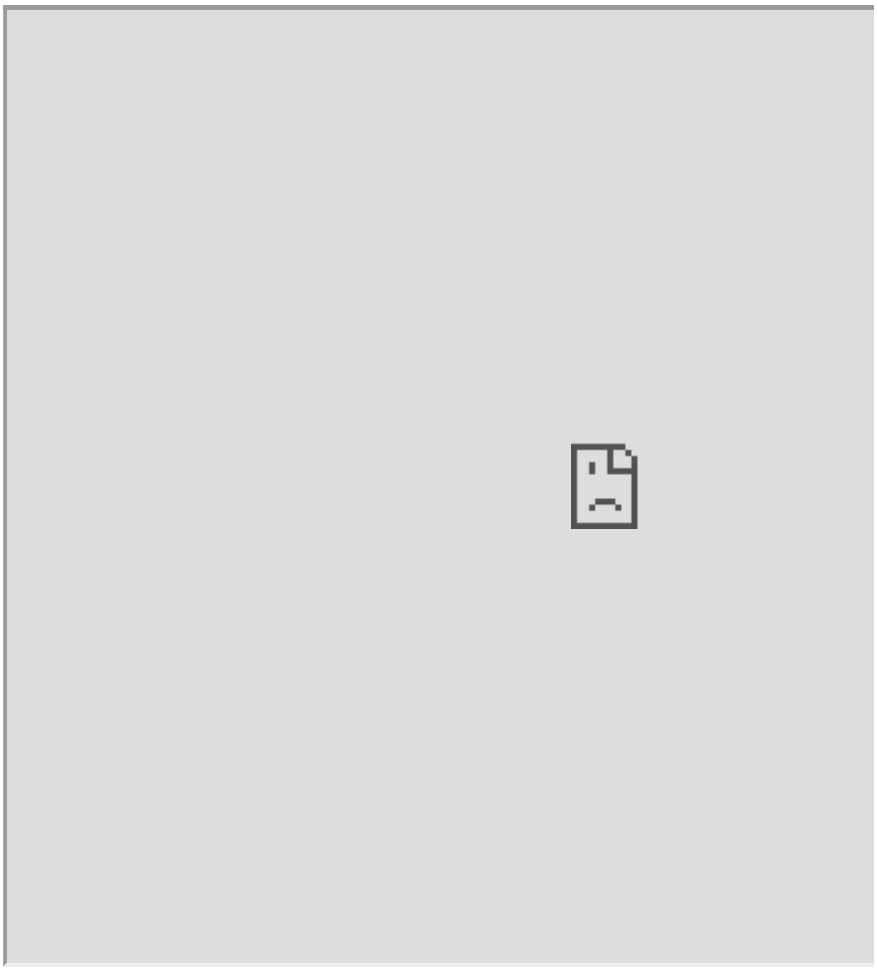
Tips:

1. The altitude attribute of the waypoint is the altitude. The altitude adjustment of the imitation route will be based on the highest point in the area to ensure flight safety.

2. The sampling interval will be automatically adjusted according to the degree of terrain undulations. The sampling points in areas with large terrain undulations will be automatically increased to ensure the best terrain following effect; sampling points in areas with small terrain undulations will effectively reduce the frequency of drone attitude adjustment , Improve endurance, flight stability and imaging effect.
3. The default flight speed (CAS) is the speed of waypoint 1.

Terrain Follow Flight Tutorial Video

Please refer to: Terrain Follow Flight



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- After-sales Policy

After-sales Policy

User can request a return& refund service within seven (7) calendar days of receiving a product if the product has a manufacturing defect. AheadX provides one-year warranty.

You can request a return& refund service where:

- Provide a legal proof of purchase, receipt, bill, invoice or order number;
- Serial number, product label and other marks shows no sign of alteration or tempering ;
- Non-artificial defect

Refund & free repair is not provided where:

- Product serial number or model does not match the product itself
- Any fault or damage of the product is caused by unauthorized use or modification;
- Any fault or Damage caused by using third-party components which is not recommended by our company;
- Damage caused by uncontrollable external factors, including fires, floods, high winds, or lightning strikes, etc;
- Other faults or damages which are not caused by our design, technology, manufacturing, quality, etc;

One year warranty:

AheadX provide one-year warranty which starts from the day of purchase.

Free repair service if the products has a manufacturing defect.

Free lifetime software upgrade.

Send back postage is on user’s side.

The following items are included in the one-year warranty period:

Warranty project	Service	Standard
Technical Support	400 Hotline (Mandarin Only)	Professional technical services provided by technical engineers, responsible for troubleshooting.
Remote Assistance	Help customers to tune or solve the problem by remote assistance.	5 days*8 hours
Customer Service Email		7 days*8 hours
Wechat、QQ		7 days*8 hours

AheadX still offers paid repair service even its out of the warranty period.

User needs to pay repair cost, replacement cost and freight for any after-sales problem which is not belong to free repair and return & refund condition

For above replacement and warranty principles, user must provide legal proof of purchase, otherwise we will not deal with the problem.

AheadX reserves the right of final interpretation of the warranty.

AheadX Technology National Service Hotline: 400-827-5966 (Mandarin Only)

Customer Service Time: Monday to Friday 09:00-18:00 Full Service

Saturday and Sunday 10:00-17:00 After-sales registration

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