

AheadX™

Dependable Flying Robot

AheadX LEO

Installation manual



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Tips

Welcome to read AheadX online document. This manual will assist you with the installation and post-installation checking of LEO.

[Blue text, suggestions and content you may need to know](#)

[Orange text, please pay close attention](#)

[Red text, must be strictly enforced](#)

Version Information

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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.

AheadXTM

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Co., Ltd.

Disclaimer

Please read the entire document carefully before using this product. By using this product, you hereby signify that you have read this disclaimer carefully and agree to abide by the terms and contents herein. This product is not suitable for children under the age of 18.

AheadX LEO is a high quality UAV navigation flight controller. 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.

Introduction

LEO GNC (Micro Guidance Navigation Control System) is a new generation of navigation flight control system designed for industrial-grade drones. It features with high integration, high reliability and high cost performance. It supports VTOL quad plane, fixed wing, helicopter, multi-rotor and other types of aircraft. .

LEO integrates IMU and a datalink with max 60km communication distance into the control system. It equips with $-15^{\circ}\text{C}\sim 85^{\circ}\text{C}$ temperature compensation MES sensor and J30 aviation connector. LEO adopts a decoupled extended Kalman filter, improved L1 guidance rate, and ADRC controller as core algorithm, which has extremely high precision.

Features and applications

- MEMS inertial measurement unit, triaxial magnetometer, barometric altimeter, airspeed meter, GNSS module, triaxial magnetometer, barometric altimeter, air speedometer, GNSS module. $-15\sim 85^{\circ}\text{C}$ temperature compensation for MEMS IMU and triaxial magnetometer.
- Built-in 900MHz data link, communication distance up to 60km*.
- Dual integrated navigation system. Decoupled 17-order extended Kalman filter to complete the information fusion. Automatically switch between the GNSS/INS and AHRS/DR navigation modes according to satellite signals
- Built-in shock absorption structure to reduce the impact caused by vibration to IMU
- Improved L1 guidance rate and ADRC controller to improve control accuracy and robustness.
- With built-in global geomagnetic model, and compass calibration has been tested in polar area. LEO can complete one-key compass calibration, take off immediately after satellite positioning.

- Powerful remote assistance service. Whenever and wherever you need technical support, you can request AheadX's official remote technical support via the Internet.
- 10 routes (The 10th route is the landing route for fixed wing or VOTL), max 200 waypoint of each route. It supports automatic route switch
- With fixed-point, equal time, equal distance shooting function. Records the POS data of the shooting point.
- Any installation method. LEO equips with installing angle correction and lever arm compensation. It can be mounted at any angle and position
- Simulation training function. LEO can work with AheadX's semi-physical simulator for pilot's daily simulation training.
- Built-in black box data logging function, it is able to cyclically record approximately 60 minutes flight data . Supports external data recorders, recording up to 2000 hours flight data.
- Online upgrade. User can quickly get the latest firmware and ground station software on the Internet.
- User can turn off the internal data link and use external data link.

Technical Parameters

Item	Maximum	Standard	Minimum	Unit
Weight		150(HV165)		g
Dimension		90 * 55 * 27		mm
Power Supply	53	12	9	V
Power consumption		2		W
Operating temperature	65	25	-20	°C
Attitude accuracy		0.5		°
Angular velocity measurement range	300		-300	°/s
Acceleration measurement accuracy		80		mg
Positioning accuracy		1		m
Speed measurement accuracy		0.1		m/s
Height measurement range	10000		-400	m
Airspeed measurement range	140		0	m/s
Ground speed measurement range	500		0	m/s
Servo control		10		CH
SBUS input		1		CH
SBUS output		1		CH
Servo update frequency	400		50	Hz
Communication interface		1		CH
Voltage monitoring channel		2		CH
Voltage monitoring range	58		0	V

Engine speed monitoring channel		1		CH
Engine speed monitoring range	65535		0	RPM
CAN interface/td>		1		CH
Extended serial port		1		CH

Flight controller installation and connection

Thanks for purchasing our Leo GNC. This chapter will guide you how to install and tune the flight controller. You can make the cables& wires and check it according to the instruction. Please read this chapter carefully and make the installation strictly abide to the guidance.

Self-prepared equipment

User needs to prepare the following equipment to work with: **Drone:** **Quad plane** - Hybrid fixed wing with four rotor configuration **Fixed wings** - Various fixed wings **Multi-rotor** - multi-rotor drone. **Data link:** with RS232 interface. **Auxiliary control joystick:** AheadX A4RC01 auxiliary joystick is recommended; Support SBUS output; Radio controller with more than 10 channels (eg FUTABA T8FG/T14SG). **Computer:** Recommend Intel Core i3 processors, 2GB memory, 200M hard disk space or better configuration to install our ground station software.

Cables&wires

Interface definition

There are two versions LEO flight controller, one is standard version and the other is HV version. Standard version comes with J30J-21 rectangular connector and HV version with J30J-37TJL connector. User can make cables according to the interface or buy AheadX's finished cables. Following chapters introduce the installation of HV version LEO flight controller.

LEO HV Interface definition

HV Interface definition	Pin	Description
1	P+: power "+"	Flight controller power supply, DC9~53V
2	PGND: power "-"	
3	GND: Ground	communicate with external black box
4	T2: Serial port 2 , RS232 level	
5	GND: Ground	
6	P1+: positive output	DC 5V/0.8A for powering low-power airborne equipment, It is strictly forbidden to supply power to ESC and servo with 5V output.
7	P1_GND+: positive output	
8	R1: Serial port 1 , 232 level	It is data link serial port when only connects to the power of the built-in data link; it is flight controller serial port when only connects to power of the flight controller. Serial port is not working when connects to both datalink and flight controller. Datalink communicate with flight controller directly.
9	T1: Serial port 1 , 232 level	
10	GND: Ground	
11	CAN_H: CAN bus H pin	CAN interface, used for connecting with other AheadX's products, such as smart batteries, external magnetic compass, height-finding radar, etc.
12	CAN_L: CAN bus L pin	
13	P2+: datalink positive input	The supply voltage must be consistent with flight controller's supply voltage if using built-in datalink.
14	P2_GND: datalink negative output	
15	SBusIn: SBus signal input	DC 5V/0.8A for supplying power to low-power airborne equipment, It is strictly forbidden to supply power to ESC and servo with the 5V output.
16	5V: 5V output, powering the receiver	
17	GND: Ground	

18	PWM1:PWM channel1	Used to control the servo or ESC
19	PWM2: PWM channel2	
20	PWM3: PWM channel3	
21	PWM4: PWM channel4	
22	PWM5: PWM channel5	
23	PWM6: PWM channel6	
24	PWM7: PWM channel7	
25	PWM8: PWM channel8	
26	PWM9: PWM channel9	
27	PWM10: PWM channel10	
28	GND: Ground	System Ground
29	SBusOut: SBus control output	Used to control the servo or ESC
30	AD1: Voltage monitoring channel 1	Voltage must be less than 58V
31	AD2: Voltage monitoring channel 2	
32	GND: Ground, for voltage monitoring only	
33	Reserved: Alternate interface	RPM monitoring, compatible with 3.3V/5V

34	RPM1:RPM monitoring 1	
35	R5: Serial port 5 , 232 level	Reserved serial port for connecting RTK and task load commands for transparent transmission
36	T5: Serial port 5 transmission, RS232 level	
37	GND: Serial port Ground	

LEO Standard Interface definition

Serial number	Pin	Description:
1	CAN_H: CAN bus H pin	CAN interface for communication with the guidance technology avionics series equipment, such as smart batteries, external magnetic compass, altimetry radar, etc.
2	CAN_H: CAN bus L pin	
3	Reserved: Alternate	Speed monitoring, compatible with 3.3V/5V
4	RPM1:Speed monitoring 1	
5	DGND: Digital Ground	
6	PWM10: PWM channel10	Used to control the servo or ESC
7	PWM9: PWM channel9	
8	PWM8: PWM channel8	
9	PWM7: PWM channel7	
10	GND: Ground	The PWM signal is reference ground and is only used to connect the ESC or servo
11	PWM6: PWM cahnnel6	Used to control the servo or ESC
12	PWM5: PWM channel5	
13	PWM4: PWM channel4	
14	PWM3: PWM channel3	
15	PWM2: PWM channel2	
16	PWM1: PWM channel1	

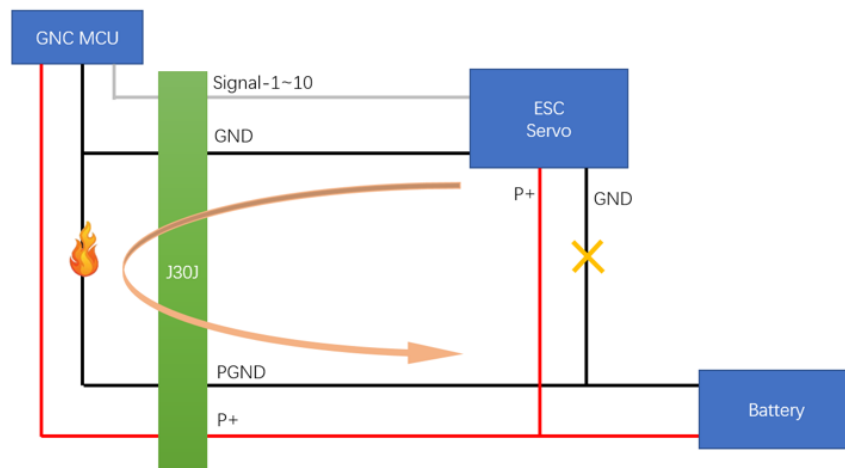
17	R5: Serial port 5 transmission, 232 level	Standby serial port for connecting RTK devices and task load commands for transparent transmission
18	T5: Serial port 5 transmission, RS232 level	
19	GND: Serial port Ground	
20	AD1: Voltage monitoring channel 1	Voltage must be less than 58V
21	AD2: Voltage monitoring channel 2	
22	SBusIn: SBus signal input	Access to the SBus signal
23	SBusOut: SBus control output	Used to control the servo or ESC
24	DGND: Digital Ground	
25	R1: Serial port 1 transmission, 232 level	Only the built-in radio power supply is the serial port of the radio; only the flight control power supply is the flight control serial port; the radio power supply and the system power supply are connected at the same time, the serial port is invalid, and the radio and the flight control are directly communicated.
26	T1: Serial port 1 transmission, 232 level	
27	DGND: Digital Ground	
28	5V: positive output	DC 5V/0.5A for powering low-power airborne equipment, It is strictly forbidden to be used to ESC and servo.
29	P2+: radio power positive input	DC 9~53V Only the radio power supply is connected, serial port 1 is the serial port of the radio; Only the system power supply is connected, serial port 1 is the flight control serial port; at the same time, the radio power supply and system power supply are connected, the serial port 1 is invalid, and the radio station and the flight control directly communicate. If power is supplied at the same time, the P1+ and P2+ voltages must be the same.
30	P+: flight control power positive input	

31	PGND: flight control power supply negative input	
----	--------------------------------------------------	--

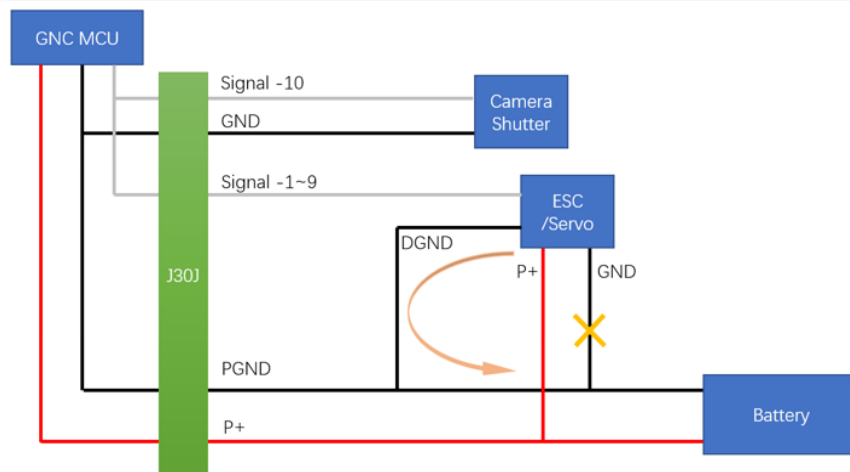
Precautions

Please pay attention whether the power GND and signal GND are connected or not when using ESC.

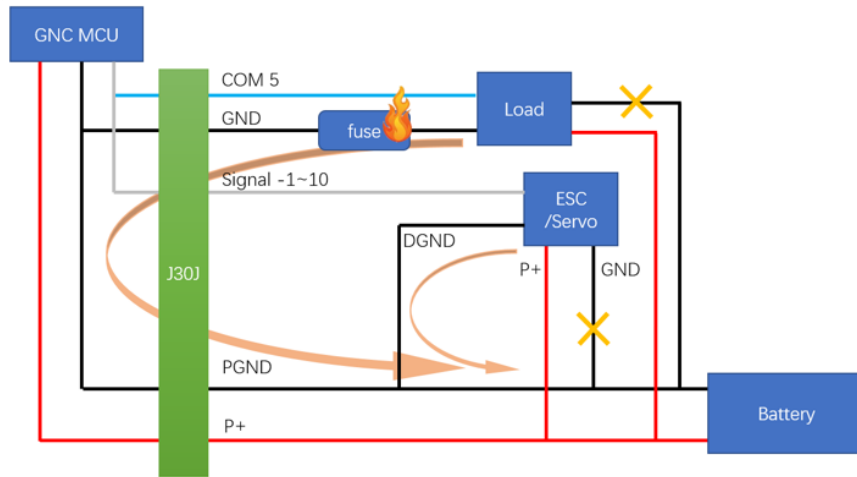
You may meet following problem if the power GND and signal GND are connected: high current may be led back to flight controller via the signal GND cable if power GND cable with any cold soldering or virtual open circuit, which may cause the flight controller to be burnt.



Therefore, user can make following modification to ensure flight controller will not be burnt even with colder soldering or virtual open circuit.



For example, when connecting nacelle to COM5, user can make self-recovering fuses connected in series with its GND cable. This will ensure flight controller will not be affected by external equipment failure.



Please ensure that the voltage or power input and output between all pins meet the above requirements, otherwise the flight control or other avionics equipment will be burned

Please ensure GND cables are connected without any differential pressure (all avionics, including flight controller), otherwise the flight control or other equipment will be burned.

If using an RTK GNSS device (eg DG1, etc.), please use the dedicated GND as listed in the table to avoid possible interference.

The voltage of P1+ and P2+ must be the same if supply power at the same time.

Equipment connection rules

Flight controller power supply

Cable 【1】 【2】 : "+" and GND of the flight control power input.

Cable 【6】 【7】 : Flight control 5V output, for low power equipment (power does not exceed 2W).

Cable 【13】 【14】 : power input of built-in data link, the voltage must be consistent with the flight control supply voltage.

Please ensure there is no potential difference between any equipment which is connected with the flight controller. Otherwise it may cause the flight controller to be burnt.

Data link

LEO flight control data communication uses RS232 level. Cable 【8】 【9】 【10】 are serial port data receiving, serial port data transmission and GND. The LINK interface is used for data communication and firmware upgrade. Please use a reliable data transmission device since it will directly affect the performance of the drone. Please connect the LINK port to your PC with the cable to upgrade the firmware if you don't know the bandwidth and SER of your data transmission device. You

may fail to upgrade firmware when your device cannot transmit data during upgrade.

User needs to disconnect the built-in data link when using COM1 to connect flight controller or external data link.

User needs to disconnect the flight controller power supply when COM1 directly connects to data link.

PWM servo connection

Quad Plan PWM servo connection

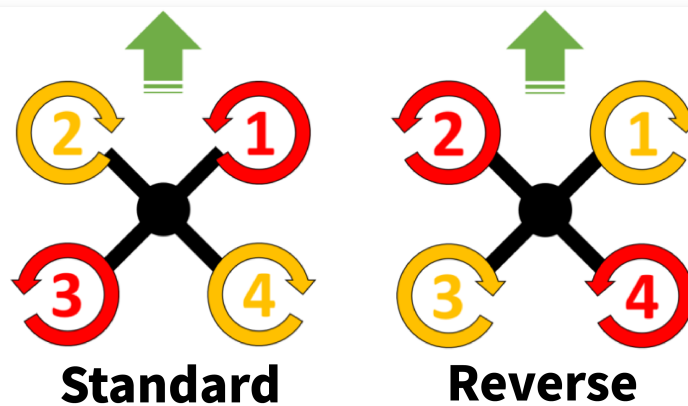
LEO-QP supports 4 channels of PWM multi-rotor ESC input, 6 channels of servo/ESC input.

PWM output signal does not correspond to RC travel. PWM signal here is completely controlled by the flight controller. You can ignore the radio control output sequence

There are strict requirements for the ESC connection of the multi-rotor part. User must remember that right front for PWM1, connect them in counterclockwise order, which means followed by PWM2~PWM4. Usually, it only needs to connect the signal cable and the GND cable. Does not need 5V power supply (except for the special model ESC, it is forbidden to take power from the flight control).

Please connect the cable 【18】 【19】 【20】 【21】 four PWM outputs in turn, and well connect GND. (example: cable 【2】).

LEO firmware 2.0 or above supports X4 and X4R configuration. Please choose the correct configuration according to your requirement.



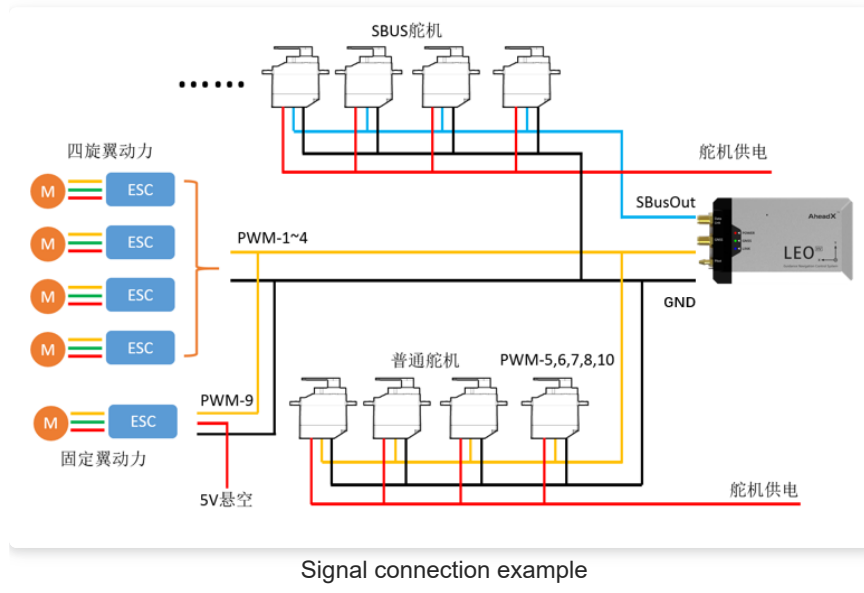
Please calibrate the throttle range with the radio control before using ESC. Calibrate the range with default setting. The standard range is 1100μs~1940μs. Fail to calibrate the throttle range will result in a power system control failure, and the resulting defect or accident is artificial.

PWM 5~PWM 10 can be connected to the servo and fixed-wing ESC (or throttle servo) according to custom and certain rules

Please keep in mind all ESC connection sequence for following parameter adjustment.

It is strictly forbidden to supply power to the servo ESC with the 5V output; Forbidden to connect 5V output to flight controller if the fixed-wing ESC has a 5V output; Forbidden to supply power to the servo with 5V output. These may cause accident or damage due to insufficient power supply

Connection example (for reference only): PWM-5 number 【22】 : left aileron; PWM-6 number 【23】 : right aileron; PWM-7 number 【24】 : elevator PWM-8 number 【25】 : rudder; PWM-9 number 【26】 : throttle; PWM-10 number 【27】 : Camera shutter



Fixed wing PWM servo connection

LEO-FW flight control provides 10 channels for PWM servo / ESC .

PWM output signal does not correspond to RC travel. PWM signal here is completely controlled by the flight controller. User can ignore the radio control utput sequence.

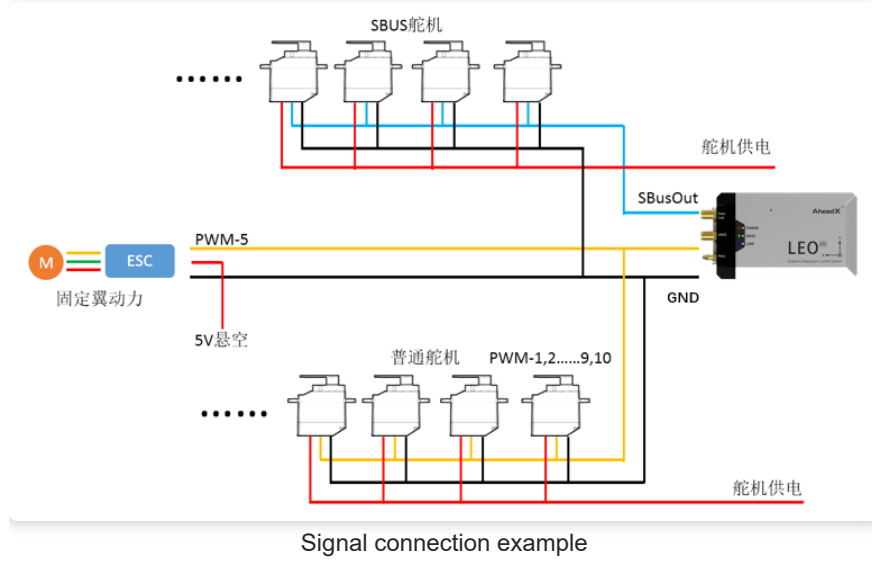
Please calibrate the throttle range with the radio control before using ESC. Calibrate the range with default setting. The standard range is 1100μs~1940μs. Fail to calibrate the throttle range will result in a power system control failure, and the resulting defect or accident is artificial.

PWM 1~PWM 10 can be connected t the servo and fixed-wing ESC (or throttle servo) according to custom and certain rules.

Please keep in mind all ESC connection sequence for parameter adjustment

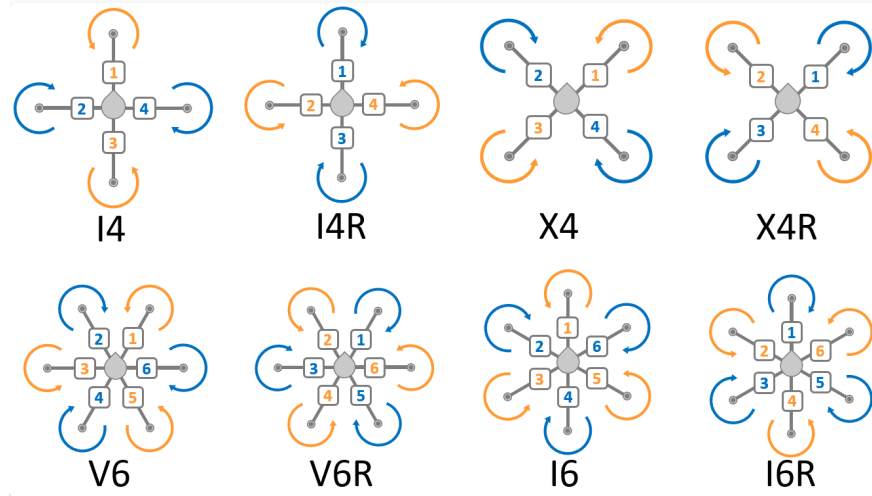
It is strictly forbidden to supply power to the servo ESC with the 5V output; Forbidden to connect 5V output to flight controller if the fixed-wing ESC has a 5V output; Forbidden to supply power to the servo with 5V output. These may cause accident or damage due to insufficient power supply.

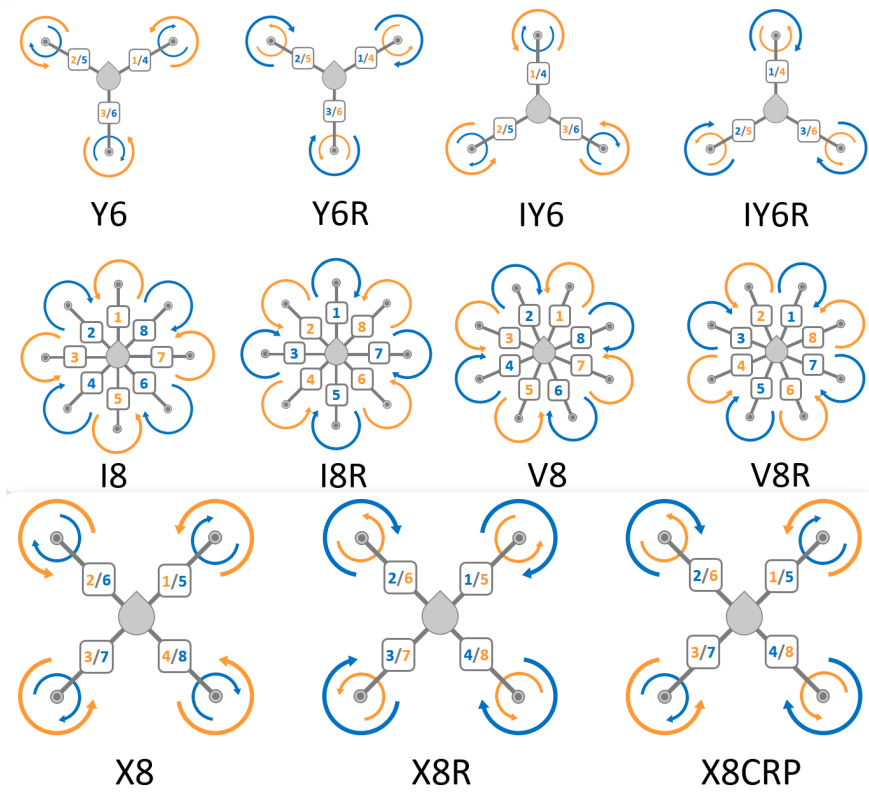
Connection example (for reference only): PWM-1 number 【18】 : left aileron; PWM-2 number 【19】 : right aileron; PWM-3 number 【20】 : elevator; PWM-4 number 【21】 : rudder; PWM-5 number 【22】 : throttle; PWM-6 number 【23】 : Camera shutter



Multi-rotor ESC connection

LEO-MR supports a variety of multi-rotor configurations and provides 8-channel PWM multi-rotor ESC input. The connection sequence as follows:





PWM output signal does not correspond to RC travel. PWM signal here is completely controlled by the flight controller. You can ignore the radio control output sequence.

Please calibrate the throttle range with the radio control before using ESC. Calibrate the range with default setting. The standard range is $1100\mu\text{s} \sim 1940\mu\text{s}$. Failure to calibrate the throttle range will result in a power system control failure, and the resulting defect or accident is artificial.

SBUS servo connection

Leo has specially designed a 16-CH SBUS signal, which is independent of 10 channels of PWM output, it can connect SBUS servos and extend the servo control

PWM output signal does not correspond to RC travel. PWM signal here is completely controlled by the flight controller. You can ignore the radio control output sequence.

Please set the servo channel of SBUS servo first. For details, please refer to the relevant manual of SBUS servo. Please correctly record the corresponding settings between servo numbers and control surfaces. Then connect all the SBUS servo signal cables to the flight controller's SBUSOut in parallel (cable number **【29】**), and the servo ground cables connect in parallel to the ground cable (example: cable No. **【2】**). After well connected, user should wait for the program settings.

It is strictly forbidden to supply power to servo ESC with flight controller's 5V output.

Voltage monitoring

LEO comes with 2 channels for voltage monitoring. The detection range of each channel is 0~58V. Cable number to be connected should be **【30】 【31】**

【32】 . Flight controller will be burnt if the monitored voltage exceeds the range. This is an artificial damage.

Common rules: AD1 for power system voltage, AD 2 for servo voltage. Flight controller will judge the low voltage and execute different command. Please don't reverse the connection.

RPM monitoring

****Quad plane & fixed wing:** ** LEO-Q and LEO FW come with two channels to monitor RPM signal inputs, typically used to monitor fixed-wing power system. The ESC should have RPM output; Or use the engine RPM monitoring module. LEO is compatible with 3.3V or 5V signal feedback.

The flight controller can be burnt if user mixed up the voltage and RPM monitoring interface. This is artificial damage. RPM monitoring must be connected to RPM1 when using a single engine.

****Multi-rotor:**** LEO-MR reserves one RPM monitoring channel, RPM1. It is only used to monitor RPM. It can not judge or execute any command.

Auxiliary joystick

User can use a radio control to assist LEO to control the drone. There are two ways to do that. Please choose the appropriate way according to your requirement. 1. Receiver connects to data link: supports SBUS-to-USB module to upload radio control signal to AheadX Space. The signal will be transmitted to FC via data link. Upstream frequency is 10Hz, and max to 20Hz in remote control mode which basically meets the control requirement of most drones. 2. Receiver directly connects to FC: install the receiver on the drone, FC will directly collect the data. But the transmission distance is short, the drone will lose signal no more than 1km. We don't recommend this way, please weigh the advantage and disadvantage carefully. Flight controller can directly collect the SBUS signal by connecting cable \[15\] \[16\] \[17\] to the receiver.

SBUS signal : SBUS (example R6208SB) SBUS2 (example R7008SB) .Please use low speed mode (70Hz), and avoid using high speed mode (140Hz).

CAN bus air unit

Used to connect AheadX's avionics, including smart batteries, external magnetic compass, height finding radar, camera gimbal/pod, smart navigation lights etc. AheadX's CAN HUB or CAN POWER HUB is a better choice if there are many CAN bus units on the drone . Please contact AheadX for custom service if user needs a customized CAN unit.

Alternate interface

LEO reserves T2 channel(cable number **【4】**) to connect Halley data recording module, which can expand the flight data recording time up to 2000 hours. Serial port R5 and T5 ,(cable number \[35\] \[36\]) for external custom avionics, which is used for transparent transmission, dual redundancy GNSS or RTK .

Equipment installation rules

LEO system needs to connect with other electrical units, user may need to weld cables or plugs. To make sure its reliability, please pay attention to following contents. Weld longer cables. Please use silver plating cable with high temperature resistant and pull resistant features to avoid any cable core broken, outer shell damaged and high resistance. Choose the self-locking plug. Fasten the key parts and dispense glue to improve reliability

Shock absorption requirements

LEO has a built-in shock absorbing structure that eliminates the need to install an external shock absorbing mechanism in most cases. It is not recommended to install LEO on a high vibration aircraft. Please install shock absorption unit if you have to do that. However, it may cause unpredictable error and LEO may fail to work due to the huge vibration. Please stop using LEO in this condition.

Anti-electromagnetic interference requirements

1. Keep away from Motor, ESC and other high-power equipment 2. Keep away from high current power supply cables, power distribution board and other components may cause electromagnetic interference 3. Keep away from radio transceivers with high radiant power.

The metal shell of LEO system comes with better anti-interference feature. But we still recommend user to avoid possible electromagnetic field interference during installation. The magnetic compass is very sensitive to magnetic fields, so it is susceptible to abnormal magnetic field interference which may affect data accuracy.

GNSS antenna installation requirements

1. GNSS antenna should be well connected to FC's SMA connector. Antenna should be led out to the top of the drone body, signal receiving surface (black plastic cover) should be parallel to the ground and facing up to achieve the best performance. Make sure no other metal components around the antenna. 2. GNSS should be far away from magnetic field, electric field, engine, servo, high current wires, data link and transmitter

For users who wants to use their own GNSS antenna, please remove the magnet on the back of the GNSS antenna to avoid any interference caused to the flight controller.

Data link antenna installation requirements

1. Datalink antenna(feeder) should be well connected to “DATA LINK”SMA connector. The antenna should be exposed to the drone body. Trying to make sure the antenna is not blocked by materials with electromagnetic shielding properties such as metal and carbon fiber. 2. The antenna should be mounted straight up or down to get a longer horizontal transmission distance

Structural interference requirement

1. Please reserve a certain space for cables,assembling and disassembling operations according to the real situation. That is used to prevent the flight controller from colliding with the drone body or other equipment. 2. Avoid any cables or wires dragging and pulling the flight controller

Indicator light

Flight control installation

Installation Environment

Electromagnetic Compatibility

The equipment may interfere the compass: engine, motor, gimbal, power supply cables, magnetic screws and other metal components.

- a) Away from engine. Engine will interfere compass and the vibration from generator will interfere flight controller
- b) Motor and gimbal will generate strong magnetic interference when they are working, which will strongly interfere compass stability.
- c) Power supply cable will generate magnetic when current changes, which may cause unpredictable interference to the compass

Any power supply cable or magnetic screws cannot be mounted within 10cm around the flight controller. Motors, gimbals and other magnetic devices cannot be mounted within 15cm around FC. Compass should be mounted 30cm away from the engine.

User can use external compass if the electromagnetic interference around the flight control is serious and unavoidable

Things may interfere PWM output signal:

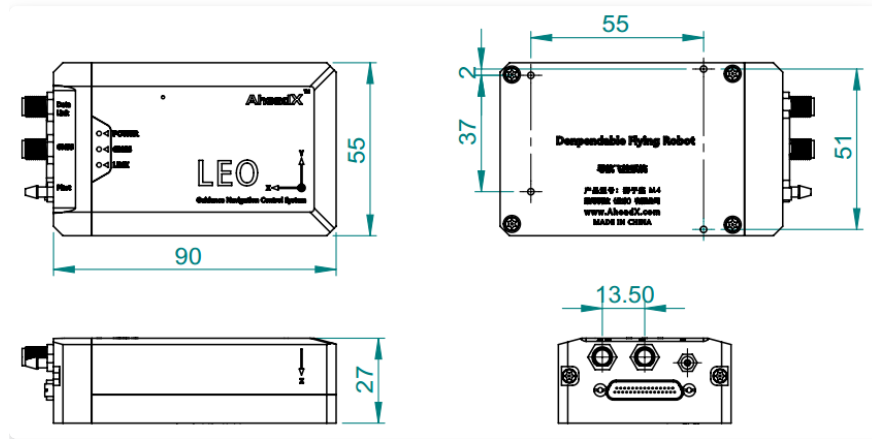
- a) radio transmission device and its transmitter antenna, power supply cables, any magnetic device
- b) It may cause jittering and other abnormal conditions if PWM signal is interfered by the electromagnetic field.

User can add anti-interference equipment like magnetic rings and shielding nets if there is strong electromagnetic interference.

Structural interference

The vibration from drone will affect the flight controller. User can add shock absorption unit to avoid flight controller touching or colliding to drone body.

In a sudden collision, flight controller cannot judge if the vibration is caused by the flight or structural interference. This kind of defect is artificial.



Flight control hardware installation

LEO flight controller can be mounted at any angle, and the installing angle can be corrected in the software, which is convenient and easy to use.

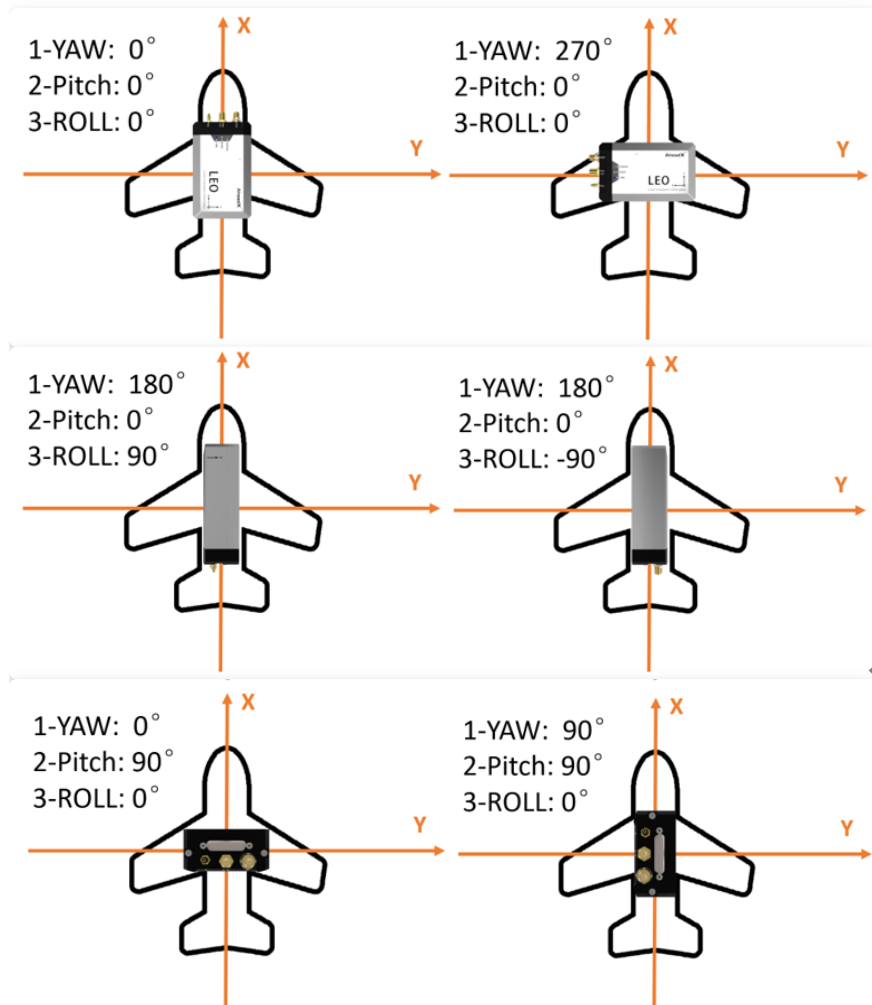
Pay attention to the following content:

1. Mount the flight controller pointing to the front (X arrow to the front, Y arrow to the right). In this way, user doesn't need to adjust the installing angle.
2. User must know the installing angle and input it in the software if user doesn't mount FC pointing to the front. It may cause bad performance or accident if real installing angle is not matched with the input value in the software.
3. User should follow Euler angles and right-hand principles (thumb points to the front of X axis, the direction four fingers bending is "+") to adjust the installing angle. Reference coordinate is the aircraft coordinate, and rotation coordinate is flight controller coordinate. It means user should rotate the flight controller according to the coordinate marked on the flight controller.
4. There is a strict order to rotate the flight controller. (Please read the "Parameter adjustment manual—Installation and Adjustment" to learn how to do the parameter configuration)
5. First rotate YAW axis (rotate around "Z" axis, the parameter can be only 0~360 degree)
6. Second rotate Pitch axis (rotate around "Y" axis, the parameter should be -90~+90 degree)
7. Finally, rotate Roll axis (rotate around "X" axis, the parameter should be 180~+180 degree)

Since the Euler angle rotation may have a non-unique path, the result and control effect are same. For convenient adjustment, it is recommended to use the shortest path setting. (that is, the sum of the absolute values of all the installing angle adjustment parameters is the smallest).

In order to obtain better measurement accuracy, LEO should be mounted within 1 m of the center of mass.

Common installation examples:



Flight control and cable connection

LEO uses the J30J connector, which leads to more cables, so user needs to pay attention to the following items: Tie up cables into bundles and take anti-interference measures according to specific situation. When connecting the cable to the flight controller, do not pull or push the flight control to avoid an unpredictable error due to the force. Any performance degradation or accident caused by this is artificial damage.

User must tighten the connecting screws at both ends to avoid loosening. This must be strictly checked and it needs to be checked frequently.

GNSS antenna installation

Installation Environment

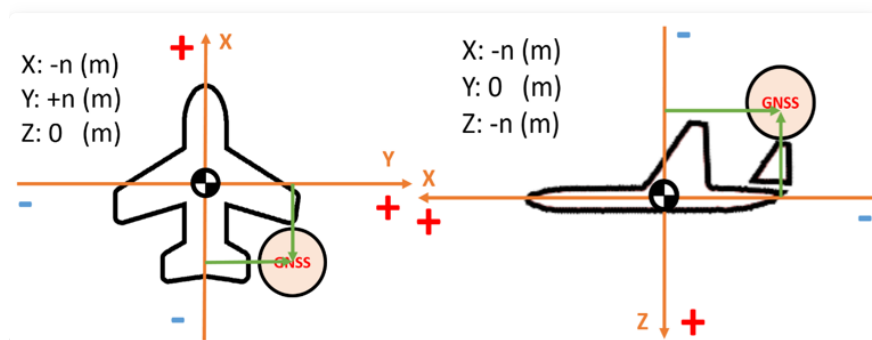
LEO supports GPS/GLONASS (or BEIDO) navigation system. The GNSS antenna is a non-magnetic weak signal receiving device. Please make sure the antenna is not shielded, otherwise, the signal will be affected. In good cases, it can receive 15~20 satellite signals

Precautions:

1. GNSS antenna should be well connected to FC's SMA connector. Antenna should be led out to the top of the drone body, signal receiving surface (black plastic cover) should be parallel to the ground and facing upto achieve the best performance.
2. The antenna can't be wrapped/covered with any metal materials like copper foil, and absorbing material like carbon fiber
3. Antenna feeder cannot be overly bent
4. Keep away from the magnetic field and electric field. Keep away from generator, servo, high current cable, data link and transmitter.
5. For users who wants to use their own GNSS antenna, please remove the magnet on the back of the GNSS antenna to avoid any interference caused to the flight controlle
6. Avoid using any radio equipment in the 1.2GHz to 1.6GHz frequency

Installation adjustment

GNSS measures the position and speed of the antenna mounting point. It will cause lever arm effect and measuring error if GNSS mounting position doesn't overlap TAURUS mounting position. In some cases, user may need to correct the mounting position and input the coordinate distance. (The distance of GNSS relative to FC).



Post-installation check

1. There should be No potential difference between GND cables of all electrical equipment
2. Flight controller 5V output only for low power equipment. Strictly forbidden to supply power to servo or other high-power units with this 5V output.

3. PWM output should not be interfered. All signal cables must be well connected, and make sure no cold soldering and insecure joint
4. Cables that are not used need to be strictly insulated from each other to avoid defect such as short circuits caused by misconnection.
5. Cables should be tied up into bundles to avoid pulling or dragging flight controller
6. The key parts should be double secured. The shock-absorbing unit needs to be checked frequently
7. Flight controller should be mounted with no magnetic substances and strong electromagnetic interference
8. GNSS antenna should not be obstructed, and the feeder should not be overly bent

Including but not limited to the above situation, for any product degradation, failure, damage and crash caused by user who didn't check TAURUS and its accessories and didn't install the flight controller according to our manual. AheadX does not assume any responsibility for direct or indirect damage caused by such circumstances.

Pitot installation

1. Pitot can be let out to corresponding port on FC by a silicon tube. The silicon tube should be as short as possible. User should ensure the tube will not be squeezed or hanging in the air after installatio
2. It will cause airspeed pressure lag, measuring error and even affect the flight if the silicon tube is too long and inner diameter changes. The tube should be well connected to the corresponding port on the FC.
3. Pitot should lead out to the drone body and point to the front. Keep the air inlet away from the fuselage surface to ensure the incoming air velocity will not be obstructed by the airframe or power system (such as propeller).

Basic test

This chapter will introduce basic test on the use of flight controller. Refer to this chapter for post-installation testing.

Hardware connection check

Air unit

System power supply: please make sure power connection is correct and voltage is within the 7-53V.

PWM connection:

Quad plane: Please confirm that PWM 1~4 connected to multi-rotor ESC ; PWM 5~10 connected to fixed-wing control servo or ESC ; The servo needs to be powered independently.

Fixed wing: PWM output connection: PWM1~10 outputs should be corresponding to your setting (ESC& servo). We recommend a separate power supply to servo to avoid any failure caused by insufficient power supply.

Multi-rotor: PWM output connection: Please confirm that the PWM corresponding output channel is correctly connected to the multi-rotor ESC and confirm the sequence.

Data link connection: Please confirm data link is connected to serial port 1.

SBUS servo connection: Please confirm the receiver is well connected if user wants to install it on the aircraft.

Ground unit

Data link : data link ground unit should be connected to PC.

Auxiliary joystick : please use SBUS-to-USB module to connect auxiliary joystick if the receiver is not mounted on the drone.

After everything is confirmed, please connect the power and check flight controller and other components..

Software connection check

Ground station software connection

Start the ground station, select "serial port" and click Connect in "Airframe management". After connected, synchronize the flight controller parameters to ground station. Online map will be automatically loaded with Internet connected. User can use offline map if Internet disconnected

Pre-flight check

The AheadX Space V3 ground station features with a complete pre-flight check. Please read [AheadX Space V3 Groud control software manual](#)-- find "Pre-Flight Check", user should do the pre-flight check according to the guidance.

Upgrade

AheadX has released a Software to upgrade the firmware Click [here](#) to download the firmware upgrade tools.

Connect COM1 to PC with serial port or datalink. Find the corresponding port and read Flight controller data. Please choose "normal version" or "developed version" firmware and install the version you need. Please make sure normal power supply during upgrade.

Please restart the flight controller after upgrade completed.

How to install and use the upgrade tool:

Double-click the "ASHIL update Tool.exe", install it according to the guidance. The main page as follows.



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. (Return postage is on AheadX's side)

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

Warranty project		Service content	Service standard	
Technical Support	400 hotline	Professional technical services provided by technical support engineers, responsible for troubleshooting	7 days*8 hours	
	Remote Assistance	Help customers to tune or solve the problem by remote assistance.	5 days*8 hours	Customer Service

AheadX still offer 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 the 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

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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