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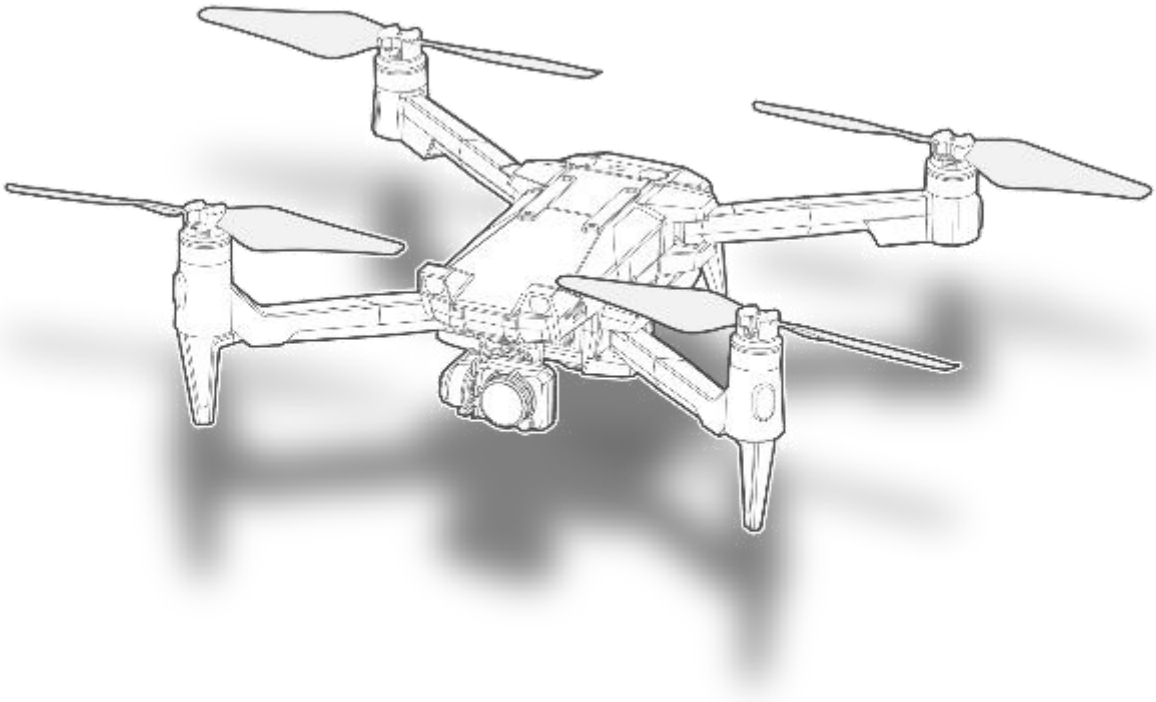
SOTEN

Flight Manual

Ver. 2.11-US1



Class 1 Laser Product

ACSL

5/17/2024

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WARNING: Read precautions and entire manual before first use.

Keep manual nearby for future reference by current and future users.

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Chapter 1

Precautions

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1.1. Introduction

1.1.1. Disclaimer

Please read this disclaimer carefully before using SOTEN. By using this product, you hereby agree that you have read this disclaimer carefully and that you understand, acknowledge and agree to the terms and conditions described herein and elsewhere in the SOTEN User Manual. SOTEN IS NOT A TOY AND IS NOT SUITABLE NOR INTENDED FOR USE BY ANYONE UNDER THE AGE OF 18.

Although SOTEN incorporated sophisticated technologies, inappropriate use of the product may result in personal injury or property damage. Please read this SOTEN User Manual carefully before using the product. The SOTEN User Manual is available at https://acsl-usa.com/support/

The SOTEN User Manual may affect your personal safety and your legal rights and obligations. Failure to read this document in its entirety and following the instructions and warnings may result in product loss/damage, injuries to you and others, and damage to property. It is essential that you read and follow all of the instructions and warnings in this documents.

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1.1.2. Warning

- Before using this product, read carefully and fully understand the safety precautions and instructions in this manual.
- Follow the warnings in this manual. Failure to do so may result in personal injury or property damage.
- Do not replace any part of this product without explicit permission from ACSL. In addition to the replacement of parts, any repairs or modifications other than those specified by ACSL are not covered by the warranty.
- During the operational life of this product, perform the pre-flight inspections, repairs, and routine maintenance as specified in Chapter 8: "Maintenance, Inspection and Disposal" .

1.1.3. Definitions – Classifications of Safety Alerts

In this manual, and on the product itself, the following classification of safety alert signal words and symbols is used in conjunction with the headings “WARNING”, “CAUTION” and “ADVISORY”. These symbols are deployed to ensure safe and proper use of the product and to prevent property damage and injury to the user or to others.
The symbols and signal words and their meanings are shown below. Please read carefully and understand the meaning of each.

This symbol is the safety alert symbol.
This symbol is used to alert you to hazards that could potentially harm people.
To avoid possible injury or death, follow all safety instructions that follow this symbol.

WARNING

This signal word indicates that failure to follow the associated guidance could result in death or serious injury.

CAUTION

This signal word indicates that failure to follow the associated guidance could result in minor or moderate injuries.

ADVISORY

This signal word indicates that failure to follow the associated guidance could result in malfunction or failure of the product, which could cause damage to other property.

The following symbols illustrate prohibited or required actions.

	**Prohibited Actions** The associated actions should not be done.
	**Required Actions** The associated actions must be done.

1.2. Ensuring Safe Use

1.2.1. Intended Use

- SOTEN is an unmanned aircraft designed specifically for industrial/official use, not for general consumer use.
- SOTEN's intended use is that it is to be flown manually by an experienced pilot, or autonomously along a planned route using the controller and the ACSL TAKEOFF ground control application.

1.2.2. Flight Conditions

- The table below lists common flight conditions and the suitability of SOTEN for those conditions.
- The user must comply with all local and national laws regarding the flight of unmanned aircraft.
- Purchase of liability insurance to protect the user against the occurrence of bodily injury to persons and damage to property is strongly recommended prior to using SOTEN. It is also strongly recommended that the user purchase property insurance.

Flight Scenario		Suitability
1	Manual flight within visual line of sight	Yes (excluding no-fly zones)
2	Autonomous flight within visual line of sight	Yes (excluding no-fly zones)
3	Flight beyond visual line of sight	Only with proper permission (check pertinent laws)
4	Daylight flight	Yes
5	Night flight	Only when properly equipped and with proper permission (check pertinent laws)
6	Good GPS reception	Yes[1]
7	No/Poor GPS reception	Yes[2]
8	Flying in a strong electromagnetic field	No[3]
9	Flying in precipitation	No[4]
10	Flying in icing conditions	No

CAUTION

1 Must continuously monitor GPS reception during flight.
If GPS reception becomes poor, immediately switch to manual (MAN) mode to continue safe flight.

2 SOTEN is capable of flight in position (POS) mode even with poor or no GPS signal reception using the three on-board stereo cameras. However, flight may become unstable depending on the lighting conditions and scenery, especially in environments with poor or extremely bright lighting, reflective or low-contrast scenery, a lot of moving scenery, or a lack of close scenery. Be prepared to switch to manual (MAN) mode immediately if you notice anything unusual or if motion becomes erratic.

3 Be careful not to use SOTEN in areas with strong interference from other wireless devices. Do not fly near areas with electromagnetic interference. In particular, areas around high-voltage power lines, cellular base stations, and radio towers are likely to be sources of electromagnetic

interference, which may cause instability or disruption of the communications between the aircraft and the controller that are necessary for safe maneuvering. If communication between the aircraft and the controller becomes unstable, discontinue the use of nearby Wi-Fi devices.

4 The main body of the aircraft (with the camera and battery installed) is dustproof and waterproof equivalent to IP43, but if rain or fog is observed or anticipated during flight, abort the flight.

1.2.3. Limitations

- Use of SOTEN must comply with the limits specified below.

Item	Min.	Max.
Takeoff weight	-	2.0 kg (4.4 pounds)
Airspeed	-	15 m/s (33.5 MPH)
Density altitude[1]	-	2,000 m (6,600 ft)
Maximum wind speed	-	10 m/s (22 MPH)
Operating ambient temperature	-20°C[3] (-4°F[3]) (conditional)	40°C (104°F)
2.4 GHz communication distance	-	4 km[2] (2.5 miles[2])

CAUTION

1 Density altitude is the equivalent altitude above sea level at international standard atmospheric pressure and temperature (1013.25 hPa, 15°C). Density altitude varies from geodetic altitude with atmospheric pressure and temperature. In general, high temperature and lower pressure weather will result in a density altitude that is higher than the geodetic altitude.

2 Communication distance is not guaranteed. Communication distance varies depending on the surrounding environment and level of electromagnetic interference in the vicinity. Continuously monitor the strength of the communications between the aircraft and the controller during flight.

3 The amount of energy that can be supplied from the battery is lower when used at low ambient temperatures compared to normal ambient temperatures. Please be aware of the following points when operating at low ambient temperatures:

- The battery level will decrease faster, and the flight time will be shorter than when flying in a normal ambient temperature. Please be aware of battery consumption and continuously monitor the battery level indicator during flight.
- The maximum power the battery can produce decreases with its internal temperature. At low temperatures, the battery may not be able to provide enough power to sustain high-speed flight against strong winds or to perform abrupt maneuvers. When flying in low ambient temperatures, consider using lower airspeed and wind speed limits than those specified in the section 1.2.3, and avoid abrupt maneuvers.
- To prevent the battery temperature from falling below 20°C (68°F), place the battery in a location with a heating system to warm up the battery before use. Avoid direct exposure to hot air from heating equipment, etc.
  (A battery should not be used if its left in low ambient temperature.)

1.2.4. Firmware Updates

Use the latest firmware. The aircraft and controller firmware can be updated through the ACSL TAKEOFF ground control application to improve performance and add new features. Check the ACSL website or your dealer for the latest information.

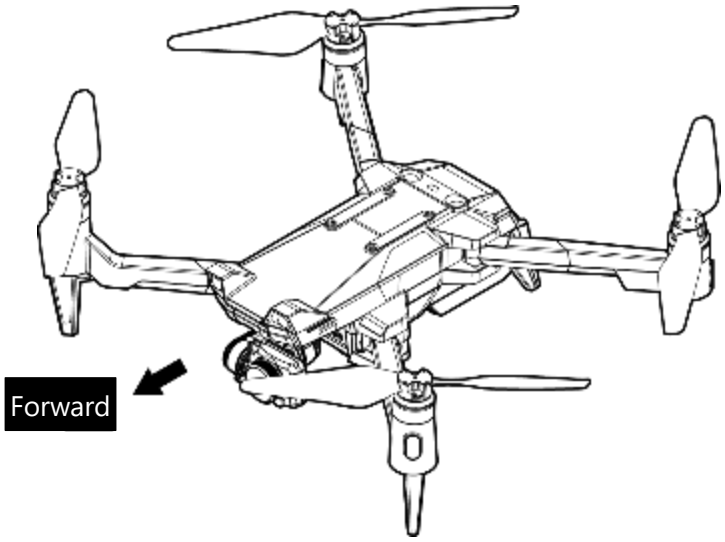
The latest version of the ACSL TAKEOFF ground control application includes all fixes from previous versions, so updating the firmware with the latest version of TAKEOFF will bring the aircraft and controller up to date. It is not necessary to update a drone and/or controller with previous versions of TAKEOFF.

Refer to the ACSL TAKEOFF ground control application User Manual for information on how to update such out-of-date firmware.

1.3. General Precautions

1.3.1. Aircraft

Familiarize yourself with the orientation of the aircraft (which side is front and which side is rear) to avoid maneuvering in the wrong direction.



Class 1 Laser Product

WARNING

	Do not touch the aircraft or battery terminals with wet hands. Doing so may result in electric shock.
	Do not disassemble or modify the aircraft in any way. Doing so may result in fire, damage, malfunction, or electric shock.
	Do not look near the two infrared sensors located on the top and bottom of the aircraft when it is powered on. Lasers operating with a wavelength outside the visible range (class 1 lasers) are emitted when the aircraft is powered on.
	Do not touch the motors immediately after flight. Doing so may result in burns, as the motors heat up significantly during flight.
	The propellers are sharp. Be careful when attaching and removing the propellers to avoid cutting your hands or body with the sharp ends.
	Japan only: Due to recent regulatory changes, the use of SIM cards may be restricted to those exclusively for use in unmanned aircraft. Please confirm and comply with the latest regulations. (LTE-equipped models only)

1.3.2. Battery

WARNING

	**Handle the battery carefully to avoid damage or leakage.** Failure to do so may result in injury.
	**Do not disassemble the battery.** Doing so may cause fire or the release toxic substances.
	**Do not use an unsuitable battery type.** Doing so may cause fire.
	**Do not drop the battery into water or splash water onto it.** Doing so may cause overheating or fire. **(In an emergency it is acceptable to douse the battery with water to prevent starting or spreading fire. See the "Precautions to prevent the spread of fire" below.)**
	**Do not short circuit the battery.** Doing so may cause overheating or fire.
	**Do not heat battery to high temperatures (>60°C or >140°F) or incinerate.** Doing so may cause an explosion or burns.
	**Do not use or charge the battery if the aircraft has been subjected to a severe shock, such as a crash or a hard landing after free fall.** Doing so may cause overheating or fire.
	**Do not mount, use, or charge a battery with bulges, breaks, cracks, holes, or deformities.** Doing so may cause overheating, fire, damage, or malfunction.
	**Do not charge, store, or leave the battery in high temperatures, high humidity, places exposed to water, or in a car under the hot sun.** Doing so may cause overheating, fire, damage, or malfunction.
	**Do not charge the battery immediately after the flight. Delay charging until after the battery has cooled down to room temperature.** The battery may be hot immediately after flight, and charging may further increase temperature and may cause overheating or fire.
	**Please dispose of used batteries properly according to the disposal method specified by your local government.** Contact your dealer for recycling of batteries with remaining useful life.

CAUTION

Precautions to prevent the spread of fire:

- When using SOTEN, take necessary measures such as having an appropriate fire extinguisher* nearby in case of fire caused by damage to the battery.
  *ABC powder fire extinguishers are recommended.
- If the battery is damaged or deformed due to excessive shock, crash, etc., dispose of it properly according to the disposal method specified by your local government.
- If the battery is damaged or deformed by excessive shock, crash, etc., or if abnormal heat generation or smoking is observed, it may catch fire. Immediately cool the battery with a large amount of water to prevent self-ignition.
- If fire is detected in the battery, prevent the fire from spreading by using fireproof cloth, fireproof sand, or a fire extinguisher. Call the local fire department and make every effort to extinguish the fire.

1.3.3. Battery Charger

WARNING

	**Do not touch or unplug the charger with wet hands.** Doing so may result in electric shock.
	**Do not drop the charger or subject it to vibration, shock, or deformation.** Doing so may cause fire or malfunction.
	**Do not operate, store, or leave the charger in high temperatures, high humidity, places exposed to water, or in a car under the hot sun.** Doing so may cause fire, damage, or malfunction.
	**Do not touch the charger for long periods of time while charging the battery.** Doing so may result in burns.
	**Do not connect the charger to or use it with devices other than those specified.** Doing so may cause overheating, fire, damage, or malfunction.
	**Do not cover the charger with blankets or other covers while charging a battery.** Doing so may cause excessive heat buildup resulting in fire or malfunction.
	**Do not disassemble or modify the charger in any way.** Doing so may cause fire, damage, malfunction, or electric shock.
	**Do not connect the charger to an electrical outlet or battery with condensation on it.** Doing so may cause fire, damage, malfunction, or electric shock.
	**Do not allow foreign matter such as dust or dirt to contact the charger terminals.** Doing so may cause overheating, fire, damage, malfunction, or electric shock.
	**Do not use flammable aerosols or sprays on or in the vicinity of the charger.** Doing so may result in fire or explosion.
	**Do not allow other metallic objects (tools, jewelry, etc.) to contact or short-circuit the charger terminals.** Doing so may result in malfunction, electric shock, or fire.
	**Do not use the charger with an excessive number of extension cords, power strips, etc.** Exceeding the current rating of the electrical wiring may cause fire.
	**Unplug the charger from the outlet when not in use for an extended period.** Power leakage due to deterioration over time may cause a fire.
	**The ground terminal of the power cord must be connected to a ground wire.** Failure to do so may cause electric shock.
	**When using an extension cord, check its user manual and current rating.** Exceeding the current rating of the extension cord may cause fire.
	**If you notice any abnormality, unplug the charger immediately.** Failure to do so may cause electric shock, malfunction, overheating or fire.

1.3.4. Controller

WARNING

	**Do not heat the controller, use it near a fire, or incinerate.** Doing so may cause overheating, ignition, damage, or malfunction.
	**Do not drop the controller or subject it to vibration, shock, or deformation.** Doing so may cause fire or malfunction.
	**Do not charge, store, or leave the controller in high temperatures, high humidity, places exposed to water, or in a car under the hot sun.** Doing so may cause fire, damage, or malfunction.
	**Do not use or charge the controller if it is swollen, damaged, cracked, punctured, or deformed.** Doing so may cause overheating, fire, damage, or malfunction.
	**Do not connect the controller to or use it with equipment other than that specified.** Doing so may cause overheating, fire, damage, or malfunction.
	**Do not drop the controller into water or splash water onto it.** Doing so may cause fire, damage, or malfunction.
	**Do not disassemble or modify the controller in any way.** Doing so may cause fire, damage, malfunction, or electric shock.
	**Do not connect the controller to a battery or an electrical outlet or with condensation on it.** Doing so may cause fire, damage, malfunction, or electric shock.
	**Do not allow foreign matter such as dust or dirt to contact the controller terminals.** Doing so may cause overheating, fire, damage, malfunction, or electric shock.
	**Do not allow the terminals of the controller to get dirty or wet.** Doing so may cause fire, damage, malfunction, or electric shock.
	**Do not use or charge the controller if it has been dropped or if has been deformed.** Doing so may cause overheating, fire, damage, malfunction, or electric shock.
	**Do not allow other metallic objects (tools, jewelry, etc.) to contact or short-circuit the controller terminals.** Doing so may result in malfunction, electric shock, or fire.

1.3.5. Soft Equipment Case

Safety Precautions

- Soft Equipment Case Instruction Manual for L14-N81LA-10 -

This product is a backpack-type soft carrying case that can hold the SOTEN industrial drone. When actually using the product, please read the instruction manual of the equipment to be stored in the case carefully and use it correctly according to the contents of the manual.

Specification	
External dimensions	W16.7 x D14.9 x H9.4 inch
Net weight	4.4lbs
Recommended storage temperature	14 ~ 140 °F

**Please note that these are the recommended storage temperatures for the case itself, and when storing devices, please pay attention to the recommended storage temperatures specified for each device.

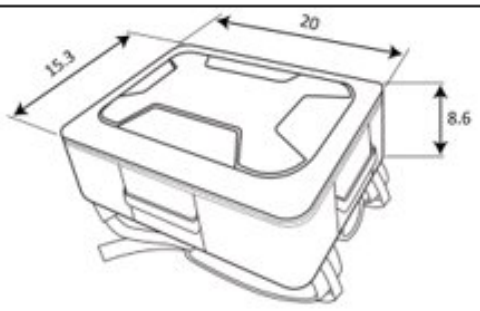
WARNING

Please be careful not to pinch cords when storing
This may cause not only malfunctions such as wire breakage, but also heat generation, ignition, and leakage of electricity from the cable.

Do not store dropped, submerged, or broken batteries
Interior materials are noncombustible and may cause fire spread in the event of ignition.

When storing batteries, do not leave them in extremely hot environments such as inside a car during the summer
If the case is continuously exposed to direct sunlight in an environment with high ambient temperatures outside the case, the internal temperature will become very hot, which may lead to battery ignition.

Product dimensions



Unit: inch

1.3.6. Water & Dustproof Case

Safety Precautions

- Water & Dustproof case instruction manual for L14-N81LA-00 -

This product is a waterproof and dustproof hard case (IP67) that can accommodate the SOTEN industrial drone. Please read the instruction manual of the equipment to be stored in the case carefully before actual use, and use the case correctly according to the contents of the manual.

Specification	
External dimensions	W20 x D16.5 x H8.5 inch
Net weight	9.7lbs
Recommended storage temperature	14 ~ 140 °F

**Please note that these are the recommended storage temperatures for the case itself, and when storing devices, please pay attention to the recommended storage temperatures specified for each device.

WARNING

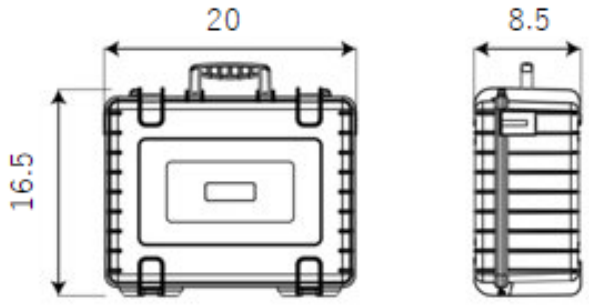
Do not store dropped, submerged, or broken batteries
Interior materials are noncombustible and may cause fire spread in the event of ignition.

Please be careful not to pinch cords when storing
This may cause not only malfunctions such as wire breakage, but also heat generation, ignition, and leakage of electricity from the cable.

When storing batteries, do not leave them in extremely hot environments such as inside a car during the summer
If the case is continuously exposed to direct sunlight in an environment with high ambient temperatures outside the case, the internal temperature will become very hot, which may lead to battery ignition.

Do not leave the case open in strong winds or in unstable places
The top cover of the case may close too vigorously, resulting in injury such as pinching of fingers.

Product dimensions



Unit: inch

1.3.7. Multi Mount Kit

Safety Precautions

- Multi Mount Kit Instruction Manual for L14-5150A-00 -

This product is an optional part with high internal risk as described on the face of this document. When using this product, strictly observe the prohibitions and precautions indicated in this manual in order to prevent harm to the user or third parties or damage to property due to malfunction, malfunction, or runaway caused by improper use.

General Precautions

⚠ WARNING ⚠

Do not install payloads (devices) other than those specified by us
Do not fly with equipment which we have not approved to be mounted on the SOTEN. Before using it, be sure to read the instruction manual on our website carefully to make sure that it is a device we allow to be mounted on the aircraft.

As stated in the "Disclaimer" on the front page of this document, we are not responsible for any events that may occur with aircraft carrying payloads other than those specified.

⚠ WARNING ⚠

Before flight, make sure the payload does not hit the rotor blades. The aircraft may crash.

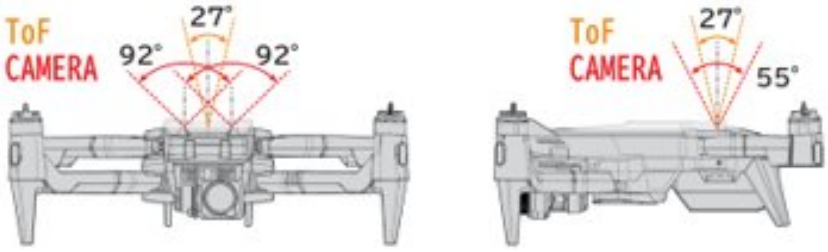
⚠ WARNING ⚠

Maximum Takeoff Weights : 4.4lbs
"Maximum takeoff weight" is the total takeoff weight allowed by the aircraft, which is the sum of the aircraft SOTEN weight and all payloads. When installing equipment that we have approved, please be sure to measure the total weight before the flight.

WARNING

If any strings, tapes, optional equipment cases, or other accessories are attached to our specified equipment, be sure to remove them before loading the equipment into the aircraft.

The aircraft may malfunction if the obstacle camera/TOF sensor moves within its detection range, or if the specified equipment is equipped with accessories which operation has not been confirmed by us.



WARNING

Always check that the payload is adequately secured before flight

May lead to payload drop or aircraft crash

Do not greatly exceed the recommended torque when fastening to the aircraft

Not only may the aircraft be damaged, but also the payload may fall or the aircraft may crash

Do not store or leave in high temperatures, high humidity, in places exposed to water, in direct sunlight, or in a car in the hot sun.

Deterioration may lead to payload drop or aircraft crash

No payloads with external damage, cracks, holes, or deformation

May lead to payload drop or aircraft crash

Please make sure to read before use

This product has the highest internal risk of all SOTEN optional parts. Please read the latest Multi Mount instruction manual carefully and take safety into consideration before actual use.

1.3.8. Rotor Blade Guard

Safety Precautions

- Rotor Blade Guard Instruction Manual for L14-45329-00 -

This product is an optional part for "objective contact only" as described on the surface of this document. To prevent injury to the user or third parties or damage to property due to the dropping of the aircraft or property (this product) as a result of improper use, please strictly observe the following prohibitions and precautions when using this product.

General Precautions

⚠ WARNING ⚠

Always check that the payload is adequately secured before flight May lead to payload drop or aircraft crash	**Do not fly with the maximum takeoff weight exceeded** May lead to aircraft crash or flyaway
Do not store or leave in high temperatures, high humidity, in places exposed to water, in direct sunlight, or in a car in the hot sun. Deterioration may lead to payload drop or aircraft crash	**Do not equip or fly this product with any external damage, cracks, holes, or deformation.** May lead to payload drop or aircraft crash
Do not allow the aircraft body to approach any person or persons even with this product attached. There is a risk of a serious accident when the aircraft body and the object come into contact with each other	**Do not use in locations where wind direction changes significantly** External forces beyond the design assumptions may cause the aircraft to lose balance and crash.

⚠ WARNING ⚠

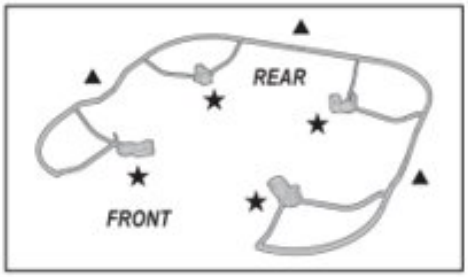
Maximum Takeoff Weights : 4.4lbs

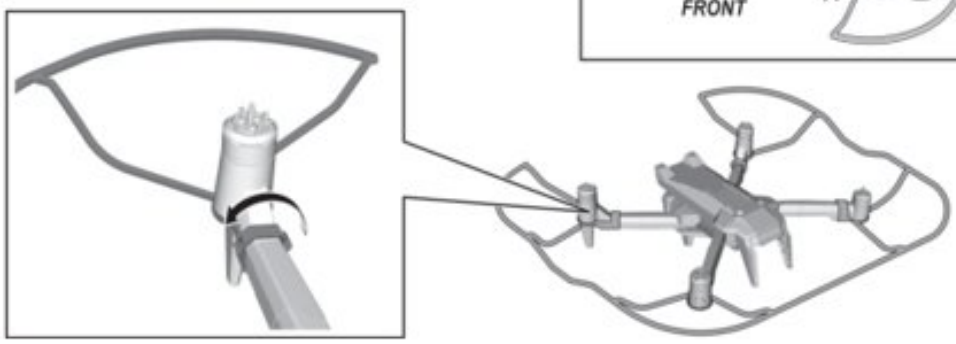
"Maximum takeoff weight" is the total takeoff weight allowed by the aircraft, which is the sum of the aircraft SOTEN weight and all payloads. When installing equipment that we have approved, please be sure to measure the total weight before the flight.

As stated in the "Disclaimer" on the front page of this document, we take no responsibility for any damage to property, injury to the human body, or any other disadvantages that cannot be mitigated or prevented by this product.

Be sure to check that the product and the fuselage are properly fastened at the four locking points indicated by the symbols (★) in the figure below. (Please refer to the instruction manual for detailed disassembly and installation of this product.

▲ : Disassemblable parts
★ : Locking points





This product is designed so that it cannot be mounted in the wrong direction. Attempting to force the product in the wrong direction may result in damage to the aircraft or this product.

⚠ WARNING ⚠

This product is not intended to prevent injury to humans or animals.
This product is an optional part designed to reduce damage when the aircraft accidentally comes into contact with property, etc., and to reduce damage to the main body of the aircraft. It is not intended to reduce damage or prevent serious accidents from occurring when the aircraft comes into contact with humans or other living organisms. (The same safety precautions are required when the product is installed as when it is not installed.

Please make sure to read before use

Incorrect installation of this product may cause the aircraft to crash or the property (this product) to fall. Please read the instruction manual carefully and pay sufficient attention to safety before actual use.

1.4. In-Flight Precautions

1.4.1. General Precautions

- Pilots should wear helmets, protective goggles, long sleeves, and long pants. In addition, an emergency evacuation area should be designated in advance.
- The flight area must be kept clear of people, including pilots, and third-party property.
  *Japan only: A flight permit is required when flying within 30 meters of third-party people or property.

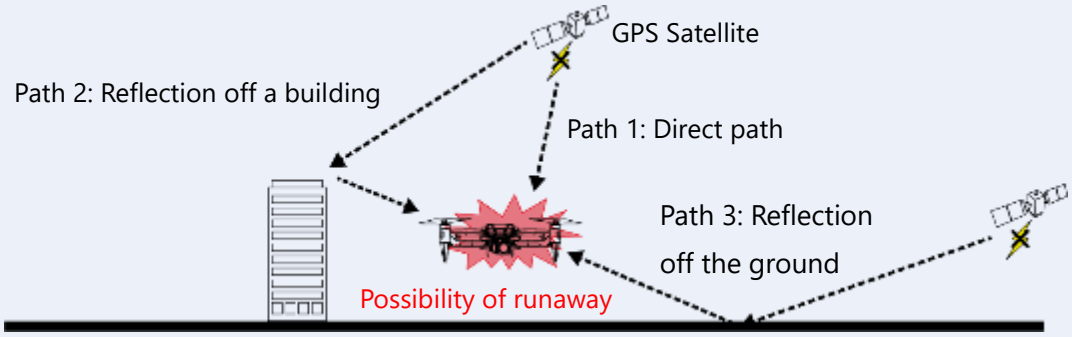
- When the motors start, the propellers rotate, which may cause cuts, amputations, or fractures. The pilot should make sure that no one is within 5 meters (15 feet) of the aircraft before starting the motors.
- Never allow anyone to come between the pilot and the aircraft.
- Provide an adequate airspace buffer around personnel involved in the flight operations, including pilots and observers, to ensure that people not involved cannot inadvertently approach the pilot and interfere with the flight operations.
- While in operation. ensure that the propellers do not touch the ground or any structure. Failure to do so may cause a serious accident, injury, death, or property damage.
- Beware of collisions with power lines, trees, birds, and other aerial objects. A serious accident may result in injury or property damage.

1.4.2. Flight Environment

- Be sure to check the current weather conditions and forecasts before flying to avoid exceeding the flight conditions and limitations specified in section 1.2: "Ensuring Safe Use."
- If weather conditions deteriorate, such as sudden rain, lightning or fog, the flight should be terminated immediately.

ADVISORY

- Depending on the surrounding environment, GPS signals may be reflected by obstacles, causing the aircraft to operate erratically.
- In places where radio waves are easily reflected or diffracted by obstacles such as buildings or terrain, a phenomenon called "multipath reception" may occur. Multipath reception can cause an error of several meters to dozens of meters in the measured position of the aircraft by the GPS receiver, which could result in a collision with an obstacle or a crash. Avoid flying in such areas.
- Indication of poor GPS reception on the controller or ground control application, or abnormal attitude or motion of the aircraft may indicate multipath reception. Pay close attention to the behavior of the aircraft and the GPS signal strength indications during flight. If you notice any abnormalities, switch to manual (MAN) mode and land the aircraft immediately.



- SOTEN is capable of position mode flight even with poor or no GPS signal reception using the three on-board stereo cameras. However, flight may become unstable depending on the lighting conditions and scenery, especially in environments with poor or extremely bright lighting, reflective or low-contrast scenery, a lot of moving scenery, or a lack of close scenery. Be sure to be able to switch to manual flight mode immediately if you notice anything unusual or if motion becomes erratic.

➔ See section 2.3.2: "Overview of the Visual System.".

- Be careful not to use SOTEN in areas with strong interference from other wireless devices. Do not fly near areas of electromagnetic interference. In particular, areas near high-voltage power lines, cellular base stations, and radio towers are likely sources of electromagnetic interference, which may cause instability or interruption of communication between the aircraft and the controller necessary for safe maneuvering. If communication between the airplane and the controller becomes unstable, discontinue the use of nearby Wi-Fi devices. Ensure that you do not exceed the flight conditions and limitations specified in Section 1.2: "Ensuring Safe Use."

1.4.3. Aircraft

- Takeoffs and landings should be made on a flat, level surface.
- Before powering on, place the aircraft on a flat, level surface.
- During startup, do not bump or tilt the aircraft until startup is complete as this may interfere with the startup calibration of the on-board sensors.
- Do not leave the aircraft unattended with the battery connected.
- A caution message will be displayed if the internal temperature of the aircraft rises above 65°C (149°F). Keep the aircraft in the shade, out of direct sunlight. See Section 7.1.14: "Caution Messages."
- After landing, first shut the aircraft down, then move it to a safe place.
- The status LED will blink white or red when a sensor error, poor GPS reception, or other abnormal condition occurs. If the LED blinks white, an abnormality has been detected in the aircraft, and the flight should be terminated immediately.
  *For other details, see Section 6.1.4: "Check the Status LED."94

- Do not exceed the maximum takeoff weight. The aircraft may not be able to maintain safe flight, which could result in injuries or property damage.

- Do not perform a hand catch or hand release. The aircraft may behave unexpectedly due to a disturbance or mishandling, which may result in injury.
- Do not touch the motors immediately after flight. Doing so may result in burns, as the motors heat up significantly during flight.

1.5. Maintenance, Inspection, Storage, and Transportation Precautions

1.5.1. Maintenance and Inspection

- Perform maintenance inspections according to the instructions in Chapter 8 “Maintenance, Inspection and Disposal”.
- Perform the periodic replacement of parts according to the instructions in Section 8.8 “Periodic Parts Replacement.”
- If the aircraft crashes or otherwise suffers a strong impact during flight, contact your dealer.

1.5.2. Storage

- If the aircraft is dropped or otherwise subjected to a strong shock during storage, contact your dealer.
- Store SOTEN in a locked area.
- Refer to Section A-1-1 “Specifications” for the storage conditions for each component of SOTEN.
- If SOTEN is stolen, it may be used for illegal or unsafe nefarious purposes. Customers are requested to make every effort to prevent theft. In the event that SOTEN is stolen, promptly file a report with the local police and contact your dealer.

1.5.3. Disposal

- When disposing of SOTEN, refer to Section 8.10 “Disposal and Recycling”. Comply with all local rules.

1.5.4. Transport

- Transport SOTEN in a storage case to avoid strong shocks to the aircraft, controller, camera, propellers, or batteries.
- Make every effort to prevent theft of this product during transportation. In the event that SOTEN is stolen, promptly file a report with the local police and contact your dealer.

If SOTEN is transported with the camera attached to the aircraft, unintentional shocks to the camera may cause contact failure at the points that it contacts the aircraft. Always remove the camera from the aircraft for storage or transportation.

1.6. FCC Compliance Statements

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

SOTEN (L14)
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

ACSL, Inc.
710 Lakeway Drive, Suite 200, Sunnyvale, CA 94085
https://acsl-usa.com/contact/

FCC CAUTION
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

This aircraft complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

The available scientific evidence does not show that any health problems are associated with using low power wireless devices. There is no proof, however, that these low power wireless devices are absolutely safe. Low power wireless devices emit low levels of radio frequency energy (RF) in the microwave range while being used. Whereas high levels of RF can produce health effects (by heating tissue), exposure of low-level RF that does not produce heating effects causes no known adverse health effects. Many studies of low-level RF exposures have not found any biological effects. Some studies have suggested that some biological effects might occur, but such findings have not been confirmed by additional research. SOTEN's controller has been tested and found to comply with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines.

1.7. Other Notes

In the unlikely event of an accident, report to the FAA along with your dealer within 10 days.
(Refer to the FAA website as per below.)

When do I need to report an accident? | Federal Aviation Administration (faa.gov)

Chapter 2

Product Overview

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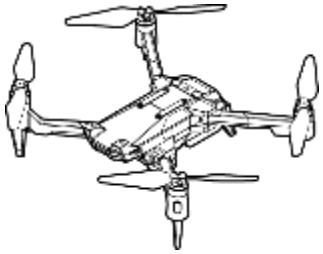
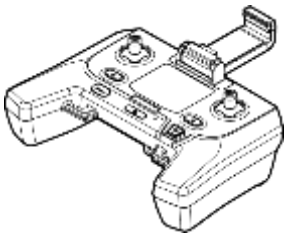
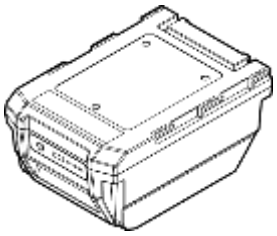
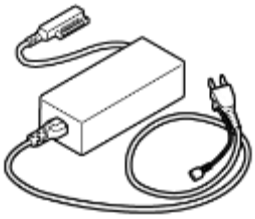
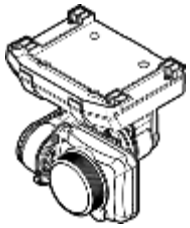
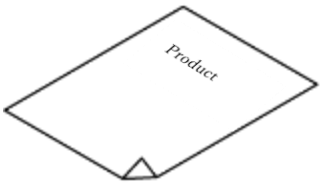
2.1. Product Details

2.1.1. Standard Parts

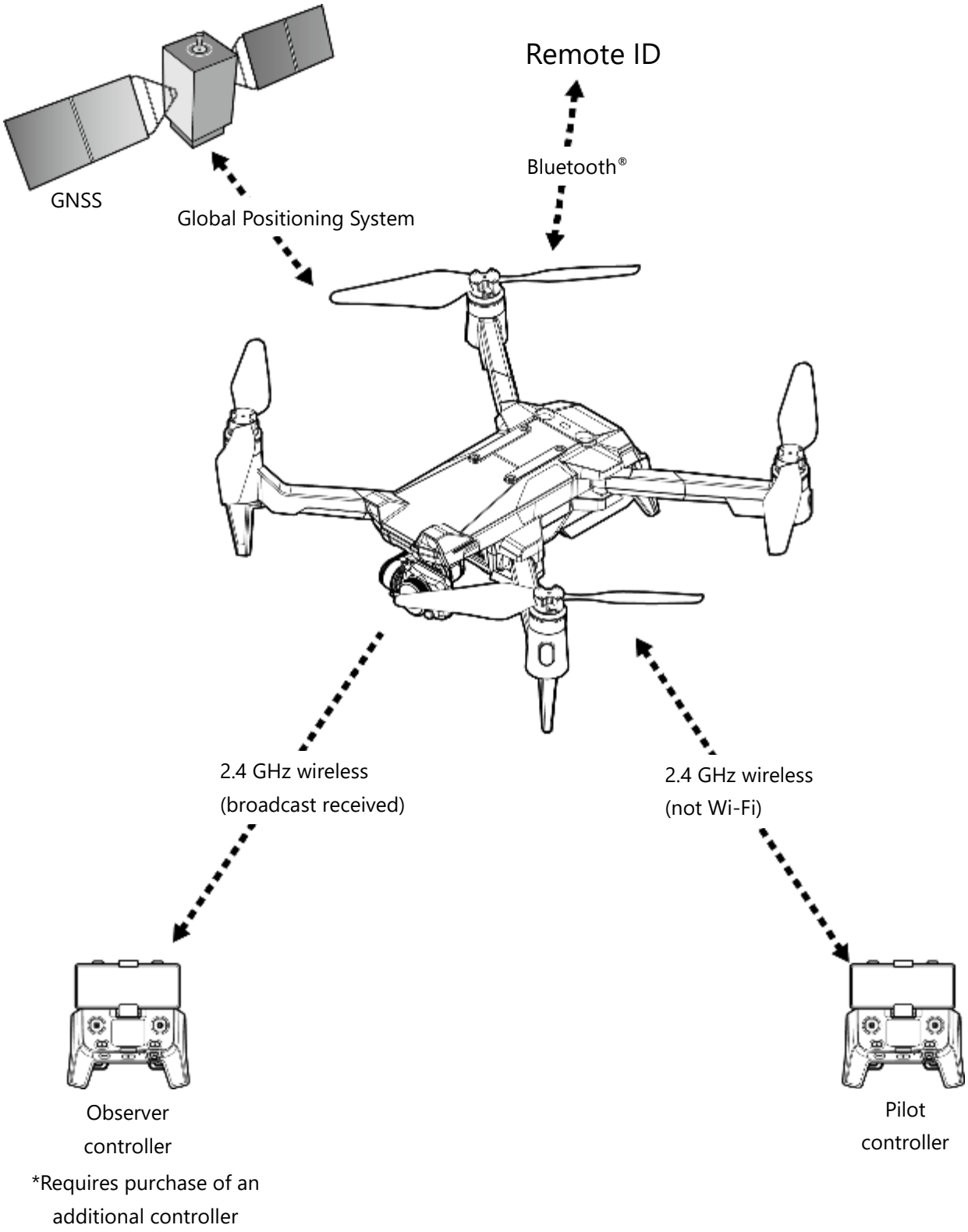
The items are included in the basic SOTEN set.

- Aircraft
- Controller (USB Type-C® cable included)
- High-capacity battery (safety precautions/warranty card included)
- Battery charger (dedicated charging cable included)
- Standard camera/gimbal
- Safety precautions/disclaimer

Aircraft	Controller	High-capacity battery
		
Battery charger	**Standard camera/gimbal**	**Product warranty**
		

2.2. System Configuration

2.2.1. System Configuration Conceptual Diagram



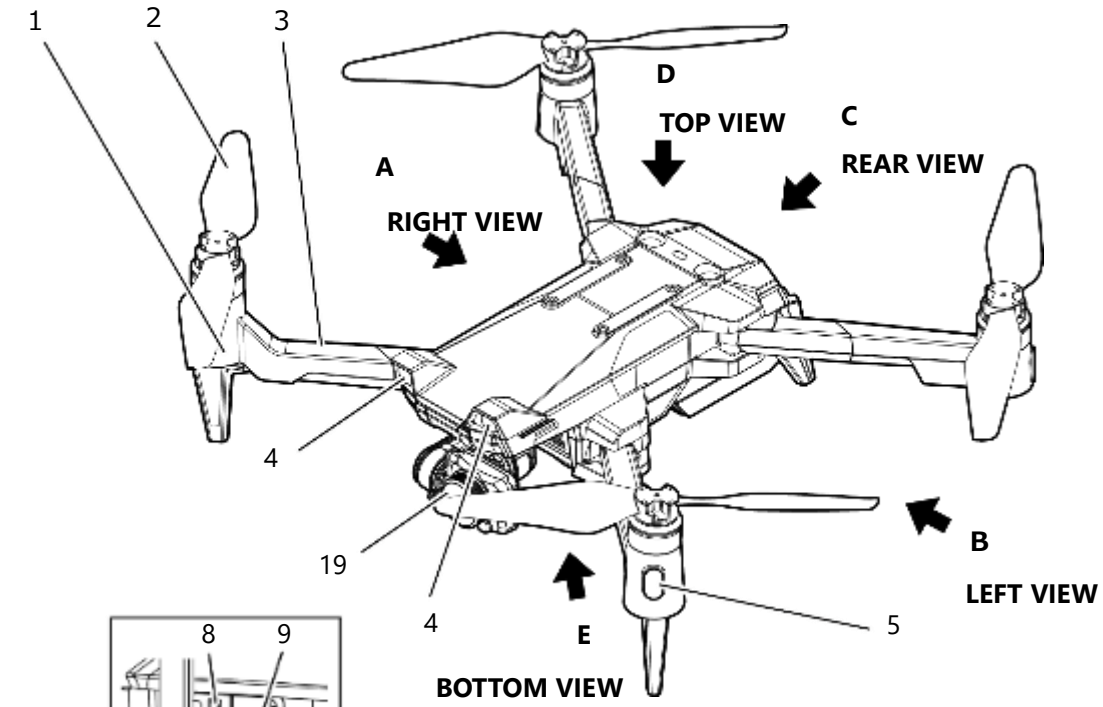
2.2.2. Functional Overview of Each Wireless System

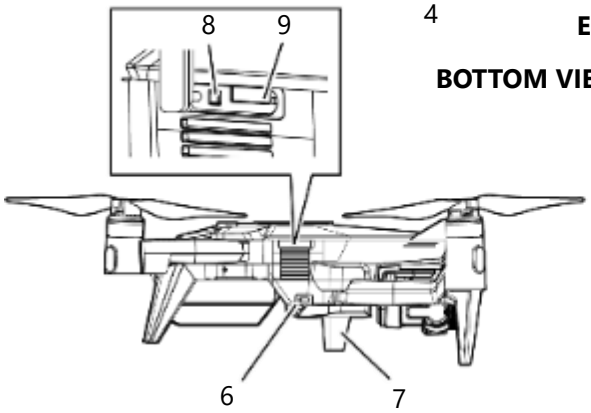
No.	Name	Feature
1	GNSS	Uses radio signals received from Global Navigation Satellite System (GNSS) satellites to estimate the location of the drone relative to the earth. GPS/SBAS/QZSS satellites are used.
2	Remote ID	Uses Bluetooth 4.0 and 5.0 to broadcasts the unique identity of the aircraft, location, and status according to national regulations.
3	Cellular	When equipped with an embedded cellular modem, a cellular connection may be used to connect the aircraft to the ACSL TAKEOFF ground control application (commands, telemetry, and video). *In Japan, this requires a subscription to either the NTT DOCOMO LTE Over-the-Air Usage Plan or the KDDI Smart Drone 4G LTE Package.
4	2.4 GHz wireless	Uses low-power 2.4 GHz wireless signals (not Wi-Fi) to communicate control, command, telemetry, and video signals between the aircraft and the controller. Up to three controllers may be bound to one aircraft. All three bound controllers can simultaneously receive signals from the aircraft (telemetry and video), but only one controller (designated the pilot) can transmit signals (control and command) to the drone at a time. Pilot authority can be toggled during flight (pilot/observer switching).
5	920MHz (Japan only)	Uses low-power 920 MHz wireless signals for communication between two controllers (teacher and student) while in the lesson mode.

- Wireless communication may be disrupted if the aircraft is operating in an environment with electromagnetic interference.
- If communication becomes unstable, abort the flight and land in a safe location.

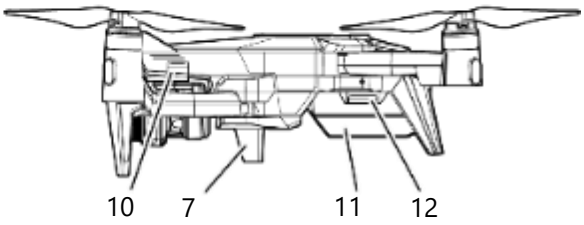
2.3. Aircraft

2.3.1. Names of Parts and Functional Overview

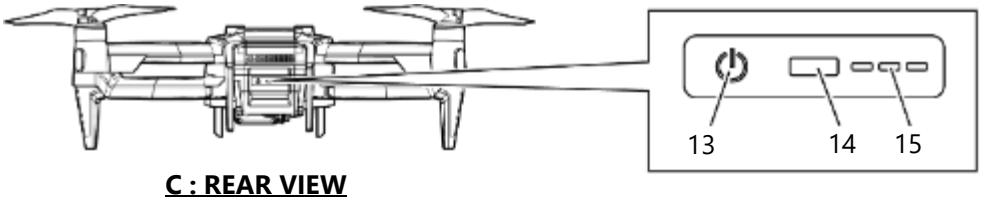




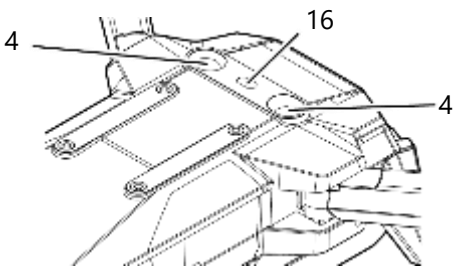
A : RIGHT VIEW



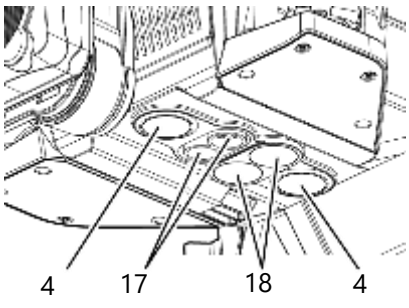
B : LEFT VIEW



C : REAR VIEW



D : TOP VIEW

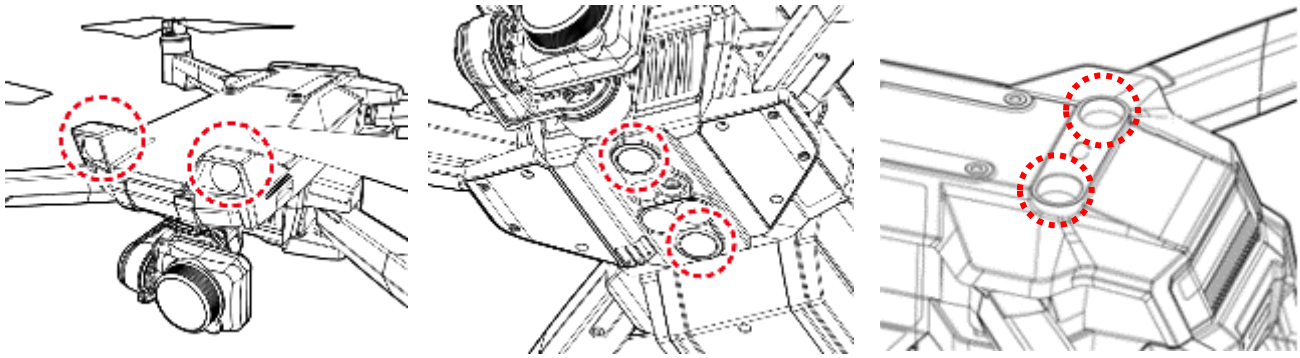


E : BOTTOM VIEW

No.	name	Feature
1	Motor	Rotates the propeller.
2	Propeller	Generates lift and propulsive force.
3	Arm	Supports the motors and propellers. Can be folded for transportation and storage.
4	Stereo cameras	Detect obstacles and the relative motion of the aircraft.
5	Navigation lights	LED lights mounted on the tip of the arms improve visibility of the aircraft's attitude and orientation.
6	USB Type-C® port	Service port used for aircraft diagnosis (not for customer use).
7	LTE antennas (LTE-equipped models only)	For high-speed cellular communications.
8	Bind button	Used to initiate the procedure for binding a controller to the aircraft.
9	SIM card slot	Slot for inserting a nano SIM card into the aircraft.
10	Camera release button	Used to release the camera from the aircraft.
11	Battery	Lithium-ion battery with an embedded battery management system (BMS).
12	Battery release button	Used to release the battery from the aircraft.
13	Power button	Used to turn the aircraft power on and off.
14	Status LED	Uses colors and patterns of flashing to indicate the status of the aircraft.
15	Battery level LED	Indicates the remaining level of battery charge.
16	Upward distance sensor	Measures the distance to obstacles above the aircraft.
17	Downward distance sensor	Measures the distance between the aircraft and the ground.
18	Downward light	Illuminates the ground below the aircraft. Note: The function to manually turn the light on and off is currently under development.
19	Standard camera/gimbal	The camera captures video and still images. The gimbal isolates the orientation of the camera from the orientation of the aircraft.

2.3.2. Overview of the Visual System

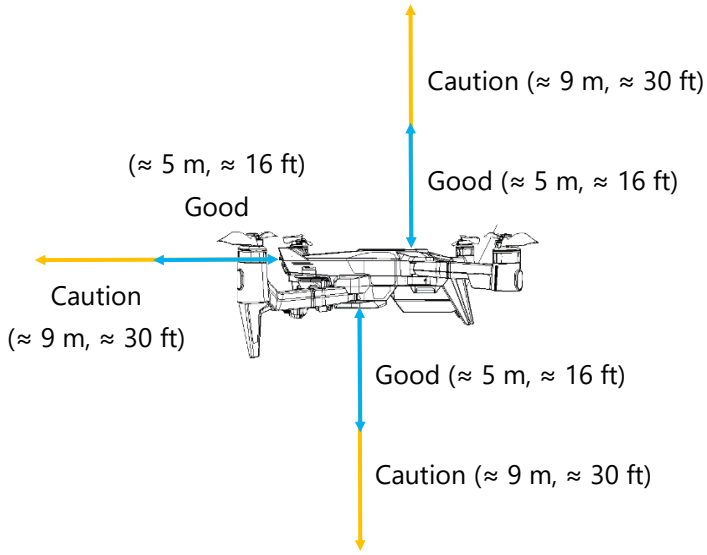
The aircraft is equipped with 3 stereo cameras mounted on front, top and bottom. These stereo cameras are used to measure the distance to obstacles to avoid collision, and for visual odometry.
Visual odometry is an advanced computer vision algorithm that deduces the motion of the aircraft relative to the surrounding environment from the images captured by the onboard stereo cameras. Depending on the lighting and texture in the environment, visual odometry can enable stable hover even when reception of GPS signals is not possible.



Stereo camera locations on the aircraft

Detection range

The detection range of the visual odometry system is as shown below.
Obstacles outside the detection range cannot be detected.)



ADVISORY

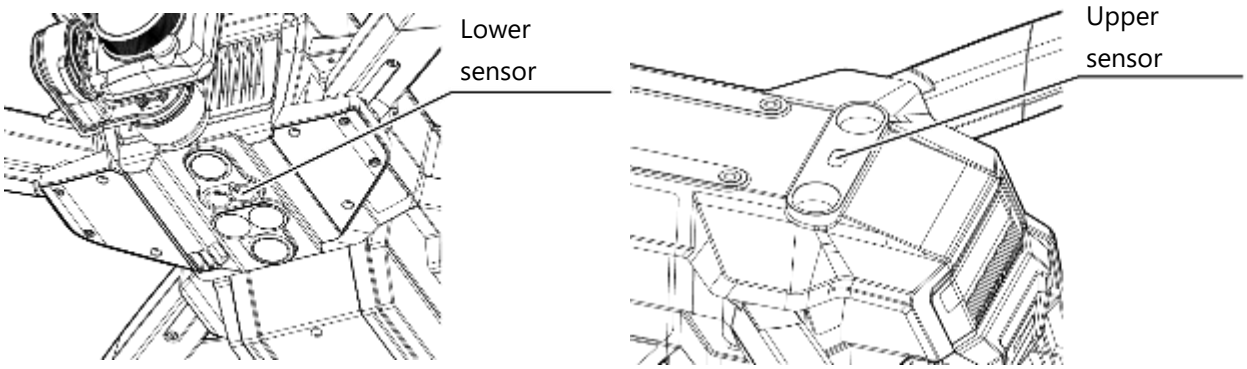
- Maximum ground speed is limited to 0.8 m/s (1.8 MPH).
- Operation may become unstable depending on the environment surrounding the aircraft.
- If operation becomes unstable, switch to manual mode immediately.
- Correct operation is not possible on plain surfaces with little visual information, surfaces with repeating, evenly spaced patterns that create optical illusions, or reflective surfaces such as glass or shiny metal.
- The visual odometry cameras may not operate properly in excessively bright or dim environments such as direct sunlight or at night.

- Obstacles less than 20 cm (8 inches) wide may not be detected.
- Always keep the camera and sensor lenses clean. Dust, dirt, and other contaminants will reduce sensitivity.
- Over time, the heading (yaw angle) will slowly drift. In this case, you will need to use the controller's yaw control to maintain the desired heading (yaw angle).

Brief description of the infrared distance sensors

Infrared distance sensors located on the top and bottom of the aircraft measure the distance to obstacles to avoid collisions and provide soft landing assistance respectively*.

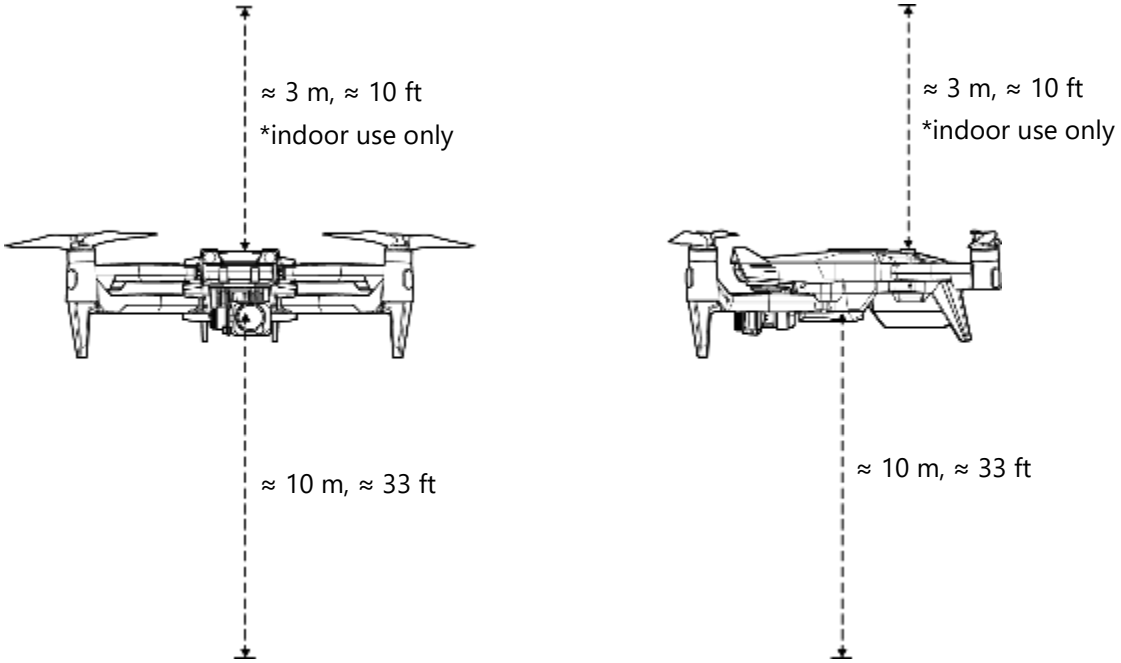
*Soft landing assist functions only in the position (POS) and auto (AUT) modes.



Detection range

The detection range of the infrared distance sensors is shown below.

Obstacles outside the detection range cannot be detected. Please use caution when referring to measurements from the infrared distance sensors.



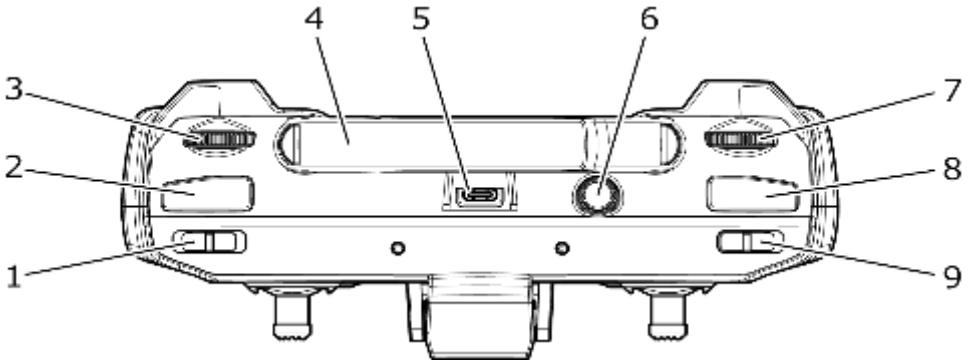
Class 1 Laser Product

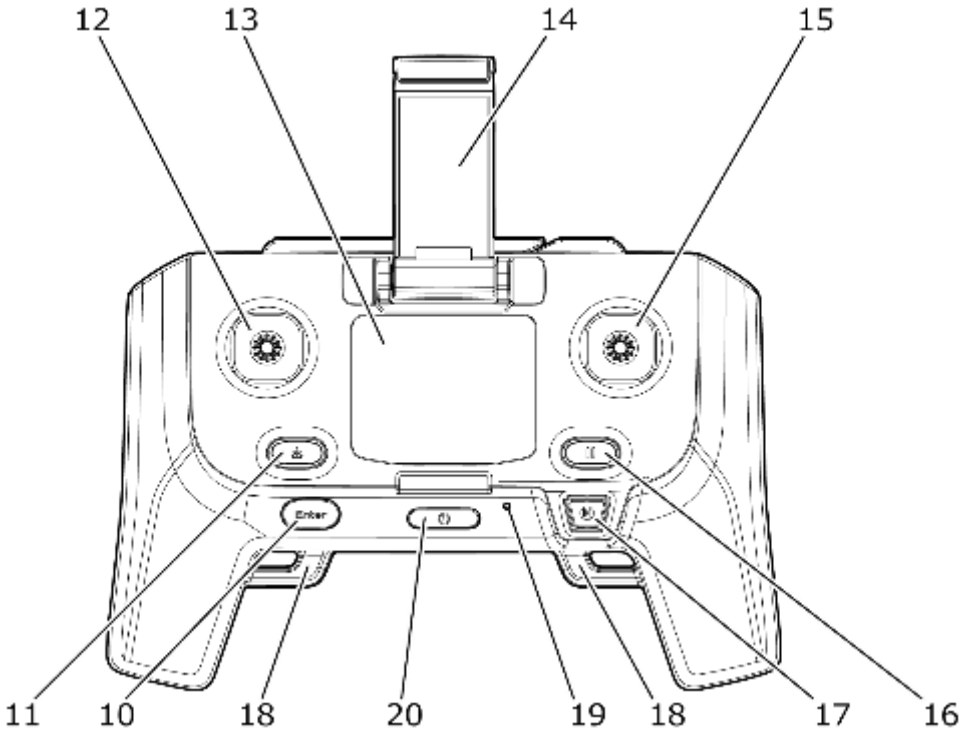
CAUTION

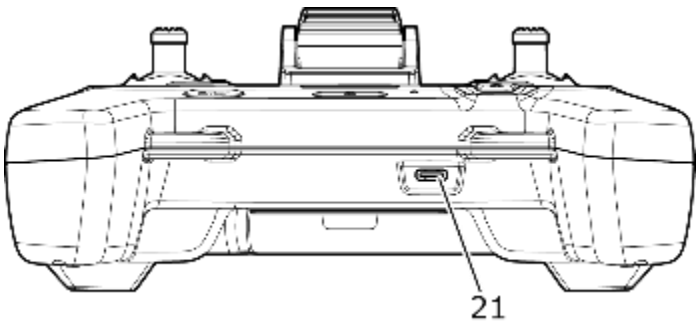
- Distance may not be measured correctly due to the influence of infrared light from the sun or other sources of infrared light.
- The top sensor is not suitable for outdoor use.
- When flying over surfaces that reflect sunlight, such as water or shiny metal, distance may not be measured correctly.
- Familiarize yourself with the detection range of the sensor. Obstacles beyond the detection range will not be detected.
- Always keep the sensor lenses clean. Dirt and debris on the lenses will reduce sensitivity.

2.4. Controller

2.4.1. Names of Parts and Functional Overview

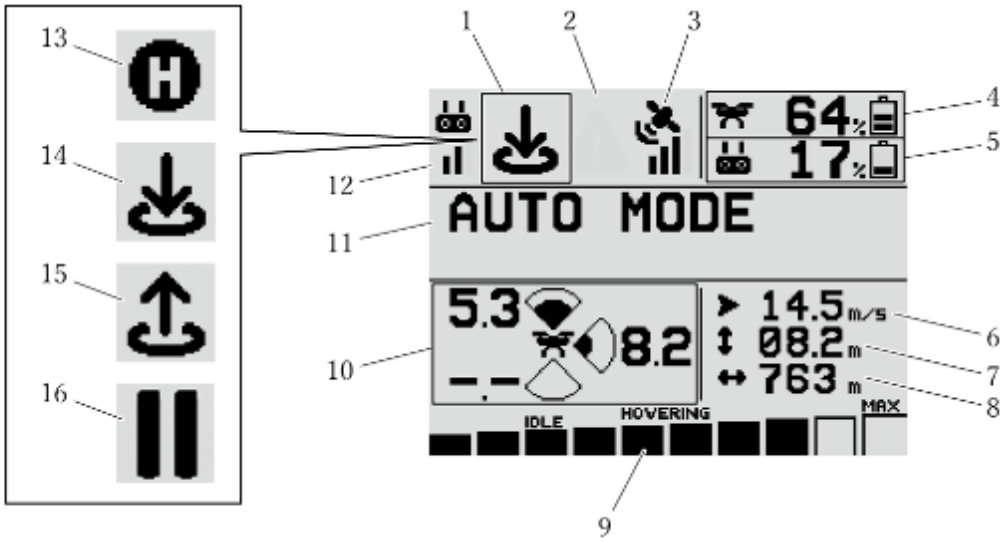






No.	Name	Feature
1	Flight mode switch	Switch to select the flight mode.
2	Gimbal control button L	Tap to point the camera forward (both pan and tilt). Press and hold to point the camera straight down (both pan and tilt).
3	Gimbal Control wheel L	Used to adjust the camera tilt.
4	Antennas	Transmits and receives 2.4 GHz signals.
5	Mobile device connection port	USB Type-C® port for wired connection to mobile devices.
6	Emergency button	Used in an emergency to stop the motors, causing the aircraft to fall from the sky if in flight.
7	Gimbal control wheel R	Used to adjust the left/right pan of the camera.
8	Camera control button R	Tap to start/stop interval photography. Press and hold to start/stop video recording.
9	Collision avoidance switch	Used to turn on or off the collision avoidance feature.
10	Enter button	Used for various settings.
11	Auto-landing button	Press and hold to Initiate an autonomous landing at the current location.
12	Left stick	Used to control the aircraft. It is a self-neutral type that automatically returns to the center position when the finger is released.
13	LCD Screen	Displays aircraft speed, battery level, error warnings, etc.
14	Mobile device mount	Used to attach a mobile device to the controller.
15	Right stick	Used to control the aircraft. It is a self-neutral type that automatically returns to the center position when the finger is released.
16	Pause button	Pauses the motion of the aircraft (enters a hover) when flying autonomously.
17	Go-home button	Press and hold to Initiate an autonomous return to the takeoff location.
18	Strap holder	A mounting location for neck straps or other straps.
19	Status LED	Indicates the controller's status.
20	Power button	Used to turn controller power on and off.
21	Charging port	USB Type-C® port to connect to a charger for charging the controller.

2.4.2. LCD Display

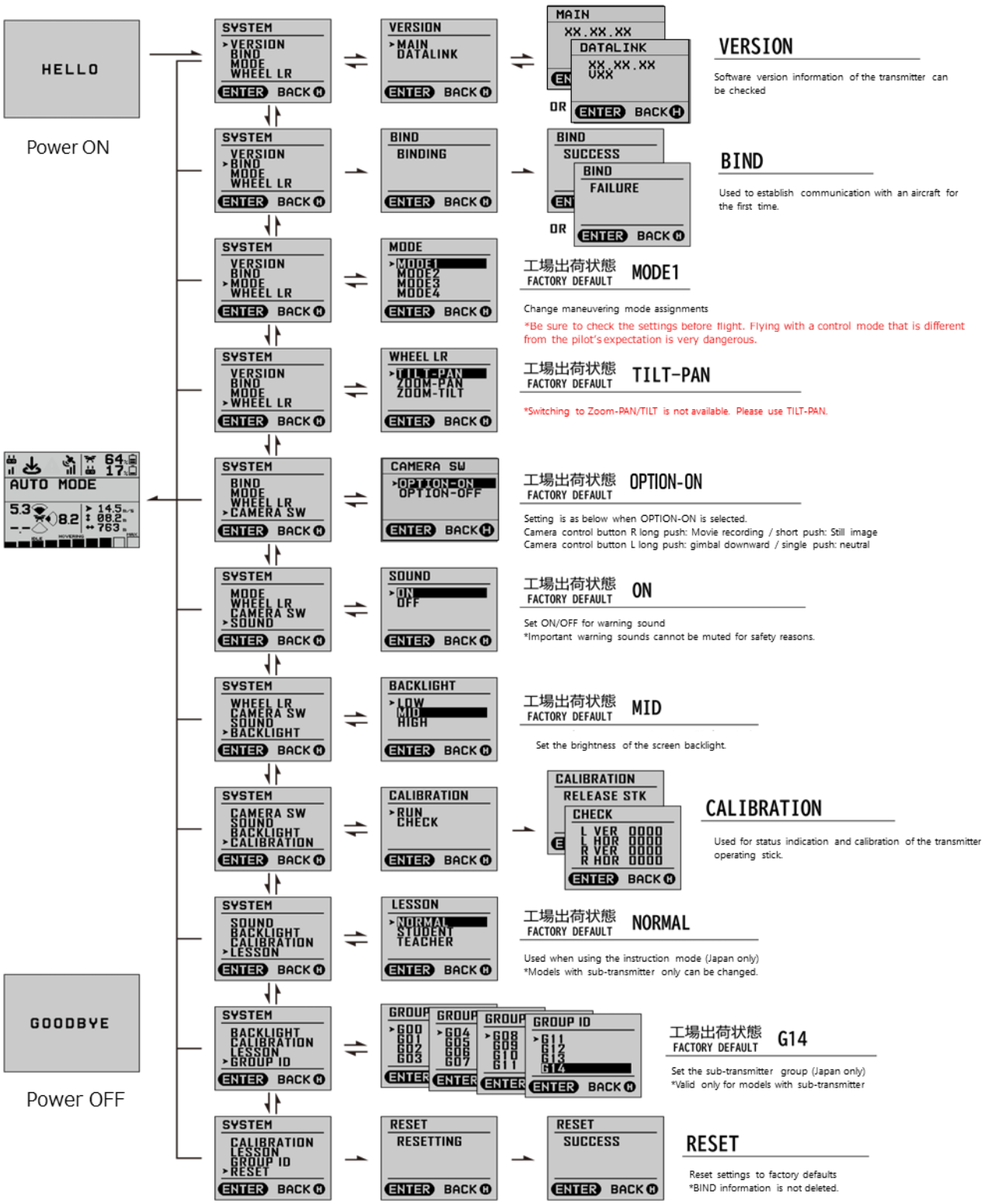


No.	name	Feature
1	Aircraft status display	The status of the aircraft is indicated by icons (nos. 13 to 16).
2	Notification symbol	Displays an icon to indicate whether a notification is a warning, caution, or alert.
3	Number of GPS satellites	Indicates the number of GPS satellites from which signals are being received. 0: 3 or less, 1: 4 to 6, 2: 7 to 9, 3: 10 to 12, 4: 13 or more
4	Aircraft battery level indicator	Displays the remaining charge of the aircraft battery.
5	Controller battery level indicator	Displays the remaining charge of the controller battery.
6	Speed indicator	Displays the speed of the aircraft.
7	Height Indicator	Displays the height of the aircraft from the takeoff point.
8	Horizontal distance indicator	Displays the horizontal distance of the aircraft from the takeoff point.
9	Aircraft power consumption indicator	Indicates the power consumption of the aircraft.
10	Distance to obstacle (m) Forward, upward, and downward	Displays the distance between the aircraft and surrounding obstacles.
11	Notification area	Displays flight modes, warnings, cautions, etc.
12	Received signal strength indicator	Indicates the strength of the signals being received from the aircraft by the controller. 0: 91 or more, 1: 90~71, 2: 70~51, 3: 50~31, 4: 30 or less (dBm).

13	Go-home indication	This icon is displayed when the aircraft is in go-home mode (autonomously returning to the takeoff point).
14	Auto-landing indication	This icon is displayed when the plane auto-landing mode (autonomously landing at the current location).
15	Auto-takeoff indication	This icon is displayed during auto-takeoff.
16	Pause indication	This icon is displayed when pausing (entering a hover) from autonomous motion of the aircraft.

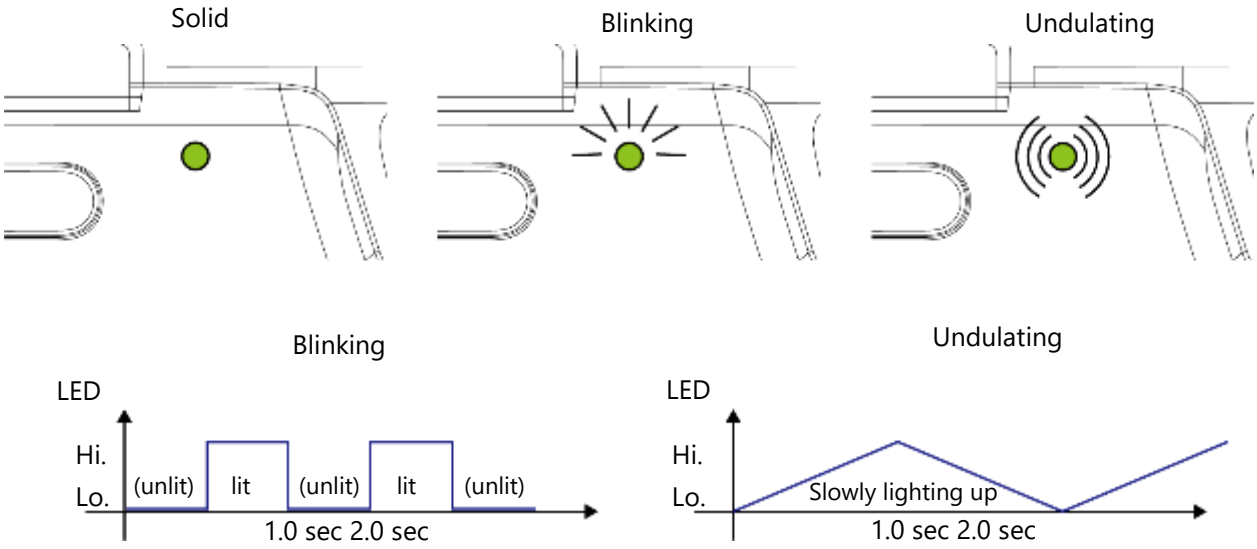
2.4.3. SYSTEM Settings Menu: Screen Transition Diagram

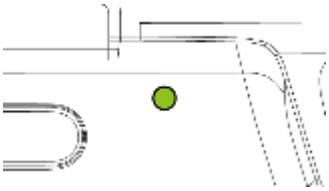
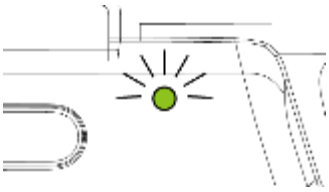
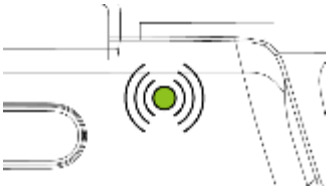
With the controller powered off, press the power button while holding down the Enter button to display the following system setup screen.

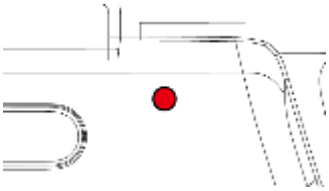
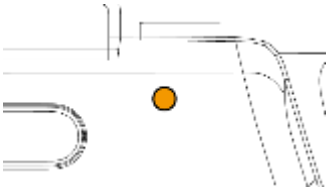
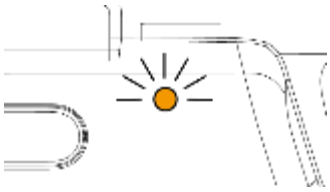
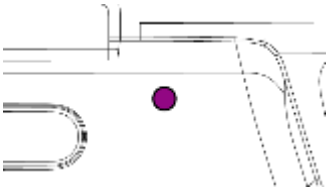
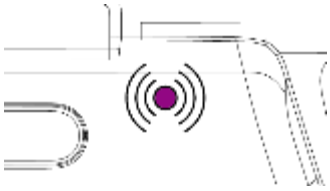


2.4.4. Status LED Indications

The status of the controller is indicated by the color and flashing pattern of the status LED as described below.



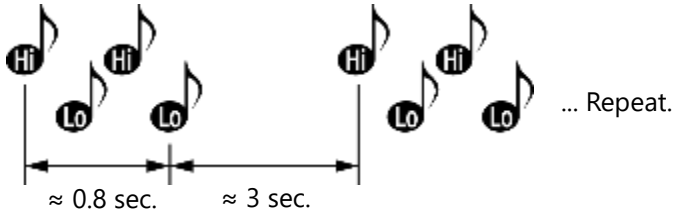
Status	Status LED
Normal operation in pilot mode	 Solid green
While in the process of pilot/observer switching	 Blinking green
Normal operation in observer mode	 Undulating green

Status	Status LED
Communication with the aircraft is interrupted or not yet established	 Solid red
Charging	 Solid orange
Charging suspended due to low temperature	 Blinking Orange
Lesson mode: teacher	 Solid purple
Lesson mode: student	 Undulating purple

2.4.5. Sounds

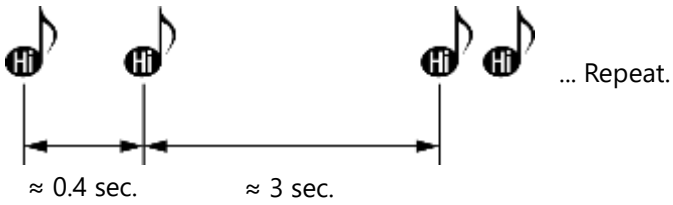
The various sounds that the controller produces to draw the attention of the pilot are described below. It is important that you understand what each sound means so that you are adequately alerted to any safety issues.

When a warning is issued



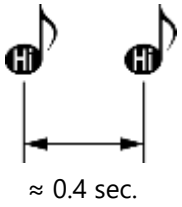
- When a warning message is issued, the controller notifies the user with both this sound and vibration.
- For safety reasons, the warning sound cannot be muted even when the SOUND setting is set to OFF in the controller settings menu.

When a caution is issued



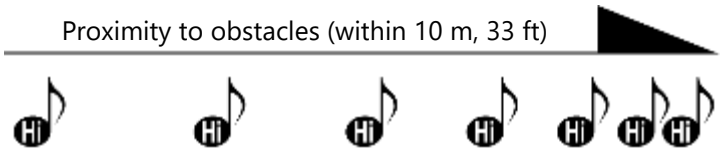
- When a caution message is issued, the controller notifies the user with this sound.
- If the SOUND setting is set to OFF in the controller settings menu, this sound is muted.
- The notification can be dismissed by pressing the Enter button.

When an alert is issued



- When an alert message is issued, the controller notifies the user with this sound.
- If the SOUND setting is set to OFF in the controller settings menu, this sound is muted.

When obstacle is detected



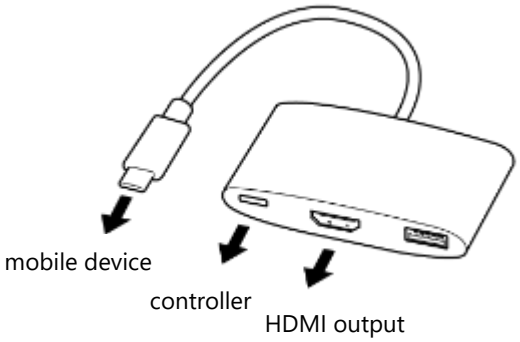
- When an obstacle is detected, the closer the obstacle is, the shorter the warning sound interval becomes.

Warning tone interval (sec)	1.0	0.7	0.5	0.3	0.1	0.1
Distance (m)	10	7	5	3	1	0.5

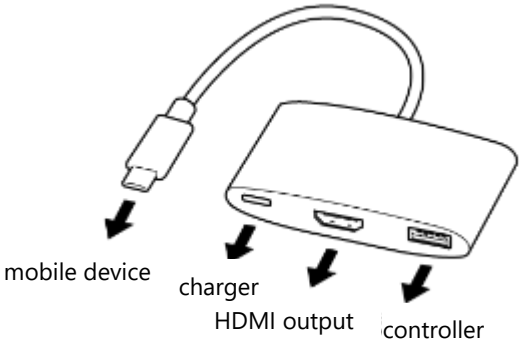
2.4.6. Extended Functionality (HDMI output and mobile device charging)

- By connecting a USB Type-C® multiport HDMI adapter to a mobile device compatible with DisplayPort Alternate Mode (Alt Mode), the screen of the mobile device can be mirrored to an HDMI output while maintaining the connection to the controller.
- Using this adapter, it is also possible to charge the mobile device while it is in use.

When charging the mobile device is not necessary



When charging the mobile device is desired



CAUTION

- Depending on quality or compatibility with HDMI or USB Type-C®, not all adapters will work properly with the particular mobile device that is being used with the controller.
- For detailed information on supported standards, etc., please refer to the instruction manual for the product in question.
- Damage to or malfunction of SOTEN resulting from the use of the USB Type-C® adapter is not covered by the warranty.

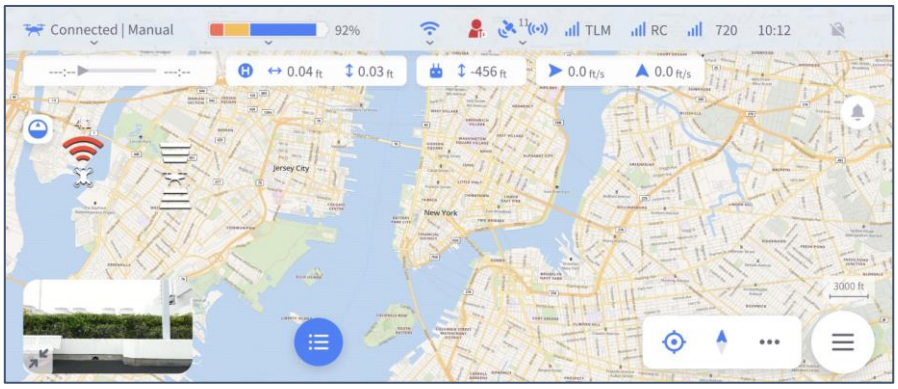
2.5. TAKEOFF Ground Control Application

2.5.1. Functional Overview

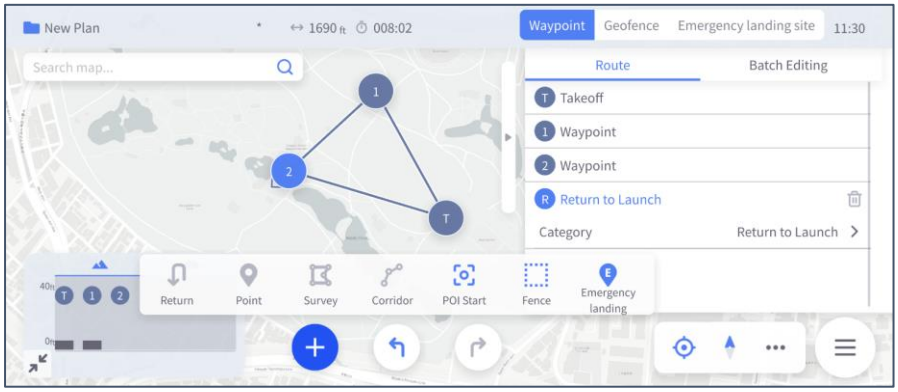
The ACSL TEKEOFF ground control application is intended for use only with ACSL SOTEN. It offers the ability to monitor the telemetry and video that is broadcast from the aircraft, manage aircraft settings, issue commands to the aircraft, set geofences, plan and execute autonomous flights, review prior flights, and more. Please refer to the ACSL TAKEOFF ground control application user manual for more information.

2.5.2. On-Screen Display

Flight Screen



Plan Screen

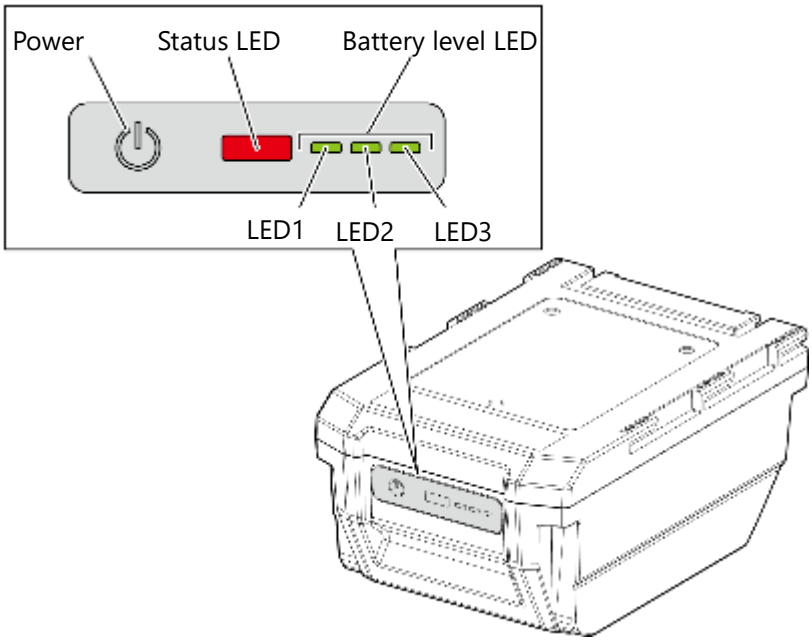


2.5.3. Key Features

- Flight command functions (preflight check, flight status display, flight commands, camera control and settings, etc.)
- Flight planning functions (creating and editing flight plans, setting geofences)
- Flight log functions (upload and download flight logs, review, etc.)
- Configuration fonctions (firmware updates, calibration, maintenance information, etc.)

2.6. Battery

2.6.1. Names of Parts



2.6.2. Battery Features

The battery is equipped with an embedded battery management system (BMS).
The features of the BMS enhance safety during use.

Monitoring

To maximize safety, the BMS continuously monitors the battery's condition (output, remaining battery charge, temperature, etc.), and logs occurrences of any conditions that are outside of the normal operating range.

Mode switching

The BMS automatically switches to sleep mode, shutdown mode, or safety lock mode to check battery level, prevent over-discharge, and limit battery use under hazardous conditions.

See Section 2.6.3: Battery Modes.

Self-diagnostics

When the battery is powered on, the BMS performs self-diagnostics to check for system abnormalities.

➔ See section 2.6.4 .Basic Battery Operation.

Product life prediction function

The BMS determines the remaining useful life of the battery based on a variety of data. When the battery is approaching the end of its life, a status LED will indicate such. When the battery reaches the end of its life, the BMS will automatically engage the safety lock rendering the battery unusable.

➔ See section 2.6.4: Basic Battery Operation.

> ADVISORY
>
> An LED warning may not occur indication before the safety lock is applied is not guaranteed. The safety lock may be applied without warning if the battery management system (BMS) deems it necessary to ensure safety depending on the method of use, operating environment, or storage environment.

Charge Standby

The BMS automatically switches from normal charge mode to charge standby mode when the internal temperature of the battery is outside the safe temperature range for charging. For example, the internal temperature of the battery may be high immediately after a flight, and the BMS may switch to charge standby mode upon connection to a charger to prevent excessive battery performance degradation caused by charging at a high internal temperature.

➔ See Section 4.3.2: Battery Charging Modes.

2.6.3. Battery Modes

The BMS may switch the battery into the following modes to enhance battery safety.

Sleep mode

The BMS puts the battery in sleep mode after the aircraft is powered off. In this mode, the BMS monitors battery condition (e.g., temperature) and records monitoring values at regular intervals for safety determination. In this mode, the user can check the battery level or power on the aircraft by pressing the battery power button.

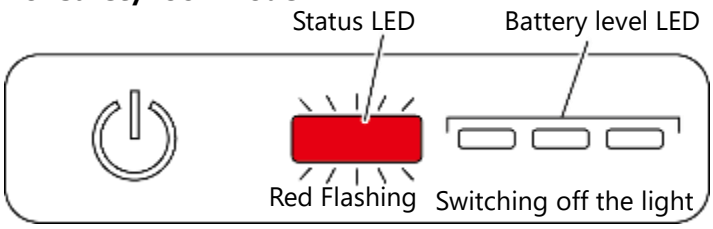
Shutdown mode

Shutdown mode is a mode that consumes less power than sleep mode and is designed to prevent over-discharge of the battery. In this mode, the battery will not respond to pressing the power button and the aircraft cannot be powered on. Note that batteries are placed in shutdown mode prior to leaving the factory. If the battery is stored for a long period of time with low remaining charge, the BMS transition to shutdown mode to prevent over-discharge, and the condition monitoring operation will also cease. Connect the battery to a charger to return it to sleep mode from shutdown mode.

Safety lock (permanent)

Safety lock is a mode that completely disables operation of the battery. The BMS transitions the battery to this mode when it determines, through several criteria, that the battery can no longer be safely used. In this mode, the status LED will continuously blink red until the battery charge reaches an appropriately low level for maximum safety. Once discharge is complete, all operation will be completely disabled. Note that the high-capacity batteries can be connected to a charger even after discharge to enable LED indication during safety lock.

LED indication of safety lock mode



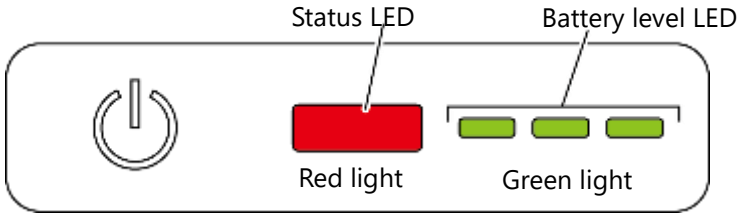
ADVISORY

If the above LED pattern is displayed, replace the battery.

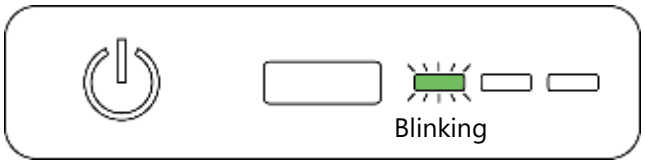
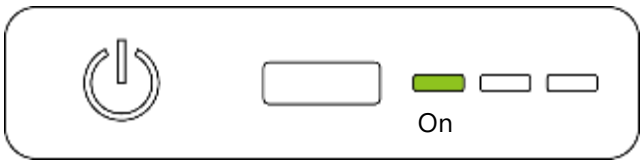
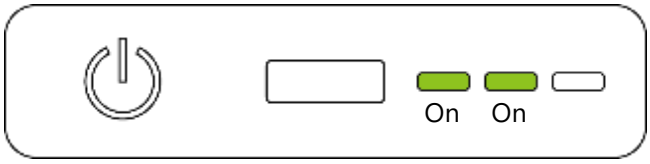
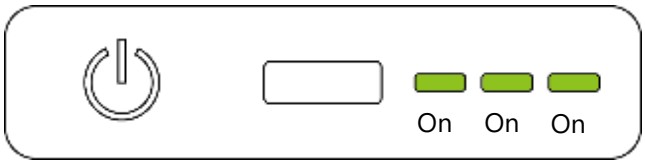
2.6.4. Basic Battery Operation

Pressing the power button initiates the BMS self-diagnostics. The self-diagnostics take about 2 seconds, and upon successful completion, the remaining battery charge is displayed.

- LED indication during self-diagnostics



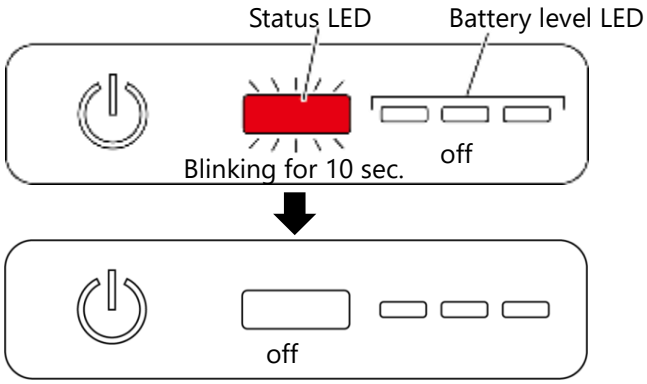
- LED indication of remaining battery charge

Status LED/Battery level LED	Battery level
	0 to 24
	25-49% (%)
	50-74% (50-74%)
	75-100

If an error state is detected during self-diagnostics, the status LED will blink for about 10 seconds and then turn off.

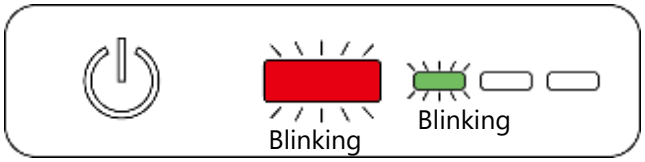
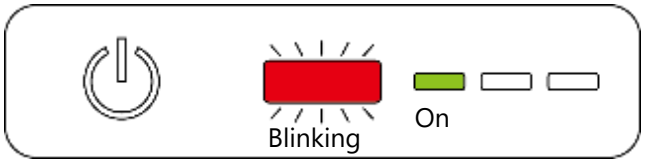
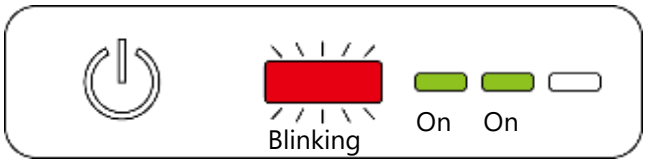
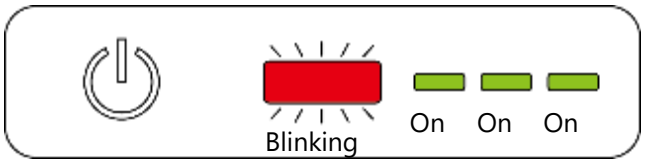
However, the standard battery holds the error condition internally for about 30 seconds, so please wait an additional 20 seconds after the LED stops blinking before pushing the power button again. As an example, the BMS may trigger an error indication if the internal battery temperature is outside the range for safe operation.

- Self-diagnosis LED indication when an error state is detected.



If the BMS determines that the battery is nearing the end of its life, the status LED will continue to blink and the remaining battery charge will be displayed.

- LED indication when battery life is nearing end of life

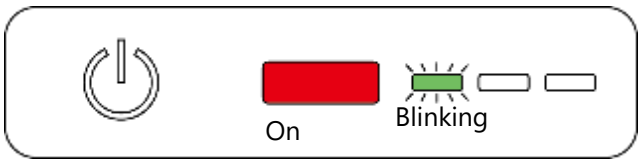
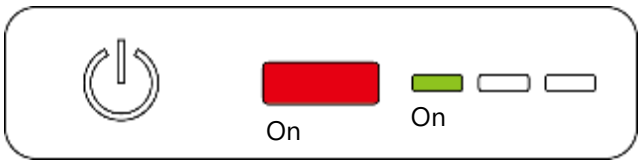
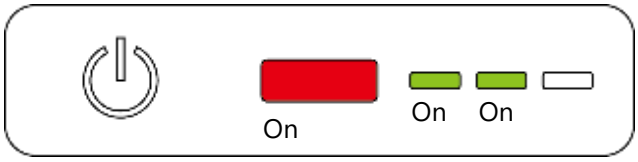
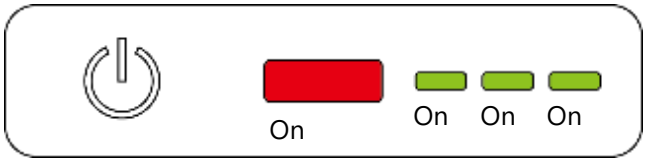
Status LED/Battery level LED	Battery level
	0 to 24
	25-49% (%)
	50-74% (50-74%)
	75-100

ADVISORY

- If the above LED pattern is displayed, the battery is nearing the end of its useful life and should be replaced immediately.
- When the battery reaches the end of its useful life, a safety lock is automatically activated and the battery will no longer power on.
- Please contact your dealer to purchase replacement batteries.

If a temporary anomaly such as communications timeout (communication failure) or overcurrent is detected when connecting to the aircraft or charger, the status LED will remain lit and the remaining charge will be displayed.

- LED indication in case of battery failure

Status LED/Battery level LED	Battery level
	0 to 24
	25-49% (%)
	50-74% (50-74%)
	75-100

At this time, if an abnormality is detected that prevents future use, the safety lock (permanent) is applied and the status LED continues to flash red.

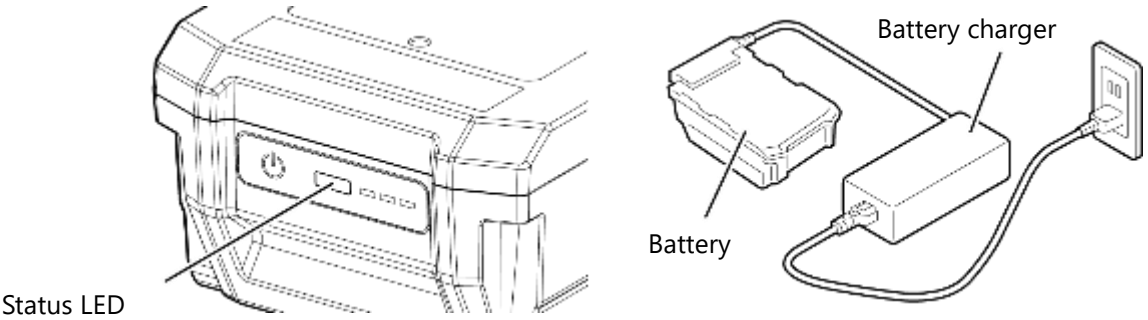
➔ See Section: 2.6.3: Battery .

2.7. Battery Charger

2.7.1. Indications

The status LED and the remaining battery LEDs light up (blink) according to the charging mode, and charging status.

➔ See Section: 4.3.2: Battery Charging Modes.

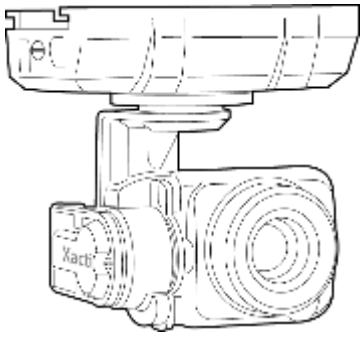


ADVISORY

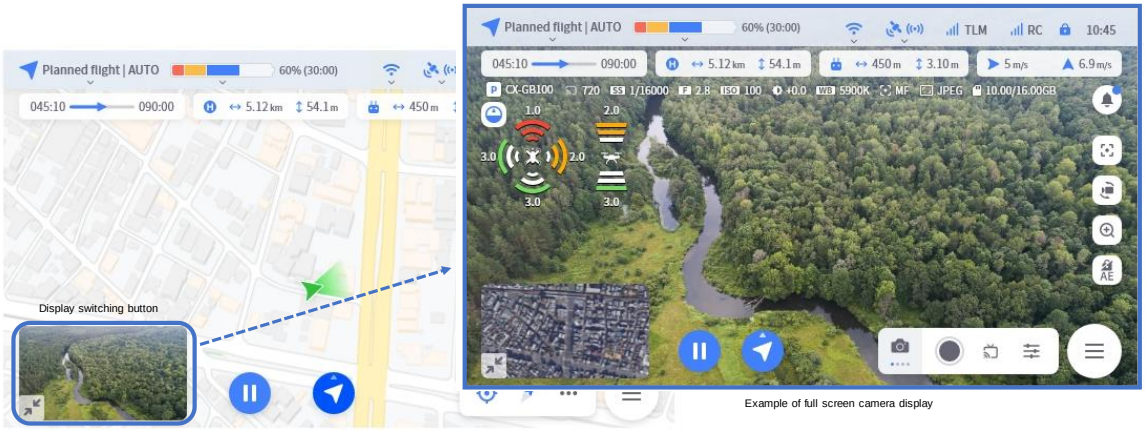
- Do not connect the battery to the charger while the battery status LED is on. Charging may not start properly.

2.8. Standard Camera/Gimbal

2.8.1. Standard Camera (visible camera)

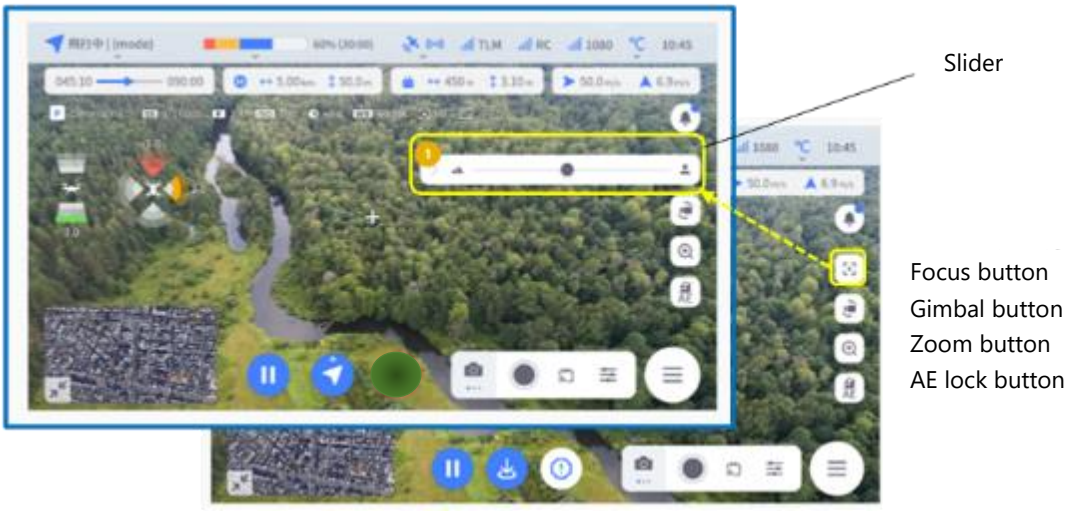


- CX-GB100 camera with integrated 20MP image sensor, large aperture lens, and 3-axis stabilized gimbal (tilt, pan, roll).
- Low-noise, high-quality image capture is achieved with a proprietary signal processor.
- For more information about the product and how to handle it, please refer to the CX-GB100 User Manual and the ACSL TAKEOFF User Manual.



Example of full screen map display

Example of full screen camera display



Example operation of the standard camera

Chapter 3

First-Time Use

3.1. Initial Battery Activation 53
3.2. Installing the TAKEOFF Ground Control Application 54
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3.6. Stick Mode Settings 62
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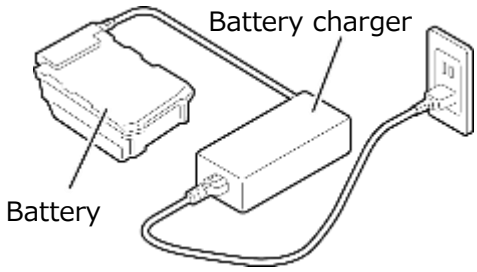
3.1. Initial Battery Activation



ADVISORY

- Batteries are shipped from the factory in shutdown mode and will not respond to the power button.
- To activate a new battery, connect it to a charger.

➔ See Section 4.3: “Battery Charging.”.

CAUTION

Always fully charge the battery before installing it onto the aircraft for flight.

3.2. Installing the TAKEOFF Ground Control Application

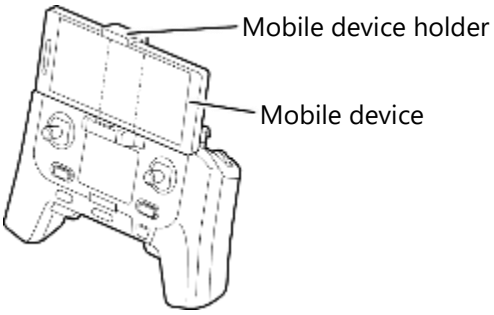
The ACSL TAKEOFF ground control application is available for Android mobile devices by downloading the application from the ACSL Soten product website or from Google Play.

- Firmware updates for the SOTEN controller, controller, communication module, and battery are all performed using the ACSL TAKEOFF ground control application.
- For details, please refer to the ACSL TAKEOFF ground control application user manual.

TAKEOFF icon

3.3. Controller Preparation

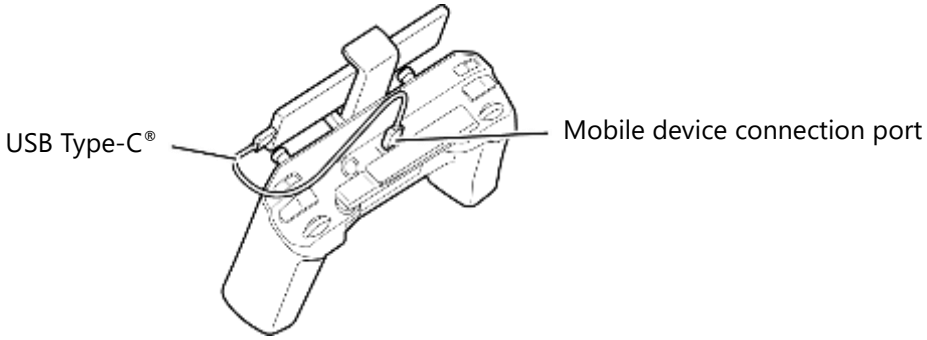
1. Attach the mobile device to the mobile device holder.



ADVISORY

Attach the mobile device to the mobile device holder so that it does not interfere with the buttons on the mobile device. Failure to do so may result in damage to or malfunction of the mobile device.

2. Connect the mobile device to the controller via USB Type-C® .

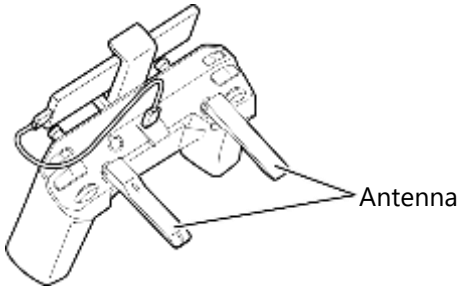


ADVISORY

The USB Type-C® cable should be connected to the mobile device connection port at the top of the controller, not the charging port at the bottom of the controller. Communication will not be possible if the mobile device is connected to the charging port.

3. Deploy the controller antennas.

➔ See Section 5.5.5 :Determine Optimal Antenna Direction.



ADVISORY

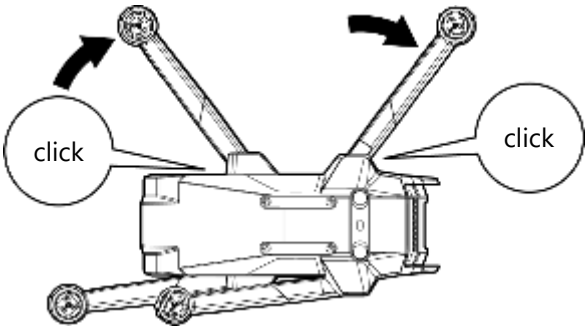
If necessary, charge the controller in advance.

➔ For information on how to charge the controller, see Section 4.4: “Controller Charging.” .

3.4. Aircraft Preparation

1. Deploy the arms of the fuselage.

Open the arms firmly until they click into place. Do not install the propellers yet.

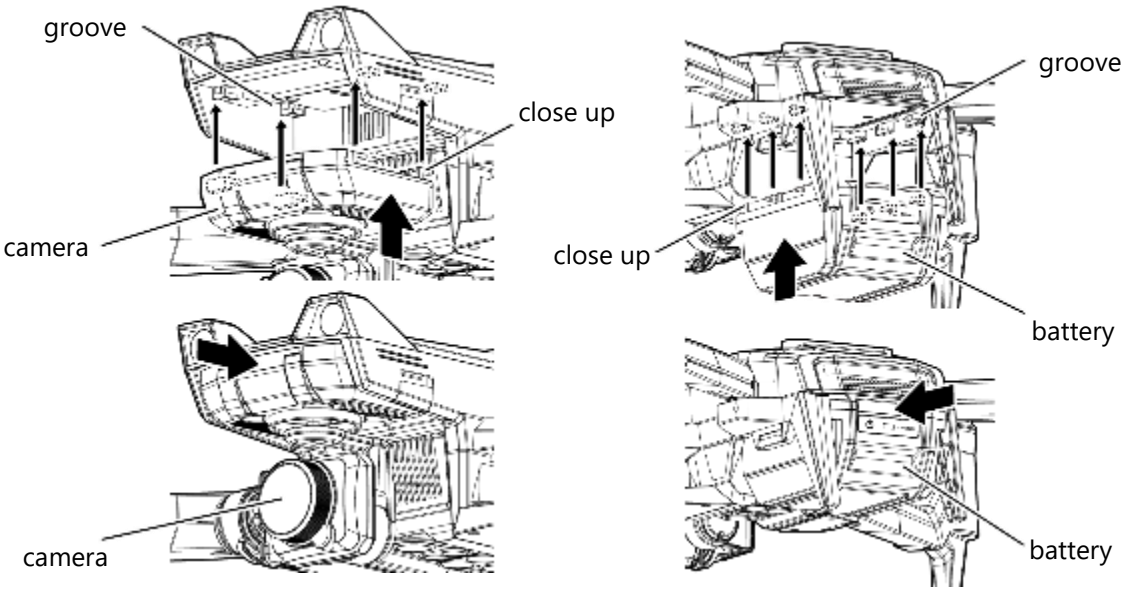


WARNING

- Open the arms firmly until they click into place. Failure to do so may result in a crash.

2. As shown in the figures below, align the camera/battery hooks with the mounting grooves on the aircraft, then slide the camera/battery in the direction shown until it locks into place.

Slide it into place until it is firmly locked.



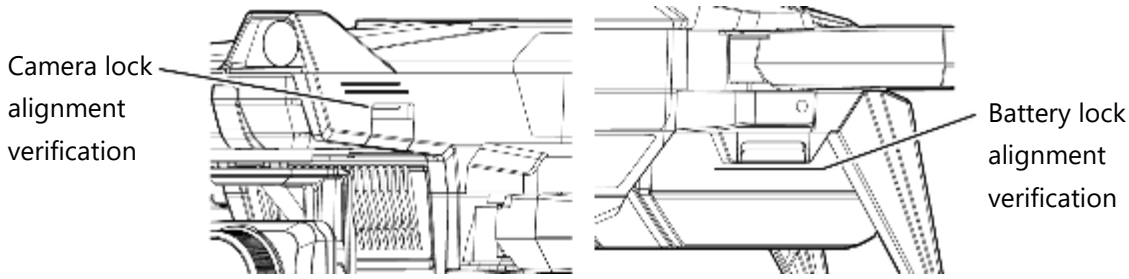
CAUTION

When installing the camera and battery, be careful not to pinch your hands or fingers. Failure to do so may result in injury.

ADVISORY

- When installing the camera, do not wear gloves, etc., but be sure to check the camera is properly installed with your bare hands.
- If a sticker made by a label maker or other means is attached to the side of the camera mount, it may interfere with installation. It is recommended that stickers only be attached to the upper part of the mount.
- Only install the camera with the aircraft powered off. Installing the camera with the power on may cause malfunction of the camera or aircraft.

3. Check that there is no misalignment between the camera and battery locks and the body of the aircraft (not half-locked). If the battery is only half-locked, the aircraft may not start.

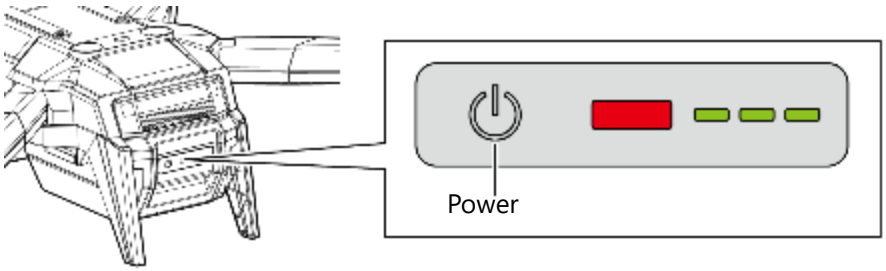


WARNING

- Flying with the camera mount not properly locked is extremely dangerous as the camera may fall during flight.
- The video feed from the camera may be displayed even when its mount is not properly locked. Do not judge the state of the lock from the video feed alone.
- Touching the camera mount release button may cause the camera mount lock to be unintentionally released.
- After confirming that the camera is installed and locked, be careful not to touch the camera mount release button. Double check that the camera mount is properly locked just prior to flight.

4. Press the battery power button to turn on the aircraft.

When power is supplied, the aircraft will produce a startup tone.



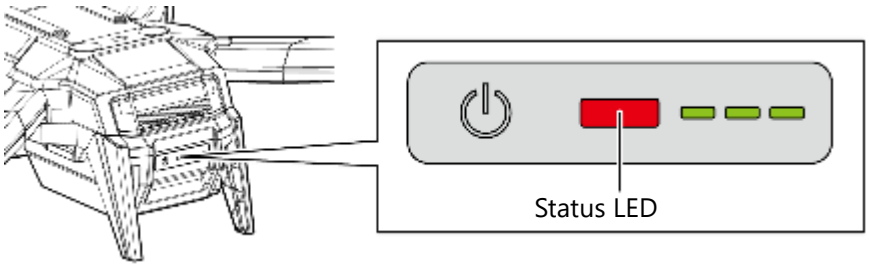
CAUTION

Lasers operating with a wavelength outside the visible range (class 1 lasers) are emitted from two infrared sensors located on the top and bottom of the aircraft when the aircraft is powered on. Do not look closer than necessary or look into the lenses of the sensors when the aircraft is powered on.

5. The status LED will illuminate briefly immediately upon startup and will begin to blink continuously once the aircraft has completed its startup procedure.

Confirm that the aircraft LED blinks normally (no abnormality).

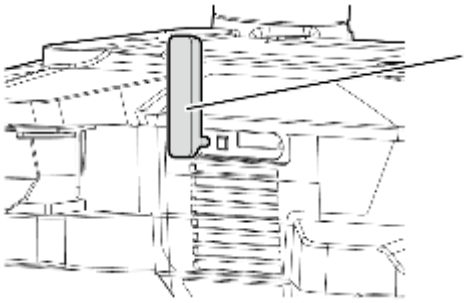
➔ See Section 6.1.4: Check the Status LED.



3.5. First Connection (binding)

3.5.1. Aircraft-Side Operation

1. Open the binding button cover on the fuselage.

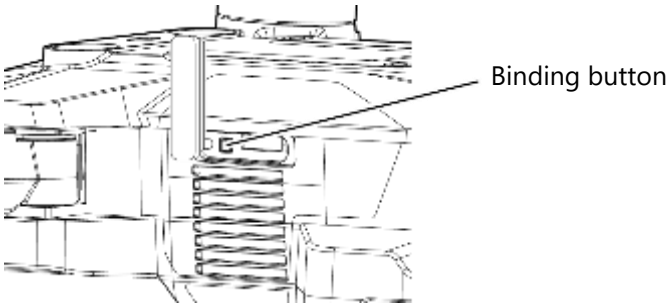


ADVISORY

Do not use sharp tools to open the cover. Doing so may result in damage to the aircraft.

2. Press and hold the binding button on the fuselage until all four position LEDs at the tips of the arms are blinking red.

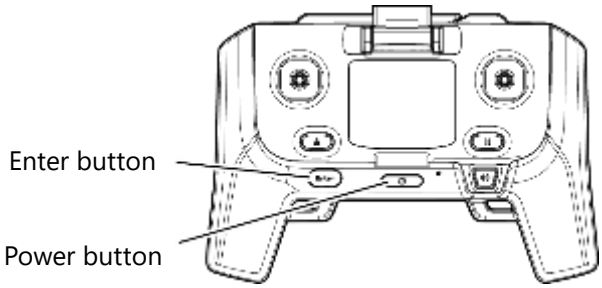
The status LED blinks and the aircraft enters the binding standby state.



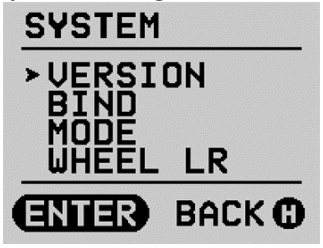
3.5.2. Radio-Controller-Side Operation

1. With the controller powered off, press the power button while holding down the Enter button.

The system settings screen appears.

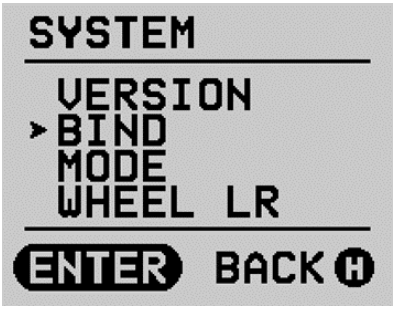


System settings menu



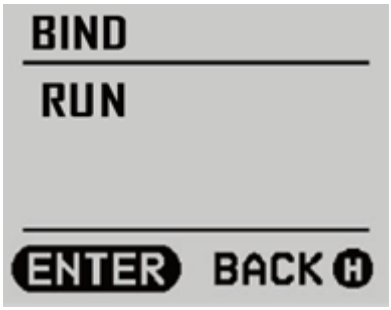
2. Move the cursor to "BIND" by operating the left stick on the controller and press the Enter button.

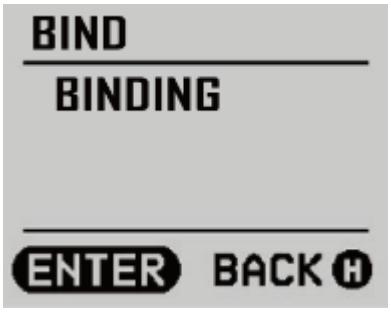
*Make sure that the aircraft is in binding standby mode before executing (see Section 3.5.1: Aircraft-Side Operation).



3. When RUN is displayed, press the Enter button again to execute binding.

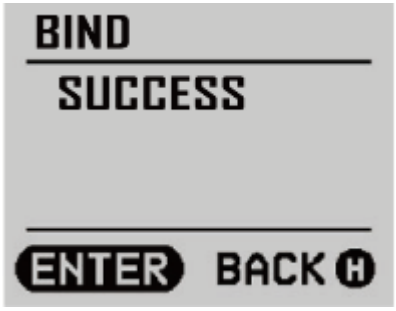
Binding may take 1-2 minutes due to the encryption process.

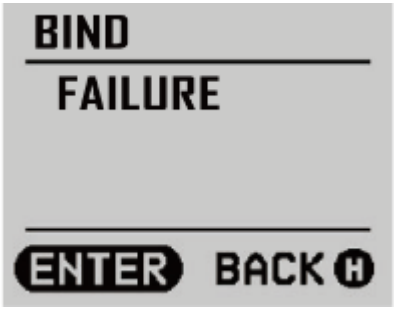




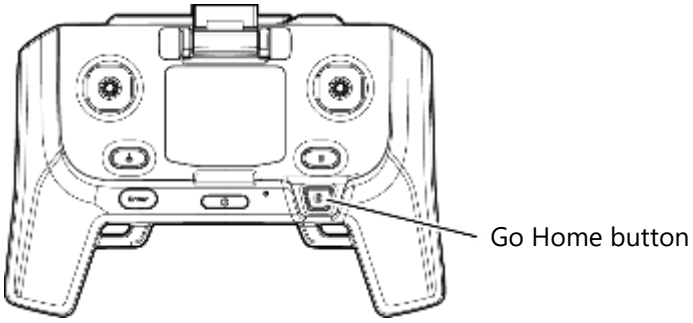
4. If binding is successful, "SUCCESS" will be displayed. If binding is not successful and "FAILURE" is displayed, repeat steps 1 through 3.

The controller retains only the binding information for the aircraft that it has most recently been bound with. When binding is performed with another aircraft, the binding information for the previously bound aircraft is deleted.

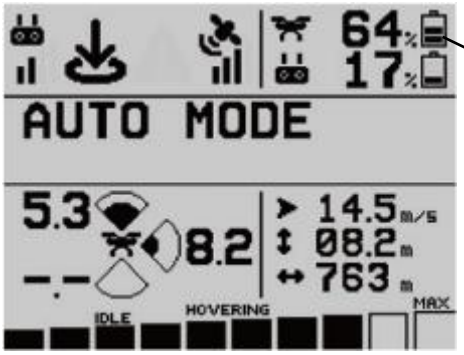




5. Press the Go Home button twice to exit the system settings menu.



6. **Verify that the controller's LCD screen displays the aircraft's battery level and other information.**



SOC	Remaining Battery
3	66% or more
2	33% or more
1	15% or more

SOC: State of Charge

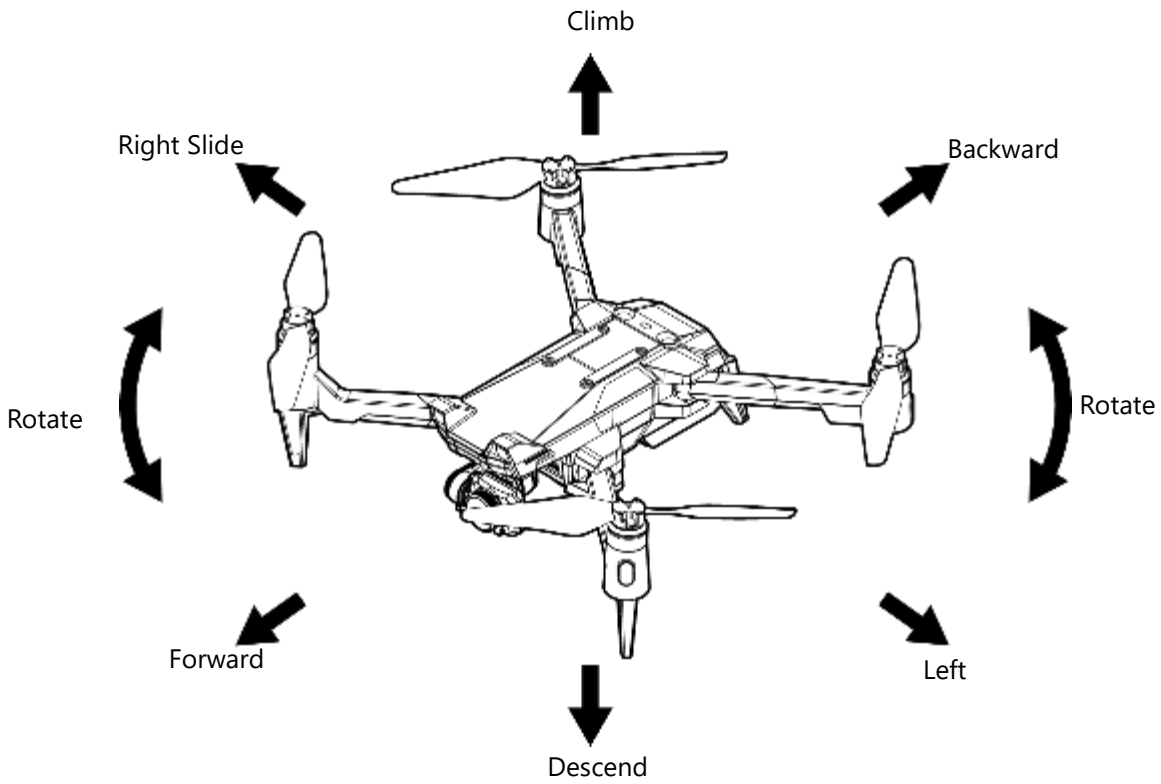
3.6. Stick Mode Settings

- The controller stick control assignments can be selected from four control modes.
- Always check the control mode before flying to ensure that the stick operation assignments are the same as those you are accustomed to using. First-time users should carefully check the stick operation assignments according to the control mode before making settings.

WARNING

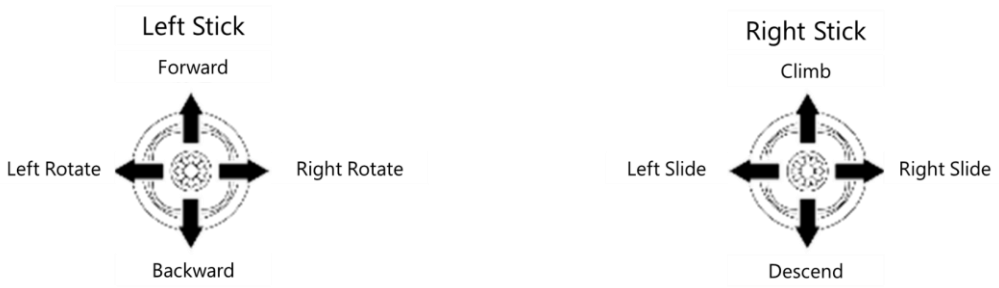
Do not operate the aircraft without checking the stick mode. Unintended movement of the aircraft may result in injuries or property damage.

3.6.1. Stick Mode Types

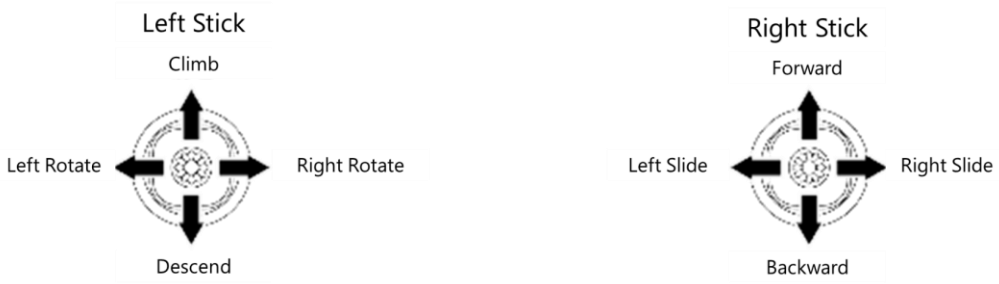


Climb/Descend: Throttle
Forward/Backward: Pitch
Slide Left/Right: Roll
Rotate Left/Right: Yaw

MODE 1



MODE 2



MODE 3

MODE 4

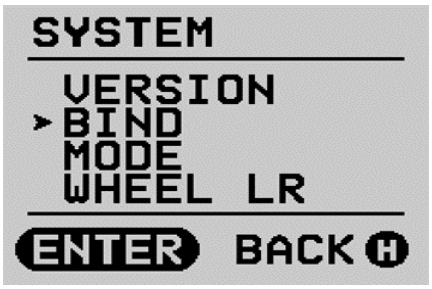
3.6.2. Changing Stick Mode

1. 1. With the controller powered off, press and hold the power button while pressing the Enter button on the controller.

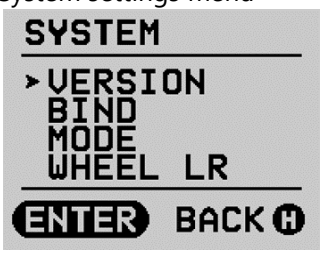
The system settings menu appears.

Enter button

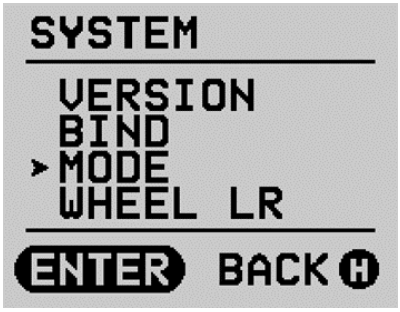
Power button



System settings menu

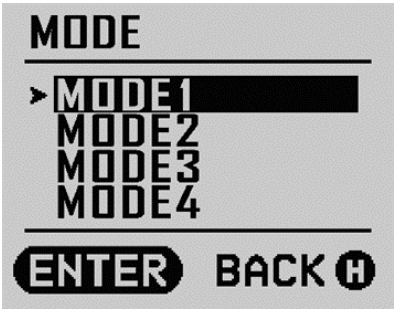


2. Move the cursor to "MODE" by operating the left stick on the controller and press the Enter button.

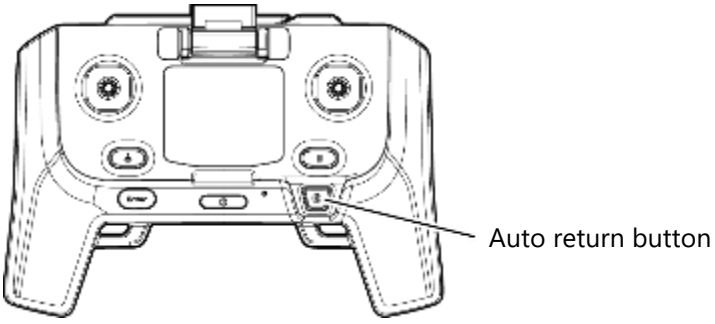


3. Move the cursor to the desired control mode and press the Enter button.

The highlighted item on the black background indicates the currently active mode.



4. Press the Go Home button twice to exit the system settings menu.



3.6.3. Confirming Stick Mode

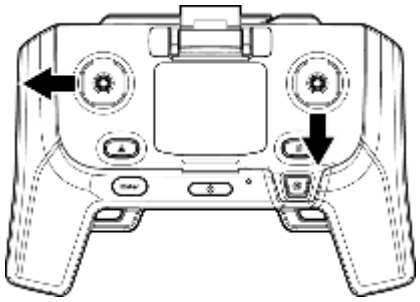
WARNING

Check the operation of the stick mode with the propellers removed. Failure to do so may result in injury.

1. Starting the motors

Holding the throttle stick down and the yaw stick to the left releases the motor lock and the motors begin to turn.

In the case of mode 1



In case of mode 2

WARNING

Do not touch the rotating parts. Doing so may result in injury.

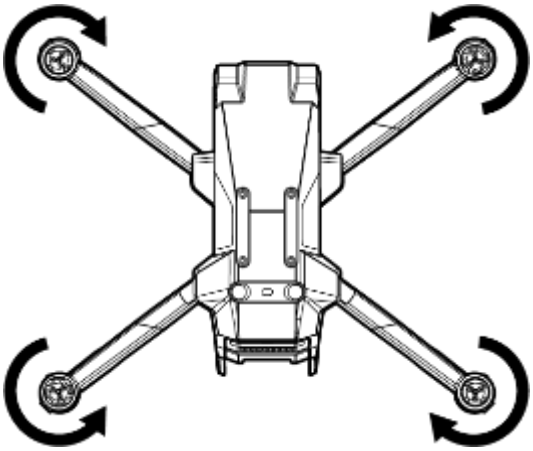
2. Confirmation of rotational operation

Check that the motor rotation operates as below picture.

➔ See Section .3.6.1: Stick Mode Types.

Clockwise rotation

Counterclockwise rotation



Counterclockwise rotation

Clockwise rotation

WARNING

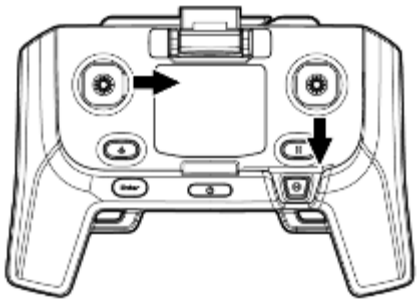
Do not touch the motors immediately after operation. Doing so may result in burns.

3. Stopping the motors

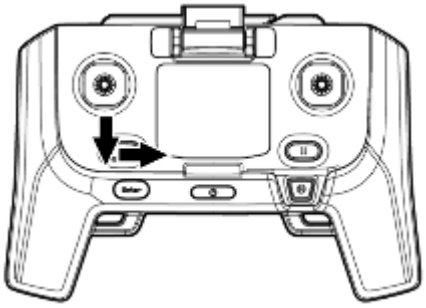
Holding the throttle stick down and the yaw stick to the right will stop the motor.

*This combination of stick inputs will not cause the motors to stop while in flight.

In the case of mode 1



In the case of mode 2



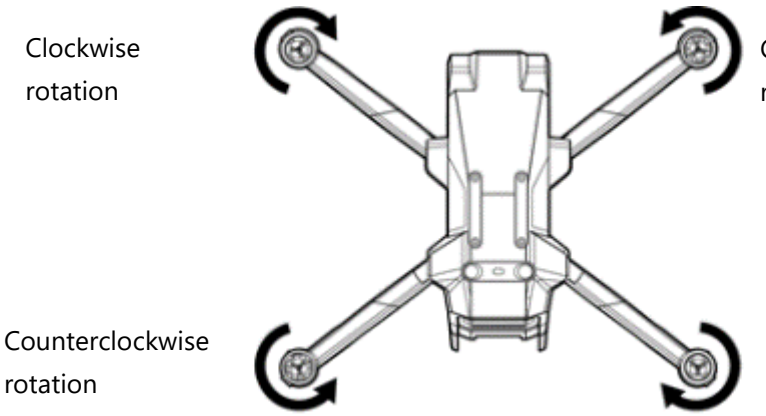
3.7. Propeller Installation

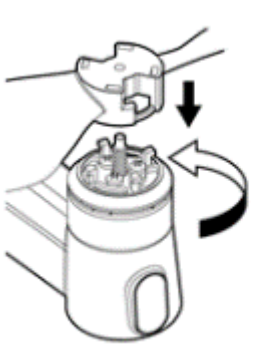
1. Turn off the power to the aircraft.

> WARNING
>
> Be sure to turn off the power to the aircraft before attaching or detaching the propellers. Failure to do so may result in injury.

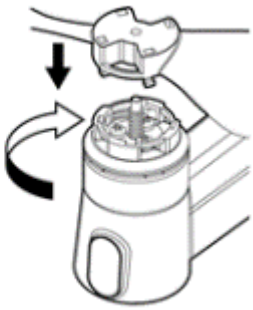
2. There are two types of propellers, clockwise rotating and counterclockwise rotating. Like propellers are installed at opposite ends. Neither propeller type will interface with the mount at the wrong location.

Install the propeller while holding the base of the motor with your fingers to prevent it from rotating and holding the arm to prevent it from being strained.

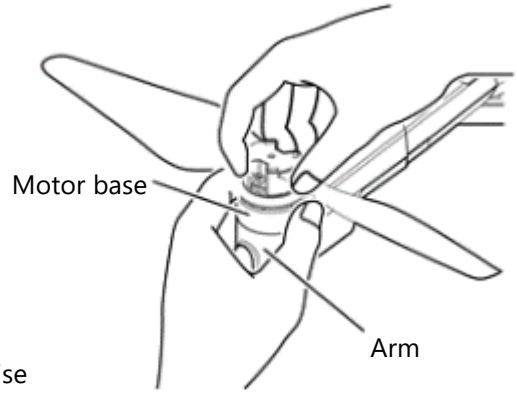




A: For clockwise propellers



B: For counterclockwise propellers



A: Align the protrusions of the propeller with the grooves on the motor and rotate it counterclockwise while pressing downward to lock it in place.

B: Align the grooves of the propeller with the protrusions of the motor and rotate it clockwise while pressing downward to lock it in place.

> WARNING
>
> The propellers are sharp. Be careful when attaching and removing them. The sharp edges can cut your hands or body.

3.8. Camera Initialization

1. Prepare a microSD card for image and video storage.

- The microSD card must meet the following criteria

  *Refer to the CX-GB100 User Manual for the recommended SD card.

  ✔ UHS Speed Class ・・・・・・・・・・・・・・・U3

  ✔ Video speed class ・・・・・・・・・・・・・・・V30 or higher

  ✔ Recording Capacity ・・・・・・・・・・・・・・・・・・・・・・ Up to 512GB

- Initialize (format) the microSD card.

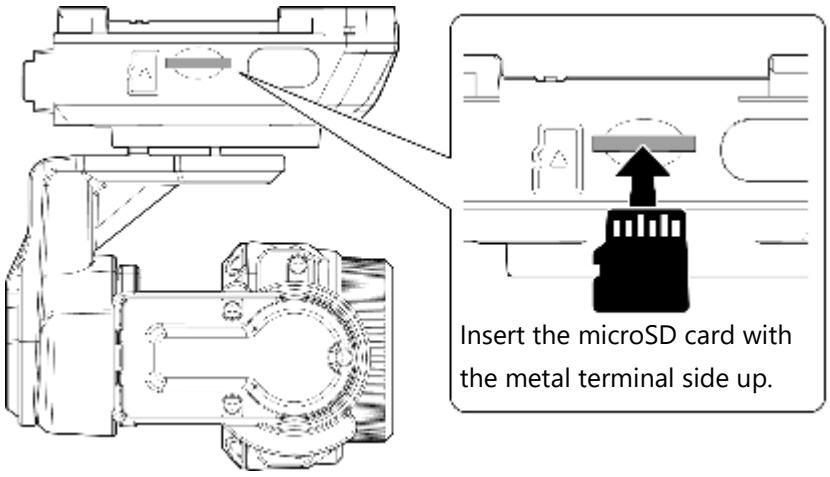
  Supported filesystem formats:

  ✔ FAT32

  ✔ exFAT

  * exFAT is recommended for microSD cards with a capacity of 32 GB or greater.

2. Insert the microSD card into the microSD card slot with the correct orientation (as shown in the illustration on the aircraft) until it locks into place.



3. Attach the camera to the aircraft.

➔ See Section 3.4: Aircraft Preparation.

Chapter 4

Pre-Flight Preparation

4.1. Pre-Flight Preparation Items 70
4.2. What You Need for Flight 71
4.3. Battery Charging 72
4.4. Controller Charging 74

4.1. Pre-Flight Preparation Items

- The following checks should be made prior to flight.
  - ✔ Batteries charged
  - ✔ Controller charged

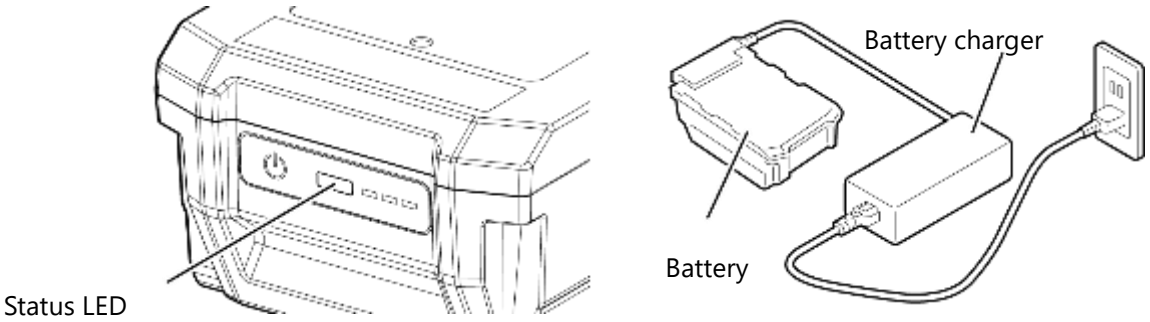
4.2. What You Need for Flight

- The following protective gear and apparatus should be readied prior to flight:
  - ✔ Helmets
  - ✔ Protective goggles *recommended
  - ✔ Gloves of a thickness that does not interfere with manipulating the controls *recommended
  - ✔ Long-sleeved clothing (top and bottom) *recommended
  - ✔ Fire extinguishers, etc. (Refer to the 'Precautions for Fire Prevention' in section "1.3.2 Precautions for Battery Handling").
  - ✔ Internet access (for map data acquisition)

4.3. Battery Charging

4.3.1. Charging Method

- The status LED and the remaining battery LED light up (blink) according to the charging mode, and charging starts.



CAUTION

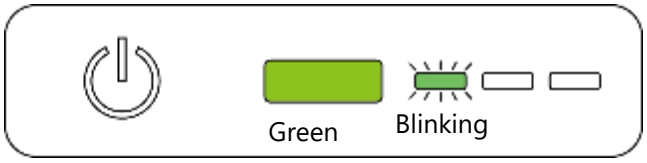
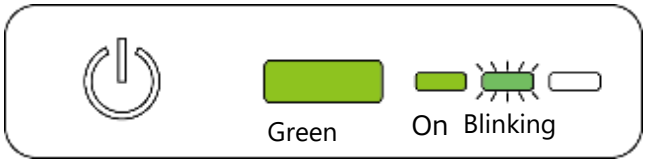
To maintain battery health, be sure to fully charge the battery before use.

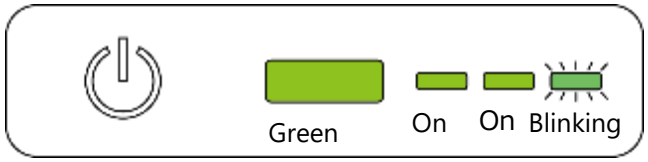
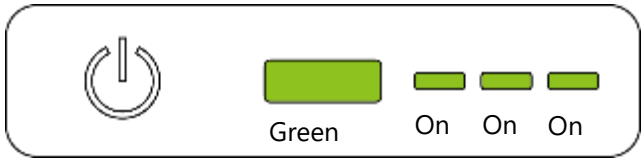
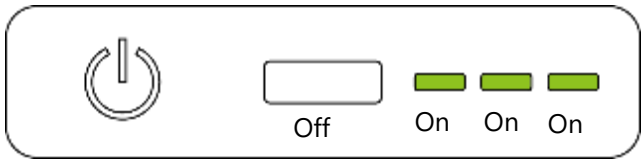
4.3.2. Battery Charging Modes

- The battery's internal battery management system (BMS) automatically switches from normal charge mode to charge standby mode when the internal temperature of the battery is outside the safe temperature range for charging. For example, the internal temperature of the battery may be high immediately after a flight, and the BMS may switch to charge standby mode upon connection to a charger to prevent excessive battery performance degradation caused by charging at a high internal temperature.
- Whether charging has initiated, and whether it is in normal charge mode or charge standby mode, is indicated by the status LED.

Normal charge mode

In normal charge mode the battery is charged at the normal prescribed rate.

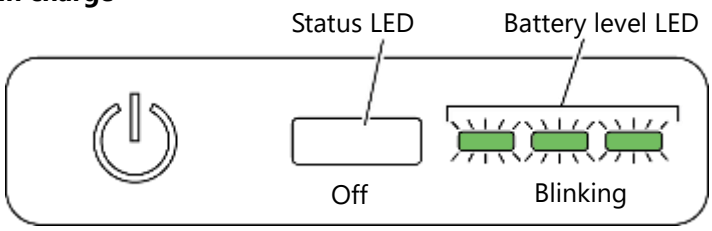
Status LED/Battery level LED	Battery level
	0-24% (0-24%)
	25-49% (%)

	50-74% (50-74%)
	75-99
	100%.

Charge standby mode

In the charge standby mode, charging is suspended because the BMS has detected that the internal temperature of the battery is outside the safe temperature range for charging. Charging is resumed when the temperature returns to the safe range for charging. Even after charging has started, if the internal temperature of the battery may exceed the safe range due to exposure to direct sunlight or other factors. In this case the BMS will again switch to charge standby mode and charging will be suspended until the temperature returns to the safe range for charging.

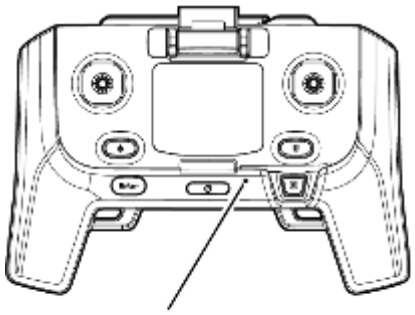
LED indication in charge

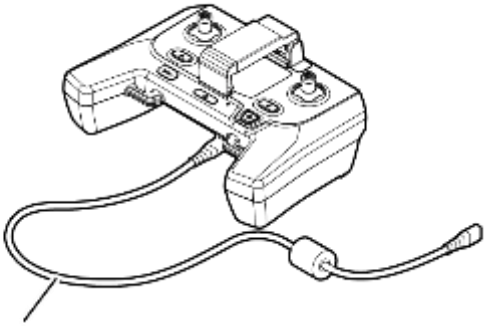


4.4. Controller Charging

4.4.1. Charging Method

Connect the controller to a commercially available USB compliant charger or other charging-capable device via USB Type-C®. The controller's status LED turns orange to indicate charging.



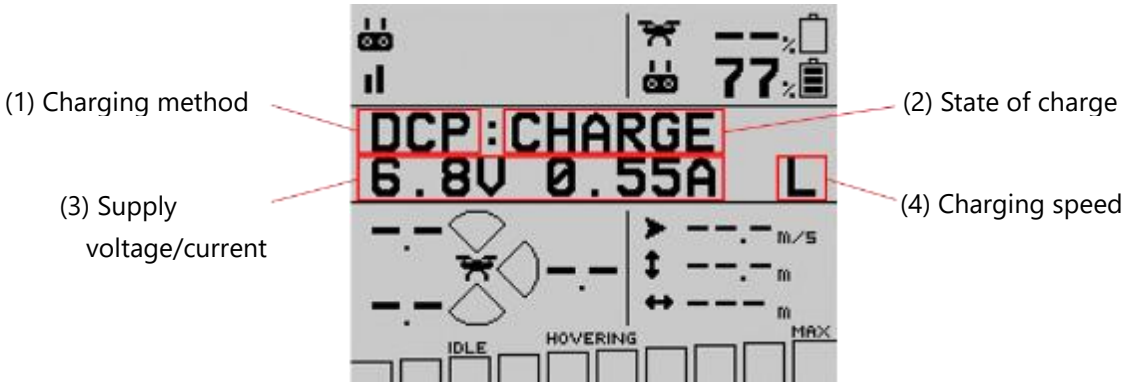


ADVISORY

- For charging, the USB Type-C® charging cable should be connected to the charging port at the bottom of the controller, not to the mobile device connection port at the top of the controller. The controller will not charge if the charger is connected to the mobile device connection port.
- Chargers that are not compliant with the USB BC standard (Battery Charging Specification 1.2) may not charge the controller properly.
- The dedicated USB Type-C® charging cable that is included with SOTEN may not work with some commercially available USB PD chargers that are capable of fast charging.

4.4.2. LCD Display While Charging (only when powered on)

When the controller is powered on while charging, the LCD screen displays the charging status.



① **About the charging method**

The controller identifies the charging method of the charger and displays the name of the charging method; the maximum current during charging is adjusted according to the identified charging method in accordance with the USB charging standard "Battery Charging Specification 1.2".

Charging method name	Details
SDP	Charging via a normal USB communications port on an electronic device (max. 5V 0.5A)
CDP	Charging a USB communications port that is also equipped for charging (max. 5V 1.5A)
DCP	Charging via a dedicated USB charging port (max. 5 V 1.5 A)
CHG1	Standard charger or equivalent (max. 5 V 2.4 A), except as noted above
CHG2	Charger that is not capable of the above current (max. 5V 1.0A)

② **State of Charge**

Displays controller charge status.

State of charge	Contents	Details
WAIT	Waiting to charge	Low or high temperature, waiting for acceptable battery temperature.
REPAIR	Over-discharge repair charging	The controller is attempting to restore its battery, which has reached an extremely low level of charge.
PRECHG	Pre-charge diagnostics	The controller is preforming diagnostics on the battery prior to initiating charging.
CHARGE	Charging	Normal state of charge.
FULL	Charge complete	Charging is complete.

③ **Supply voltage/current to internal battery**

Displays the voltage and current supplied to the internal battery. Note that the voltage and current in this display are not the input voltage and current from the USB port.

④ **Charging speed limit indication**

The letter "L" is displayed when the charger has reached the upper limit of the power it can supply and the controller is limiting the current consumed to protect the charger. Note that this will also be displayed when the input power has reached the maximum allowable for the active charging method, regardless of whether the charger is capable of supplying more power.

Chapter 5

Pre-Flight Inspection

5.1. Pre-Flight Inspection 78
5.2. Pre-Flight Battery Inspection 79
5.3. Pre-Flight Aircraft Inspection 80
5.4. Pre-Flight Propeller Inspection 85
5.5. Pre-Flight Controller Inspection 86
5.6. Pre-Flight Camera Inspection 89

5.1. Pre-Flight Inspection

Perform the following inspections prior to flight.

1. Pre-Flight Battery Inspection

- Confirm level of charge ····· 5-2-1
- Inspect exterior ····· 5-2-2

2. Pre-Flight Aircraft Inspection

- Inspect exterior ····· 5-3-1
- Inspect battery terminals and locking mechanism ····· 5-3-2
- Inspect camera terminals and locking mechanism ····· 5-3-3
- Inspection air intake ····· 5-3-4
- Inspect motors ····· 5-3-5
- Inspect propeller mounts and arms ····· 5-3-6
- Inspect arm locking mechanisms ····· 5-3-7
- Inspect camera and battery lock status ····· 5-3-8
- Confirm flight conditions/limitations ····· 5-3-9
- Inspect stereo cameras and infrared sensors ····· 5-3-10

3. Pre-Flight Propeller Inspection

- Inspect propellers ····· 5-4-1

4. Pre-Flight Controller Inspection

- Confirm level of charge ····· 5-5-1
- Confirmation controller binding ····· 5-5-2
- Confirm the stick mode ····· 5-5-3
- Confirm signal strength ····· 5-5-4
- Determine optimal antenna direction ····· 5-5-5
- Confirm antenna position ····· 5-5-6

5. Pre-Flight camera inspection

- Confirm startup ····· 5-6-1
- Confirm video transmission ····· 5-6-2
- Confirm gimbal operation ····· 5-6-3

5.2. Pre-Flight Battery Inspection

CAUTION

If any abnormality is found during the battery inspection, do not use it for flight. Contact your dealer.

5.2.1. Confirm Level of Charge

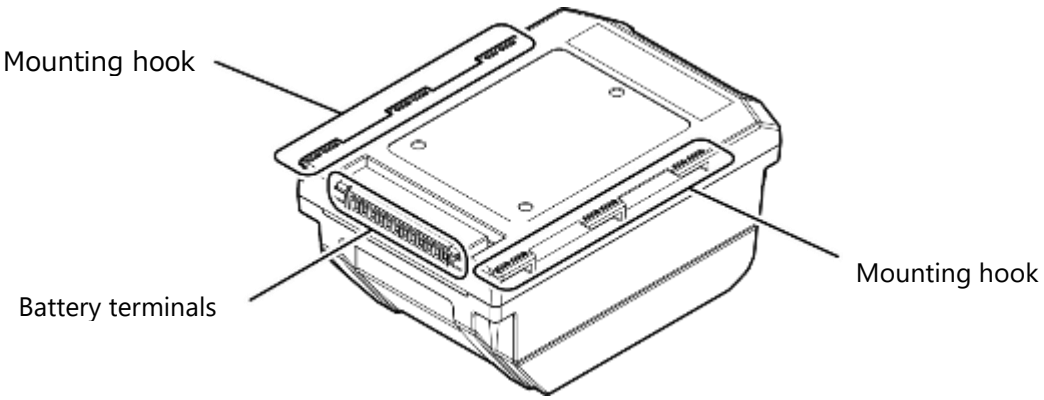
- Ensure that the battery is fully charged (100%).
  ➔ See Section 4.3: Battery Charging.

CAUTION

Always fully charge the battery before installing it onto the aircraft for flight.

5.2.2. Inspect Exterior

- Verify that there are no cracks or other damage to the mounting hooks and that they are not deformed.
- Verify that there are no debris in or around the battery terminals.
- Verify that there are no cracks or other damage or deformation near the terminals.



5.3. Pre-Flight Aircraft Inspection

CAUTION

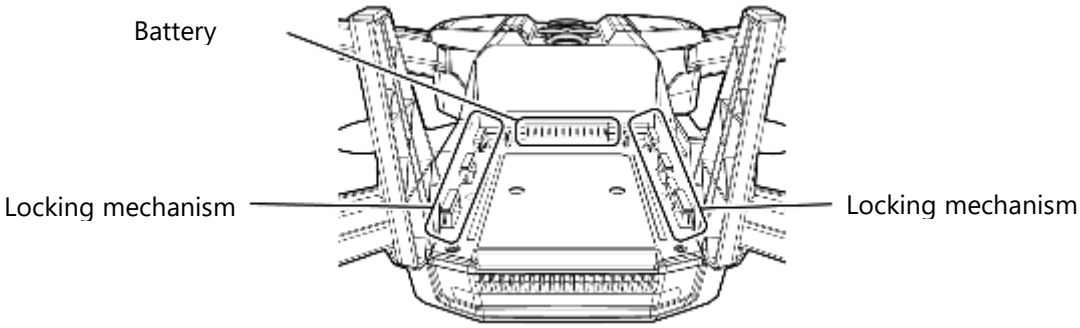
If any abnormality is found during the aircraft inspection, do not fly the aircraft. Contact your dealer.
Pre-flight inspections of the aircraft should be performed with the aircraft powered off.

5.3.1. Inspect Exterior

- Verify that there are no cracks, scratches, or other damage or deformation on the exterior of the aircraft.
- Deploy the arms and verify that they do not tilt or wobble when placed on level ground.

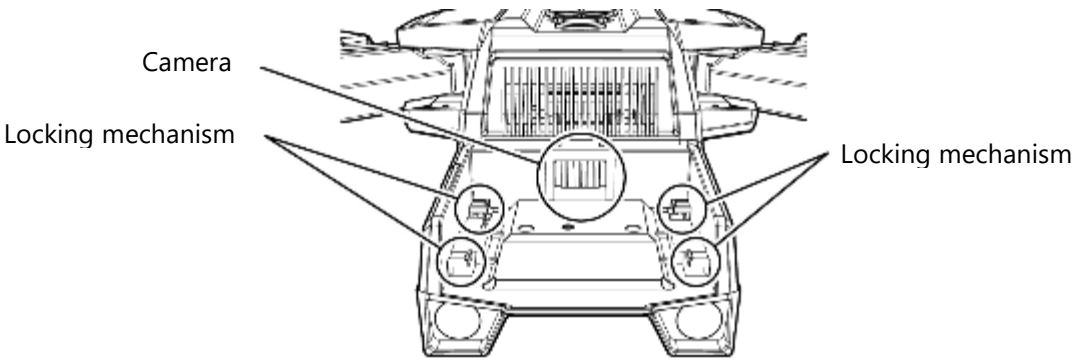
5.3.2. Inspect Battery Terminals and Locking Mechanism

- Verify that there is no deformation or rattling near the battery terminals or in the locking mechanism. Perform the inspection with the battery removed from the aircraft.
- Verify that there are no cracks, deformation, or other damage or debris near the terminals.
- Verify that there are no cracks, deformation, or other damage or debris near the locking mechanism.



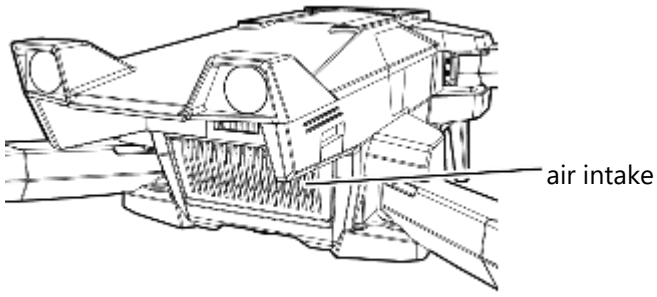
5.3.3. Inspect Camera Terminals and Locking Mechanism

- Verify that there is no deformation or rattling near the camera terminals or in the locking mechanism. Perform the inspection with the camera removed from the aircraft.
- Verify that there are no cracks, deformation, or other damage or debris near the terminals.
- Verify that there are no cracks, deformation, or other damage or debris near the locking mechanism.



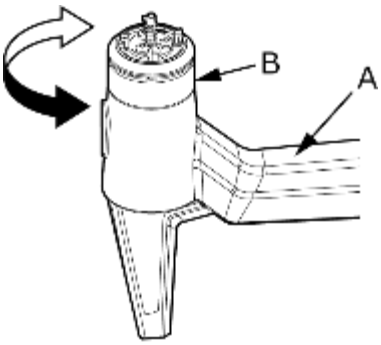
5.3.4. Inspect Air Intake

- Verify that there is no debris adhering to the air intake port, which is located at the front of the aircraft, just under the camera terminals. Perform the inspection with the camera removed from the aircraft.



5.3.5. Inspect Motors

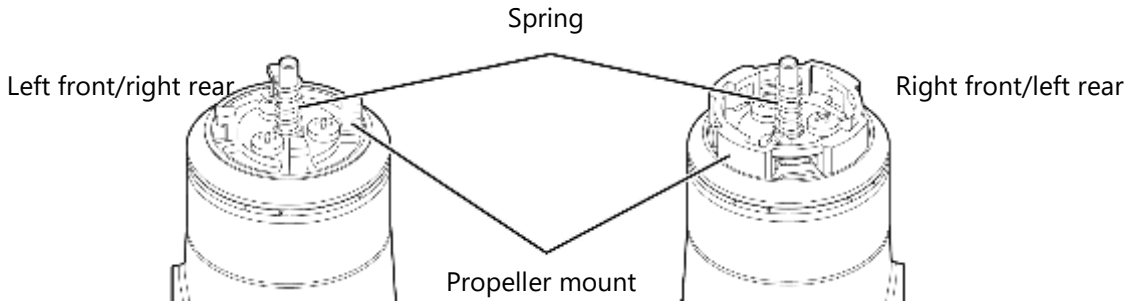
- Verify that the motors are not damaged or deformed.
- Turn all motors by hand and verify that they all turn with about the same resistance.
- Verify that the motors are securely fastened to the arm and are not rattling.
  Compare all 4 motors to confirm that there are no significant differences.



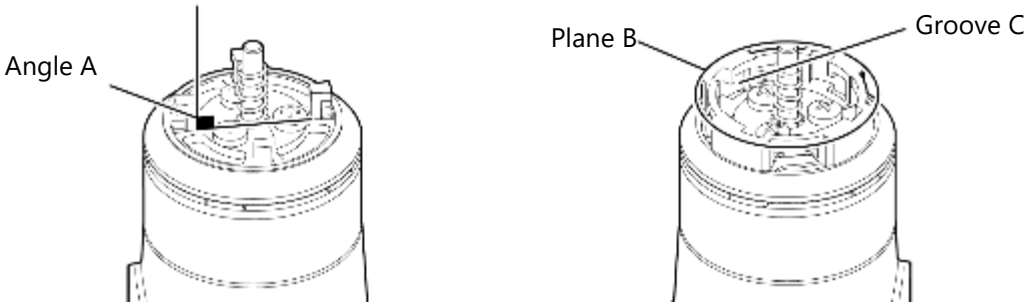
Hold part A and move part B

5.3.6. Inspect Propeller Mounts and Arms

- Verify that there are no cracks or deformation on the arms.
- Verify that there are no cracks, chips, deformation, debris, or other contamination of the propeller mounts.
- Verify that the springs attached to the motor shaft are not deformed or contaminated with debris.
- After mounting the propellers, verify that they are not loose or rattling.

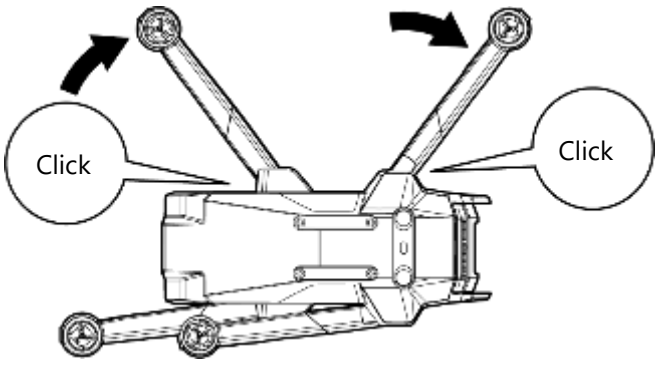


- For the left front and right rear motors, verify that the angles of the 4 propeller mounting hooks are vertical (Angle A in the figure below).
- For the right front and left rears motors, verify that there are no indications of contact or melting on the top surface of the propeller mounts (Plane B in the figure below).
- For the right front and left rears motors, check that there are no contact marks in the propeller mounting grooves (Groove C in the figure below).



5.3.7. Inspect Arm Locking Mechanisms

- Open the arms completely until an audible click is heard. Check that there is no rattling of the arms.

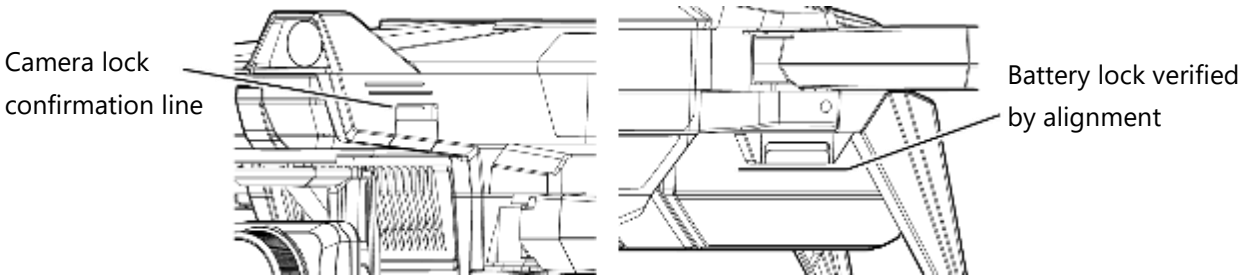


WARNING

An arm that is not fully open may move due to the normal accelerations of the motor during flight, severely impairing the ability of the aircraft to control its attitude, possibly resulting in a crash.

5.3.8. Confirm Camera and Battery Lock Status

- The camera release button has a lock confirmation line that visually indicates the lock is engaged. If this line is not visible, then the lock is not fully engaged. The battery release button does not have a lock confirmation line, but lock engagement can be confirmed by verifying that the bottom of the button is aligned with the aircraft structure behind it.
- Before flying, visually check both lock lines to make sure they are not half-locked.



WARNING

If the battery is not securely locked, it may fall out during flight, resulting in a crash.

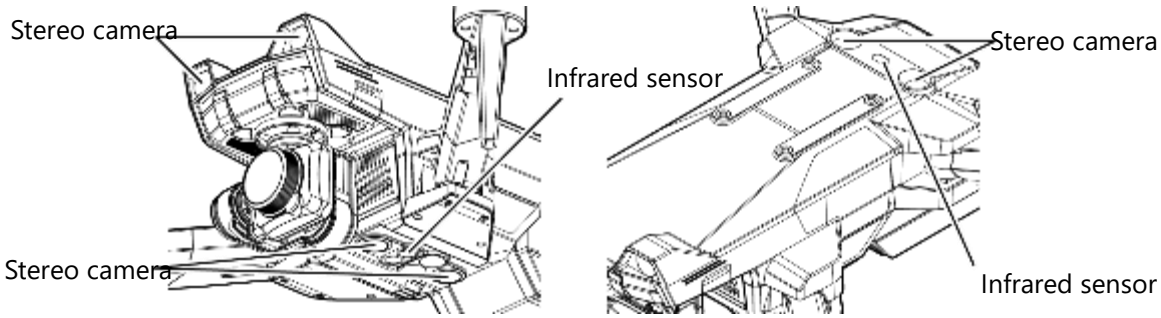
5.3.9. Confirm Flight Conditions/Limitations

- Check the applicable payloads user manuals for flight conditions and limitations with or without payloads prior to flight.
- Whenever payloads (including optional items) are loaded onto the aircraft, make sure that total takeoff weight of the aircraft does not exceed 2,000 g (4.4 pounds).

5.3.10. Inspect Stereo Cameras and Infrared Sensors

Check the lenses of the three pairs of stereo cameras mounted at the front, top, and bottom of the aircraft and the two infrared sensors mounted at the top and bottom of the aircraft for scratches and dirt. If there is dirt, gently wipe it off with a soft, clean cloth.

- Check the lenses of the three pairs of stereo cameras for fingerprints, fogging, scratches, cracks, or deformation.
- Check the lenses of the two infrared sensors for fingerprints, fogging, scratches, cracks, or deformation.

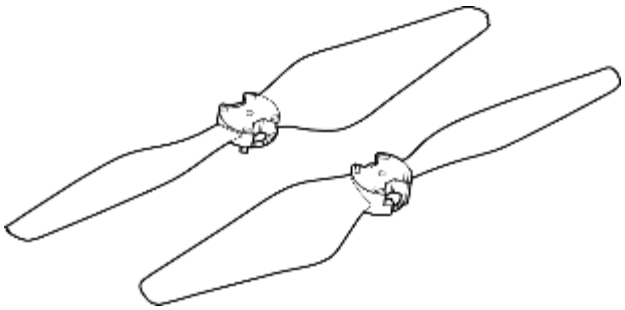


5.4. Pre-Flight Propeller Inspection

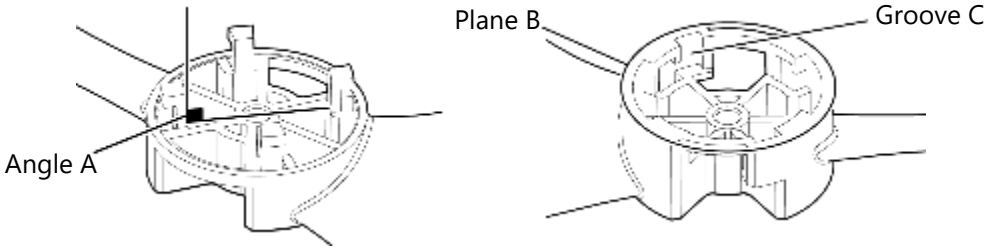
> CAUTION
>
> If any abnormality is found with a propeller during inspection, do not use it for flight. Contact your dealer.

5.4.1. Inspect Propellers

- Check the propellers for cracks, chips, deformation, dirt, or other contamination.
- Ensure that there is no damage or wear on the blade tips.



- For the counterclockwise propellers, verify that the angles of the 4 propeller mounting hooks are vertical (Angle A in the figure below).
- For the clockwise propellers, verify that there are no indications of contact or melting on the bottom surface of the propellers (Plane B in the figure below).
- For the clockwise propellers, check that there are no contact marks in the propeller mounting grooves (Groove C in the figure below).



5.5. Pre-Flight Controller Inspection

CAUTION

If any abnormality is found during the controller inspection, do not use if for flight. Contact your dealer.

5.5.1. Confirm Level of Charge

- Ensure that the controller battery is fully charged.
  ➔ Refer to Section 4.4: Controller Charging.

CAUTION

If the controller's battery runs out, the aircraft will detect the loss of communication with the controller and go into emergency mode.
➔ Refer to Section 7.1.4: "Emergency Menu" for details.

5.5.2. Confirm Controller Binding

- When the controller and the aircraft are turned on, "CONNECTION CHECKING" is displayed on the controller and the controller status LED blinks green. Connection to the aircraft is made automatically.
- When "SUCCESS" is displayed on the controller and the controller status LED becomes solid green, the connection between the controller and the aircraft is complete.

ADVISORY

- If the status LED is blinking red, communication with the aircraft has been lost. If, after some time, connection cannot be established, restart the controller and aircraft.
- If the aircraft is bound to more than one controller, "TO BE PILOT PUSH ENTER" will be displayed. Press and hold the ENTER button on the desired controller to acquire pilot authority.

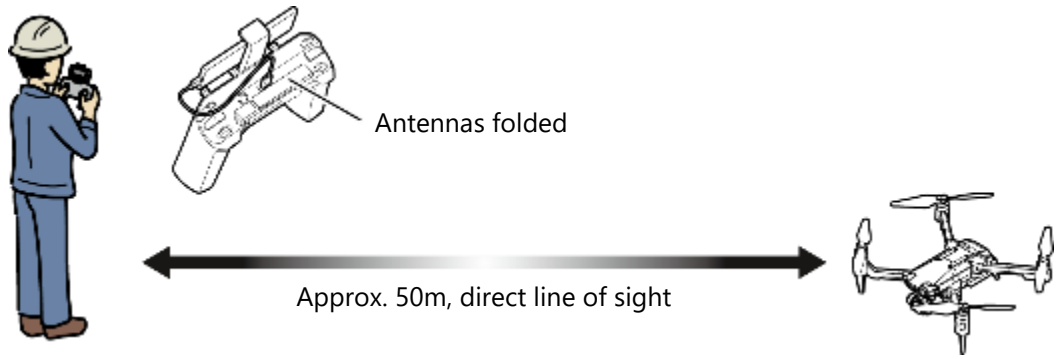
Notification	Processing details
CONNECTION CHECKING	Checking the connection between the aircraft and the controller.
TO BE PILOT PUSH ENTER	The aircraft is soliciting for a pilot.

5.5.3. Confirm the Stick Mode

- Always check the control mode before flying to ensure that it is set to the pilot's preferred mode.
  ➔ Refer to Section 3.6 Stick Mode Settings.

5.5.4. Confirm Signal Strength

- Verify the lack of wireless interference between the controller and drone by performing the following test procedure. With the antennas folded in the stowed position, confirm that the camera video stream can be received smoothly at approximately 50 m (160 ft) from the aircraft.
- Remember to deploy the antennas after completing the signal strength check.

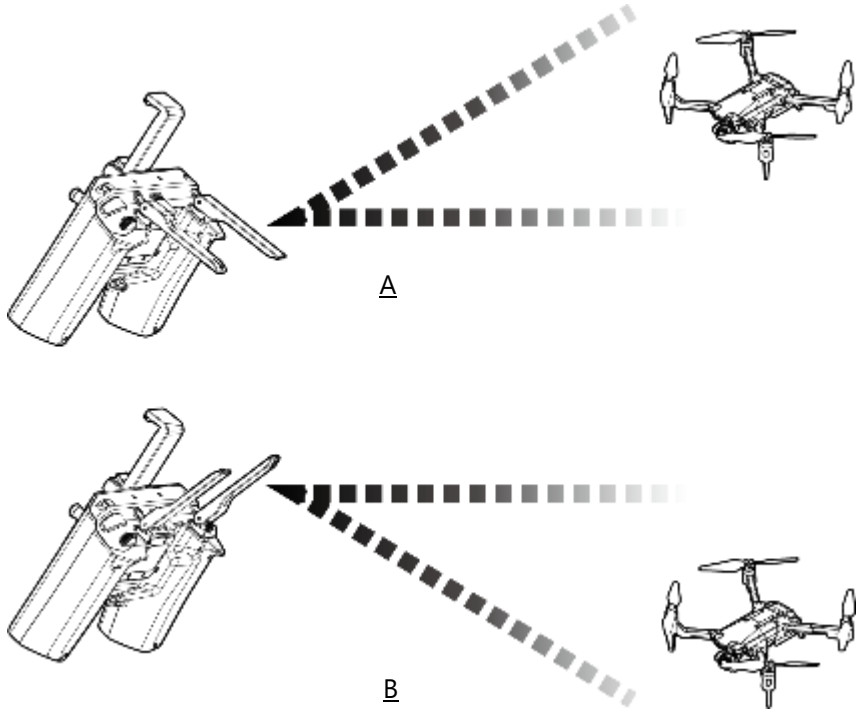


CAUTION

Beware of radio interference when other drones are flying in the vicinity or when in the vicinity of other 2.4 GHz devices (such as Wi-Fi).

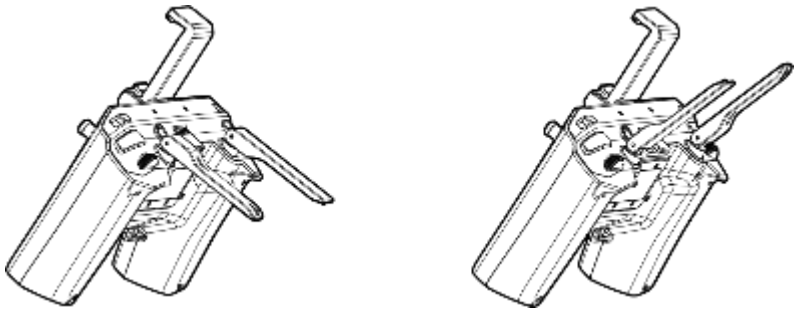
5.5.5. Determine Optimal Antenna Direction

- The antennas are directional; radio waves are transmitted and received most strongly in the direction that is perpendicular to the plane of the antennas.
- Referring to the figure below, communication with a distant aircraft tends to be more stable in state B than in state A in the figure below. Configuration B is recommended when the aircraft and controller are far from each other.



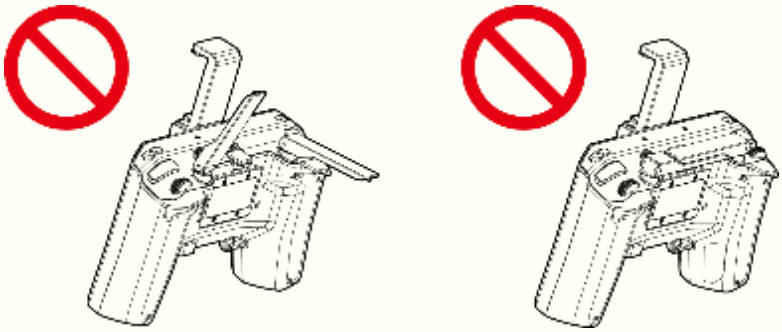
5.5.6. Confirm Antenna Position

- The two antennas must be deployed so that they are in parallel.

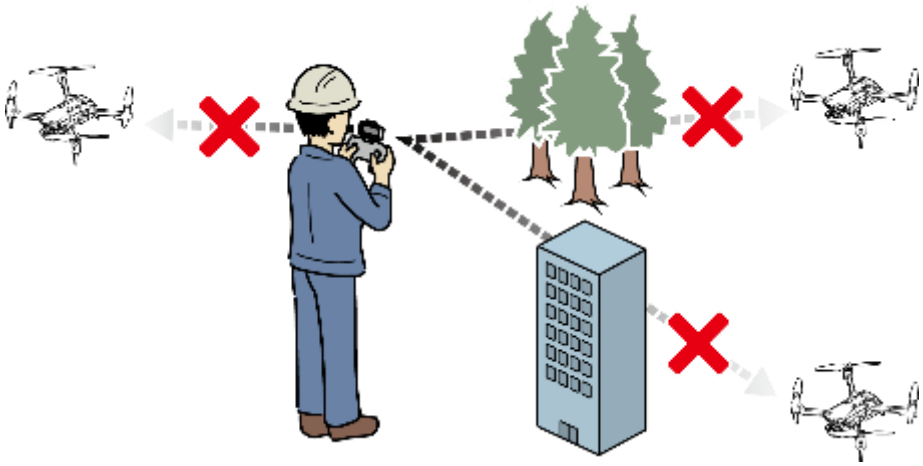


CAUTION

Antennas that are folded or not deployed in parallel may cause unstable communication between the aircraft and the controller.



- The 2.4GHz band used for communication between the controller and the aircraft is capable of high-bandwidth data communication, but it is easily obstructed by obstacles between the controller and the aircraft.



CAUTION

- Objects blocking the line of sight between the aircraft and the antennas may disrupt communication.
- If the aircraft is flown behind the pilot, the pilot themselves may obstruct communications. To maintain communications, the pilot should turn so that the controller always has an unobstructed line of sight to the aircraft.

5.6. Pre-Flight Camera Inspection

> ADVISORY
>
> For details on camera/gimbal operation with the ACSL TAKEOFF ground control application, refer to the ACSL TAKEOFF ground control application User Manual.

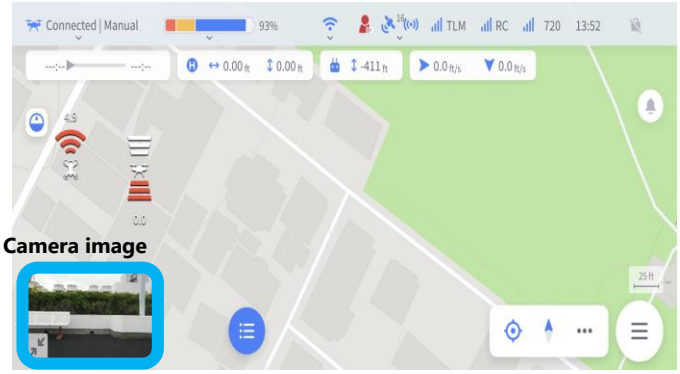
5.6.1. Confirm Startup

- The gimbal performs a self-calibration when the aircraft is started up.
- After self-calibration is completed, confirm that the gimbal holds a forward-facing orientation.

> ADVISORY
>
> If, during calibration, the gimbal touches the ground or other obstacle, calibration will fail, the gimbal will not function properly, and a gimbal error message will be displayed. When starting up the gimbal, place the aircraft on a flat, level surface.

5.6.2. Confirm Video Transmission

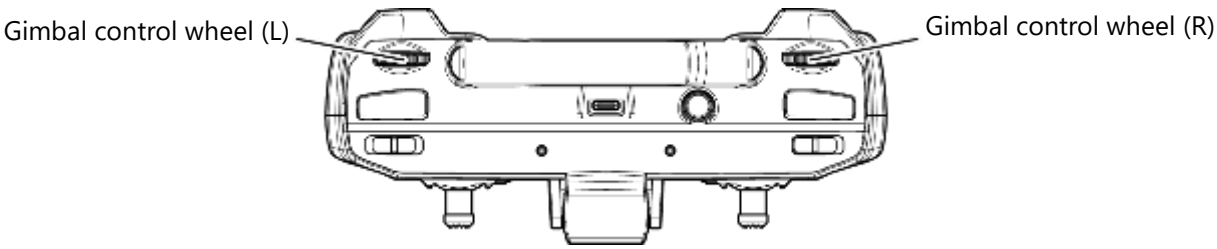
- Connect the ACSL TAKEOFF ground control application to the controller and confirm that the live video feed is displayed.



Example of full-screen map display

5.6.3. Confirm Gimbal Operation

- Check that the controller's left gimbal control wheel operates the gimbal tilt.
- Check that the controller's right gimbal control wheel operates the gimbal pan.



Chapter 6

Normal Operating Procedures

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6.4. Controller Multicast 117
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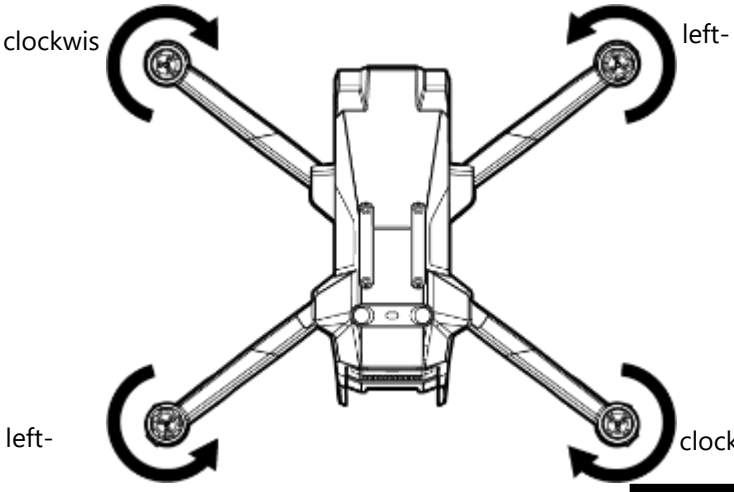
6.1. Test Run

6.1.1. Verify Motor Start and Stop Procedure

- Before the first flight of the day, briefly start then stop the motors to confirm correct setting of the stick mode and operation. Refer to Section 3.6.3 Confirming Stick Mode.



Class 1 Laser Product

WARNING

Lasers operating with a wavelength outside the visible range (class 1 lasers) are emitted from two infrared sensors located on the top and bottom of the aircraft when the aircraft is powered on. Do not look closer than necessary or look into the lenses of the sensors when the aircraft is powered on.

ADVISORY

- During startup, do not bump or tilt the aircraft until startup is complete as this may interfere with the startup calibration of the on-board sensors.
- During startup, if the sticks are not centered, a safety lockout function is activated and the motors will not start. The safety lockout function is deactivated once the sticks are centered.
- If the motors do not start, refer to Chapter 9 "Troubleshooting."

6.1.2. Verify Correct Magnetic Orientation

- Perform a magnetic orientation check on the first flight of the day.

  Magnetic Orientation Check Procedure

  - Confirm that the propellers are removed from the aircraft.
  - Power on the aircraft and controller.
  - Verify connection between the aircraft and controller.
  - Verify connection between the aircraft and the ACSL TAKEOFF ground control application.
  - While keeping the aircraft flat, lift the aircraft and rotate it 360-degrees around the yaw axis in about 2 to 3 seconds.
  - Verify that the "AZIMUTH ERROR INCREASED" message is not displayed on the controller or ACSL TAKEOFF ground control application.

CAUTION

If the "AZIMUTH ERROR INCREASED" caution message is displayed, follow the instructions below.

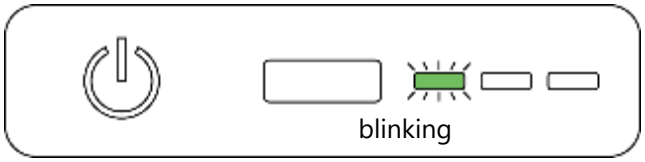
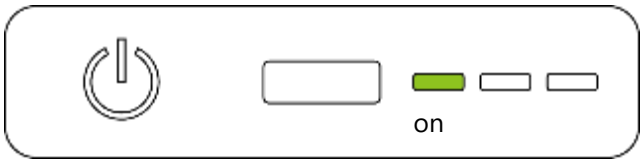
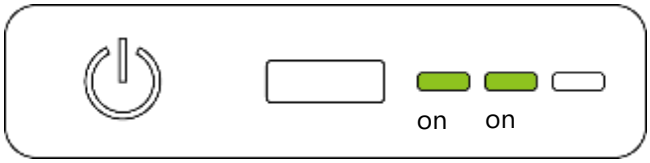
- If any equipment that emits a strong magnetic field is installed, buried, or suspected in the vicinity, do not take off in either the position (POS) or auto (AUT) mode.
- Perform a magnetic calibration when the aircraft configuration is changed, such as adding optional equipment or removing a standard camera.

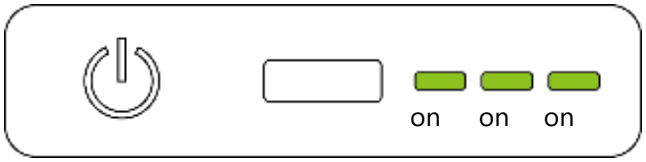
*Refer to the ACSL TAKEOFF ground control application User Manual for instructions on performing a magnetic calibration.

- If none of the above apply, it is recommended that you do not fly in either the position (POS) or auto (AUT) mode.

6.1.3. Confirm Level of Charge

- Before flight, check the level of charge of the battery that will be inserted to the aircraft.

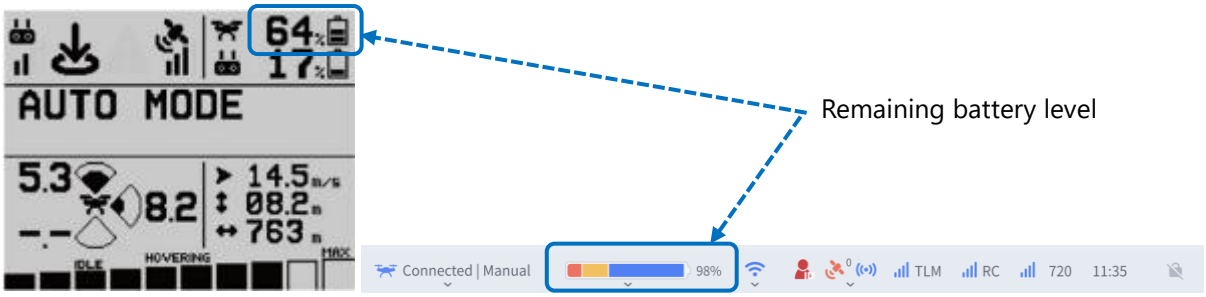
LED indication of remaining battery charge during normal charging	
Battery level LED	**Battery level**
	0-24%
	25-49%
	50-74%

	75-100%

CAUTION

The ability to take off (i.e. the ability to increase motor speed above idle) is inhibited when the aircraft's battery level is 13% or lower. See below for dealing with low battery.

- Continually monitor the battery level of the aircraft during flight.



Battery level	Message	Resulting actions
24%	Battery voltage low (caution)	Battery power is low. Continue to monitor the battery level.
13%.	Battery voltage low (warning)	The ability to take off is inhibited. Land in a safe place as soon as possible. If in auto (AUT) mode, the aircraft will enter emergency mode.
6%	Battery voltage low (warning)	An emergency landing (automatic landing on the spot) that cannot be overridden will commence.

WARNING

- If the aircraft's battery level falls to 6% or lower, the battery level LED will blink and the aircraft will make an emergency landing straight down to prevent a crash. The emergency landing cannot be cancelled by the user, and all controls will be locked out. Continually monitor the battery level during flight and land the aircraft in a safe location before the battery level falls to 6%.

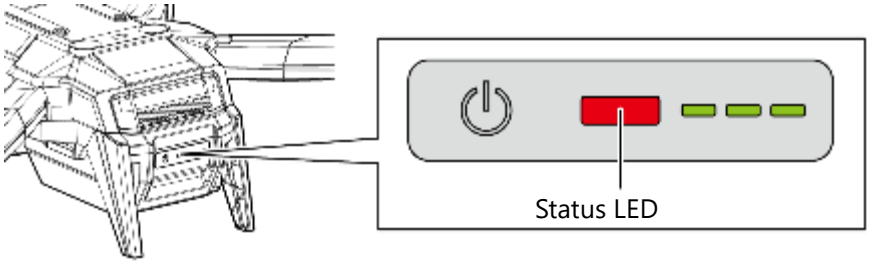
6.1.4. Check the Status LED

CAUTION

If any abnormality is found during the inspection, do not fly the aircraft. Contact your dealer.

➔ With the battery installed in the aircraft, when the power button is pressed the status LED will display the flight mode set on the controller. The status LED will also flash red when a GPS or visual odometry abnormality is detected, and white when an aircraft abnormality is detected.

➔ Refer to Section 6.2.1: Flight Mode Settings.



Status LED indication when the aircraft is powered on			
Flight mode	Mode indication	GPS and visual odometry abnormality	Aircraft abnormality
Manual mode Switch position: MAN	Flashing yellow	Flashing red	Flashing white
Position mode Switch position: POS	Flashing green		
Auto mode Switch position: AUT	Flashing blue		
Manual mode Position mode Auto mode Switch position: MAN/POS/AUT (Auto takeoff and landing)	Flashing purple		

WARNING

- If, while in flight, the status LED flashes red, immediately switch to manual (MAN) mode.
- Continued flight in position (POS) or auto (AUT) mode with the status LED flashing red may result in loss of control and a crash.

ADVISORY

The ability to take off (i.e. the ability to increase motor speed above idle) is inhibited in position (POS) or auto (AUT) mode while the status LED is flashing red.

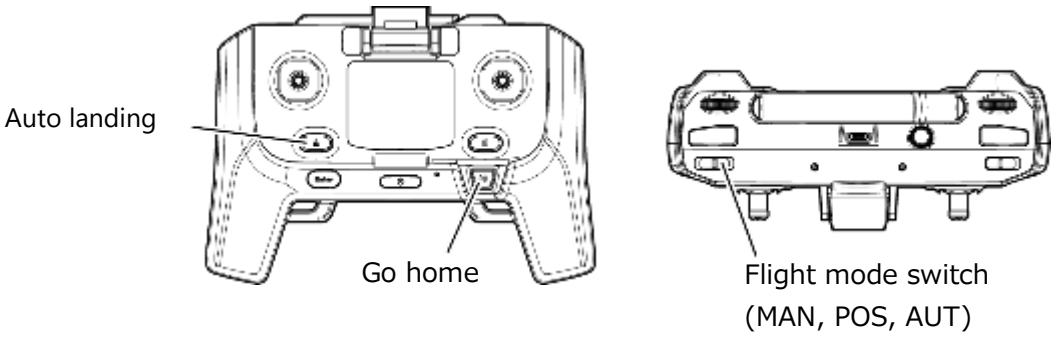
6.1.5. Install Propellers

Install the propellers.

➔ Refer to Section 3.7: “Propeller Installation” for instructions on how install the propellers.

6.2. Basic In-Flight Operations

6.2.1. Flight Mode Settings



Flight mode	Feature
Manual mode Switch position: MAN	This mode does not use GPS. The aircraft will achieve a flat attitude when the sticks are released, but a hover at a fixed position will not be achieved.
Position mode Switch position: POS	This mode uses GPS or visual odometry to control the position and speed of the aircraft. The aircraft will achieve a hover at a fixed position when the sticks are released.
Auto mode Switch position: AUT	This mode uses GPS to autonomously execute a flight along a route that was pre-planned using the ACSL TAKEOFF ground control application. This mode cannot be used in a non-GPS environment.
Automatic landing mode Switch position: MAN, POS, AUT	This mode uses GPS or visual odometry to autonomously land at the current location. This mode is entered by pressing either the land button on the ACSL TAKEOFF ground control application or the auto-landing button on the controller.
Go home mode Switch position: MAN, POS, AUT	This mode uses GPS to autonomously return to the takeoff location. This mode is entered by pressing either the go home button in the ACSL TAKEOFF ground control application or the go home button on the controller.
Command flight Switch position: AUT	This mode uses GPS to control the location and orientation of the aircraft using the ACSL TAKEOFF ground control application.

Auto-takeoff Switch position: AUT	This mode uses GPS or visual odometry to autonomously take off. This mode is entered by pressing the takeoff button on the ACSL TAKEOFF ground control application.
Idling	The aircraft has transitioned from the powered-on state to the flight-ready state and the motors are rotating at the minimum rotational speed.

CAUTION

Flying in manual (MAN) mode requires advanced piloting skill.
Position (POS) and auto (AUT) modes primarily use GPS for position control, but automatically switch to visual odometry when reception of GPS signals is poor or not possible.
* The ability to take off (i.e. the ability to increase motor speed above idle) is inhibited in auto (AUT) mode while GPS reception is poor (as indicated by the status LED flashing red or a red GPS icon in the ACSL TAKEOFF Ground Control Application).

6.2.2. Basic Manual Mode (MAN) Operations

- This section describes basic operations in manual (MAN) mode. This mode requires active use of the controller and is primarily intended to give the pilot full control in case of an operational abnormality or emergency.
  ➔ Refer to Chapter 7: Abnormal Operating Procedures.
- Manual (MAN) mode should be used when GPS or visual-odometry cannot correctly measure the aircraft's position or speed.
- Assists the pilot in maintaining a constant aircraft attitude and altitude or vertical speed.

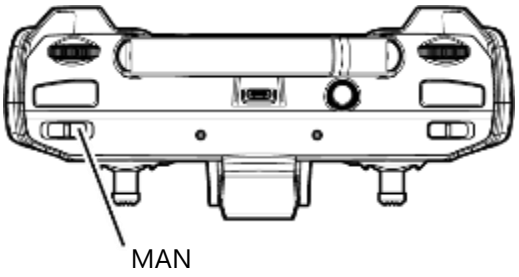
WARNING

Failure to comply with the following may result in an unexpected collision or crash that could cause injury, fire, or damage.

- There is a risk of lacerations or other injury from contact with the rotating propellers. Always keep a sufficient distance.
- The aircraft will not maintain its position in manual (MAN) mode. The pilot must make continuous corrective inputs to maintain the aircraft's position in manual (MAN) mode. Always exercise care after switching to manual (MAN) mode.
- When switching to manual (MAN) mode, be sure to confirm the forward heading (yaw angle) of the aircraft before manipulating the controls. It is recommended to turn the aircraft so that it faces away from the pilot for intuitive maneuvering.
- If the aircraft's battery level falls to 6% or less, the battery level LED will flash and the aircraft will make an emergency landing straight down to prevent a crash. The emergency landing cannot be cancelled by the user, and all controls will be locked out. Continually monitor the battery level during flight and land the aircraft in a safe location before the battery level falls to 6%.

① **Switching to manual mode**

- If the aircraft is not able to measure it's position or speed with GPS or visual-odometry, switch to manual mode by setting the controller's flight mode switch to the "MAN" position.
- Verify that the aircraft's status LED is blinking yellow.



Controller flight mode switch	TAKEOFF display	Aircraft status LED
MAN	Manual	Blinking yellow

② **Maneuvering the aircraft using the controller**

- Takeoff
  - After starting the motors, slowly manipulate the throttle stick upward from the center position to take off.
- Hovering
  - The pilot has direct control of aircraft attitude. The aircraft will not hold its position.
  - The position of the aircraft should be controller by manipulating the roll and pitch sticks.
  - Manipulate the yaw stick to change the heading direction of the aircraft.
- Altitude
  - The aircraft will maintain a constant altitude when the throttle stick is in the center position.
- Moving forward, backward, left, and right
  - Manipulate the roll and pitch sticks to adjust the path and speed of the aircraft.
- Landing
  - Manipulate the throttle stick downward to descend the aircraft toward the ground.
  - When nearing the ground, ease the throttle stick toward the center to reduce the rate of descent.
  - Upon landing, hold the throttle stick in the lowest position until the aircraft is securely grounded.

WARNING

There is a risk of flyaway or loss of control when flying in winds that are higher than the specified wind speed limit.

➔ Refer to 1.2.3. Limitations. Abort flight immediately if the wind speed exceeds the limit.

CAUTION

- If, during takeoff or landing, any part of the landing gear or the aircraft inadvertently contacts the ground or any other object, do not attempt to climb. Immediately hold the throttle stick in the lowest position and land the aircraft.
- Attempting to climb or hover while in contact with the ground or other object may result in excessive attitude angles and a possible crash.
- Excessive use of pitch or roll in manual (MAN) mode may cause the aircraft to exceed its maximum speed and lose control. Fly at or below the maximum speed.

ADVISORY

- Takeoffs and landings should be performed on a flat, level surface.
- During takeoff, any stick input other than throttle may cause the aircraft to tip over.
- The aircraft will not maintain its position in manual (MAN) mode. The pilot must make continuous corrective inputs to maintain the aircraft's position in manual (MAN) mode.
- Wind gusts may cause the aircraft to move suddenly.
- When landing, do not land with any horizontal speed. Attempting to land with horizontal speed may cause the aircraft to tip over or the propellers to contact the ground.
- The soft-landing assist function does not work in manual mode. Depending on the condition of the landing area, landing with high vertical speed may cause damage. Operate the throttle stick carefully and land slowly.

6.2.3. Basic Position Mode (POS) Operations

- This section describes basic operations in a position (POS) mode. This is the mode that should normally be used when it is desired to control the location of the aircraft via the control sticks.
- GPS or visual-odometry are used to measure the aircraft's position and speed.
- Assists the pilot in maintaining a constant aircraft position or speed.

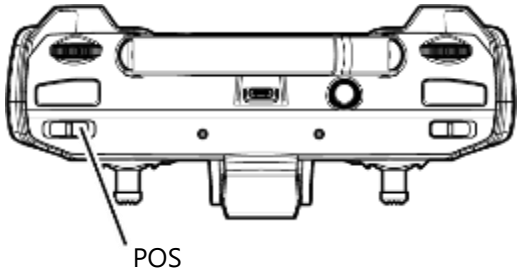
WARNING

Failure to comply with the following may result in an unexpected collision or crash that could cause injury, fire, or damage.

- There is a risk of lacerations or other serious injury from contact with the rotating propellers. Always keep a sufficient distance.
- In position (POS) mode, the aircraft relies primarily on GPS signals (when available) for position control. Switch to manual (MAN) mode immediately if the GPS icon in the ACSL TAKEOFF ground control application turns red, if the aircraft's status LED flashes red, or if the aircraft drifts or otherwise moves in a way that seems abnormal.
- When reception of GPS signals is poor or not possible, the aircraft will switch automatically to visional odometry for position control. Switch to manual (MAN) mode immediately if the "VISION Accuracy Degraded" caution message is displayed in the ACSL TAKEOFF ground control application, if the aircraft's status LED flashes red, or if the aircraft drifts or otherwise moves in a way that seems abnormal.
- If the aircraft's battery level falls to 6% or less, the battery level LED will flash and the aircraft will make an emergency landing straight down to prevent a crash. The emergency landing cannot be cancelled by the user, and all controls will be locked out. Continually monitor the battery level during flight and land the aircraft in a safe location before the battery level falls to 6%.

① **Switching to position mode**

- Switch to position mode by setting the controller's flight mode switch to the "POS" position.
- Verify that the aircraft's status LED is blinking green.
- Verify that the aircraft's status LED is not blinking red.
- Ensure that the takeoff area is not within a user-defined geofence no-fly zone.



Controller flight mode switch	TAKEOFF display	Aircraft status LED
POS	Position	Blinking green

ADVISORY

- The ability to take off (i.e. the ability to increase motor speed above idle) is inhibited in position (POS) mode while the status LED is flashing red.
- The ability to start the motors is inhibited if the aircraft detects that it is within a no-fly zone set by the user with the ACSL TAKEOFF ground control application.

② **Maneuvering using the controller**

- Takeoff
  - After starting the motors, slowly raise the throttle stick upward from the center position and take off.
- Hovering
  - The pilot has direct control of the aircraft's position.
  - The position of the aircraft can be adjusted by manipulting the roll and pitch sticks.
  - Manipulate the yaw stick to change the heading direction of the aircraft.
- Altitude
  - The aircraft will maintain a constant altitude when the throttle stick is in the center position.
- Forward/backward/left/right sideways
  - Manipulate the roll and pitch sticks to adjust the speed and trajectory of the aircraft.
- Landing
  - Manipulate the throttle stick downward to descend the aircraft toward the ground.
  - When nearing the ground, the soft-landing assist function will automatically adjust the rate of descent.
  - Upon landing, hold the throttle stick in the lowest position until the aircraft is securely grounded.

WARNING

There is a risk of flyaway or loss of control when flying in winds that are faster than the specified wind speed limit. Abort flight immediately if the wind speed exceeds the limit.

CAUTION

- If, during takeoff or landing, any part of the landing gear or the aircraft inadvertently contacts the ground or any other object, do not attempt to climb. Immediately hold the throttle stick in the lowest position and land the aircraft.
- Attempting to climb or hover while in contact with the ground or other object may result in excessive attitude angles and a possible crash.
- Malfunction of the soft-landing assist function may result in an excessively slow descent. Switch to manual (MAN) mode to regain control of the descent speed.
- In position (POS) mode, with good reception of GPS signals, the maximum possible ground speed is 15 m/s (33.5 MPH). If reception of GPS signals is poor or not possible, the aircraft will automatically switch to visual odometry for position control and ground speed will be limited to 0.8 m/s (1.8 MPH).
- The collision avoidance feature only functions in the forward and upward directions. Avoid flying at low altitude to prevent collision with rising terrain.

ADVISORY

- Takeoffs and landings should be performed on a flat, level surface.
- During takeoff, any stick operation other than throttle may cause the aircraft to tip over.
- As the aircraft approaches the ground for landing, it will automatically decelerate to assist in a soft landing based on the distance measurements from the infrared sensor on the bottom of the aircraft.
- *Depending on the composition and condition of the ground directly below the aircraft, this feature may not function properly. The pilot should monitor the landing and be ready to manually adjust the rate of descent if it appears not to be slowing near the ground. When landing, do not land with any horizontal speed. Attempting to land with horizontal speed may cause the aircraft to tip over or the propellers to contact the ground.

6.2.4. Basic Auto Mode (AUT) Operations

- This section describes basic operations in the auto (AUT) mode. This is the mode that should normally be used when it is desired to control the location of the aircraft via the ACSL TAKEOFF ground control application.
- GPS or visual-odometry are used to measure the aircraft's position and speed.
- Assists the pilot in maintaining a constant aircraft position or speed.

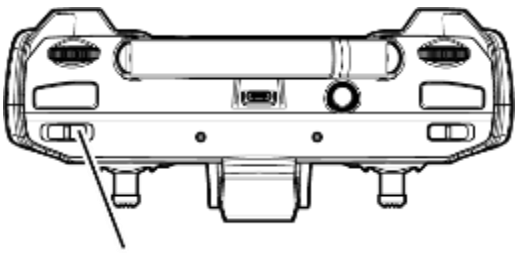
WARNING

Failure to comply with the following may result in an unexpected collision or crash that could cause injury, fire, or damage.

- There is a risk of lacerations or serious injury from contact with the rotating propellers. Always keep a sufficient distance.
- In auto (AUT) mode, the aircraft relies primarily on GPS signals (when available) for position control. Switch to manual (MAN) mode immediately if the GPS icon in the ACSL TAKEOFF ground control application turns red, if the aircraft's status LED flashes red, or if the aircraft drifts or otherwise moves in a way that seems abnormal.
- If the aircraft's battery level falls to 6% or less, the battery level LED will flash and the aircraft will make an emergency landing straight down to prevent a crash. The emergency landing cannot be cancelled by the user, and all controls will be locked out. Continually monitor the battery level during flight and land the aircraft in a safe location before the battery level falls to 6%.

① **Switching to auto mode**

- Switch to position mode by setting the controller's flight mode switch to the "AUT" position.
- Verify that the status LED on the aircraft is blinking blue.
- Verify that the status LED on the aircraft is not blinking red.
- Ensure that the takeoff area is not within a user-defined geofence no-fly zone.



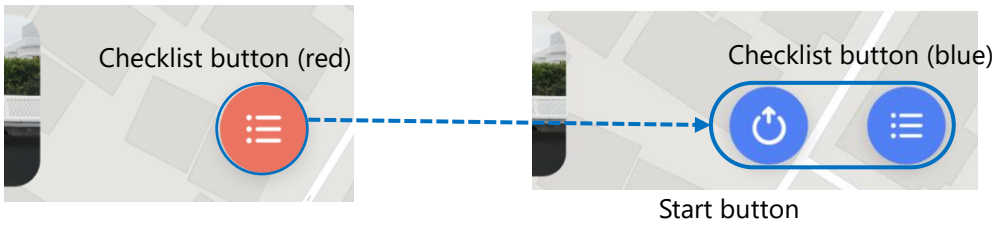
Controller fried mode switch	TAKEOFF display	Status LEDs on the aircraft
AUT	Auto	Blinking blue

ADVISORY

- The ability to take off (i.e. the ability to increase motor speed above idle) is inhibited in auto (AUT) mode while the status LED is flashing red.
- The ability to start the motors is inhibited if the aircraft detects that it is within a no-fly zone set by the user with the ACSL TAKEOFF ground control application.

② **Checklist**

- When the controller's flight mode switch is set to the "AUT" position, a red checklist button will appear in the ACSL TAKEOFF ground control application.
  *For details on the checklist, please refer to the ACSL TAKEOFF ground control application user manual.
- Press the checklist button to display the preflight checklist.
- The preflight checklist automatically checks for GPS and sensor health.
- When all checks, including manual check items, are completed, the checklist button turns blue and the start button appears.



③ **Free flight**

➔ Refer to section 6.3.6: Directional Pad (D-Pad).

④ **Planned flight**

➔ Refer to Section 6.3.12: Planned Flight.

6.3. In-Flight Functions

6.3.1. Availability of Functions for each Flight Mode

Functions that may be executed from the controller

Function	Manual (MAN)	Position (POS)	Auto (AUT)
Auto landing	✓	✓	✓
Pause	From go home or auto landing modes		✓
Go home	✓	✓	✓
Collision avoidance	-	✓	✓
Camera/gimbal operations	✓	✓	✓
Forced stop	✓	✓	✓

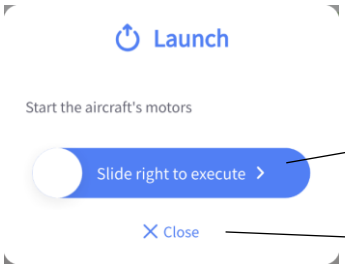
Functions that may be executed from the ACSL TAKEOFF ground control application

Function	Manual (MAN)	Position (POS)	Auto (AUT)
Auto takeoff	-	-	✓
Auto landing	✓	✓	✓
Pause	From go home or auto landing modes		✓
Directional pad (D-pad)	-	-	✓
Go home	✓	✓	✓
Go to Transmitter	✓	✓	✓
Camera/gimbal operations	✓	✓	✓
Planned flight	-	-	✓
User-defined geofence	-	✓	✓
Altitude limitations	-	✓	✓
Marker tracking	-	-	✓
Emergency landing	✓	✓	✓

Forced stop	✓	✓	✓

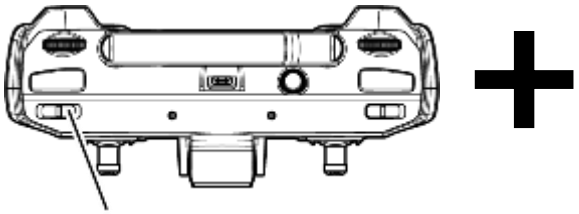
6.3.2. Modal Dialog (TAKEOFF Ground Control Application)

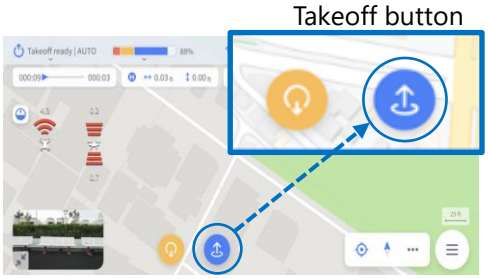
- In the case of the ACSL TAKEOFF ground control application, the following functions are executed only after confirmation via a modal dialog window. The intention to execute the function is confirmed by sliding the confirmation slider to the right, and can be canceled by pressing the close button.
  - Auto takeoff
  - Auto landing
  - Go to Transmitter
  - Emergency landing
  - Forced stop



6.3.3. Auto Takeoff

- Allow the controller sticks to remain in the center position.
- Set the controller mode switch to atuo (AUT) mode and tap the takeoff button on the ACSL TAKEOFF ground control application to execute an automatic take off on the spot.
- After takeoff, the aircraft will hover at approximately 3 meters (10 feet).





ADVISORY

- Complete the checklist before starting the motors.
  - ➔ Refer to Section 6.2.4: Basic Auto Mode (AUT) Operations for details.
- Take off from a flat, level surface.

6.3.4. Auto Landing

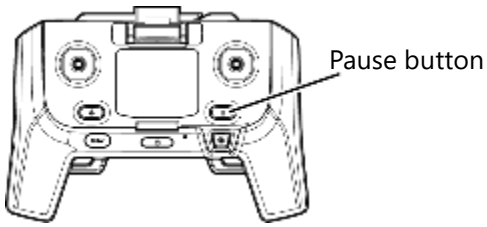
- Press and hold the Auto Landing button on the controller or tap the Land button from the Command Menu in the ACSL TAKEOFF ground control application to execute an automatic landing on the spot.

ADVISORY

Land on a flat, level surface.

6.3.5. Pause/Resume

- Press and hold the Pause button on the controller or tap the Pause button on the ACSL TAKEOFF ground control application to pause the function currently being executed.
- In manual (MAN) mode and position (POS) mode, it is only possible to initiate a pause while executing a go home, Go to Transmitter, or auto landing.
- In auto (AUT) mode, pause can be initiated while executing an auto takeoff, planned flight, go home, Go to Transmitter, or auto landing.
- Releasing the pause button on the controller or pressing the resume button on the TAKEOFF ground control application will cause the paused function to resume.

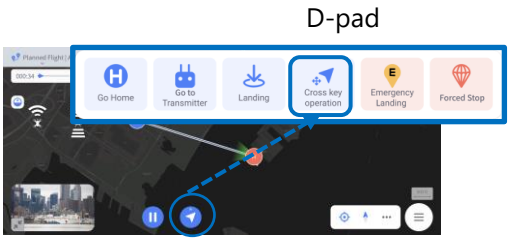


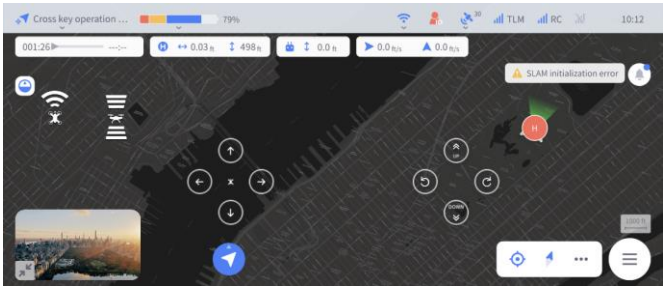

Pause button


Resume button

6.3.6. Directional Pad (D-Pad)

- Directional Pad (D-Pad) control can be initiated in the ACSL TAKEOFF ground control application, by tapping the D-Pad button from either the command menu or the emergency menu (in some situations, see Section 7.1.4 Emergency Menu on pg. 126). D-pad control is automatically initiated while in auto (AUT) mode, if no flight plan has been uploaded to the aircraft, or when the flight plan is complete.
- The D-Pad allows the pilot to manually control the drone from within the ACSL TAKEOFF ground control application.
  Note that pressing and holding the D-Pad button will not result in continuous movement of the aircraft.





Left Directional Pad		Right Directional Pad	
Froward	Distance: 2 m (6.5 ft) per press Speed: 1 m/s (2 mph)	Up	Distance: 2 m (6.5 ft) per press Speed: 1 m/s (2 mph)
Back	Distance: 2 m (6.5 ft) per press Speed: 1 m/s (2 mph)	Down	Distance: 2 m (6.5 ft) per press Speed: 0.5 m/s (1 mph)
Right (slide)	Distance: 2 m (6.5 ft) per press Speed: 1 m/s (2 mph)	Right (turn)	30° per press
Left (slide)	Distance: 2 m (6.5 ft) per press Speed: 1 m/s (2 mph)	Left (turn)	30° per press

WARNING

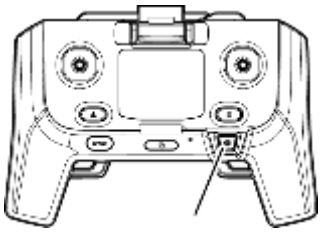
There is a risk of flyaway or loss of control when flying in winds that are faster than the specified wind speed limit. Abort flight immediately if the wind speed exceeds the limit.

CAUTION

If you cannot decrease the altitude of the aircraft or if the descent speed is low due to collision avoidance feature, switch to manual (MAN) mode.

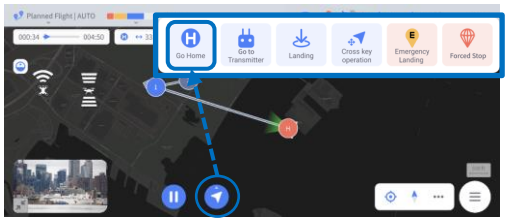
6.3.7. Go Home

- Press and hold the Go Home button on the controller or tap the Go Home button from the Command Menu in the ACSL TAKEOFF ground control application to execute the Go Home function. Upon execution, if the aircraft is at an altitude that is lower than 10 m (33 ft) above the takeoff location, then it will immediately climb to that altitude. The aircraft will then return to the takeoff location, maintaining it's altitude, and then will initiate an automatic landing.



Go Home button

Go Home button



Command button

CAUTION

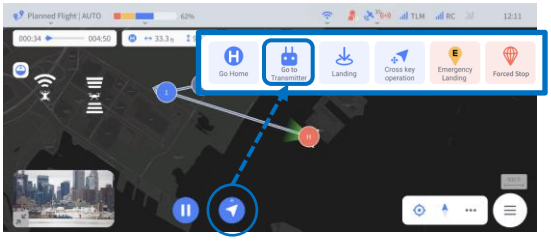
Switch to manual (MAN) mode immediately if the GPS icon in the ACSL TAKEOFF ground control application turns red, if the aircraft's status LED flashes red, or if the aircraft drifts or otherwise moves in a way that seems abnormal.

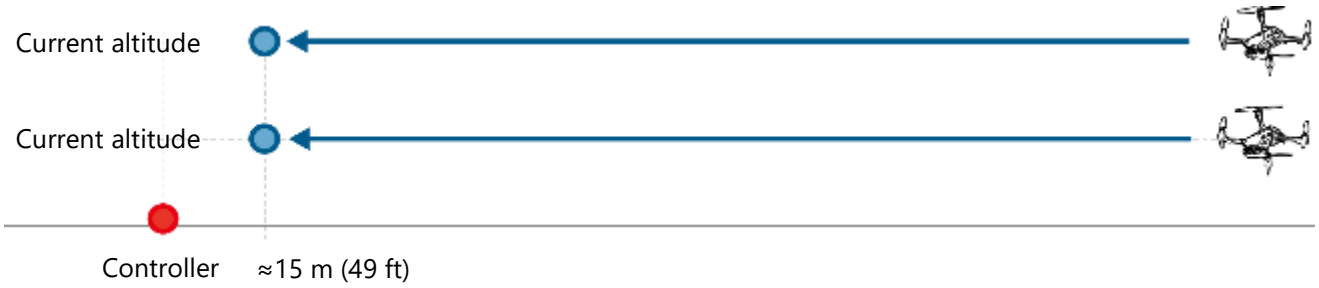
ADVISORY

- The aircraft will proceed to the home location in a straight line from its current location. Please confirm in advance whether there are any obstacles in the way. If necessary, increase the aircraft's altitude prior to engaging Go Home mode.
- In Go Home mode, the pilot can regain control of the aircraft at any time by switching the flight mode on the controller.
- In Go Home mode, the motion of the aircraft can be paused and resumed using the pause button on the controller.
- In Go Home mode, commands may be issued from the command menu in the ACSL TAKEOFF ground control application. For details, check the ACSL TAKEOFF ground control application User Manual.

6.3.8. Go to Transmitter

- Press and hold the Go to Transmitter button on the controller or tap the Go to Transmitter button from the Command Menu in the ACSL TAKEOFF ground control application to execute the Go to Transmitter function. The aircraft will maintain its altitude and proceed directly to the nearest location that is approximately 15 m (49 ft) from the controller, and then initiate a hover.
- If the controller's location changes during the return, the aircraft will recompute the target location (the nearest location that is 15 m (49 ft) from the controller).
- Control will transition to Directional Pad (D-Pad) approximately 2 seconds after initiating the hover.





CAUTION

- In Go to Transmitter mode, the aircraft will proceed in a straight line to a location approximately 15 m (49 ft) from the controller's location and initiate a hover. Be careful not to move to a location directly under the aircraft.
- Switch to manual (MAN) mode immediately if the GPS icon in the ACSL TAKEOFF ground control application turns red, if the aircraft's status LED flashes red, or if the aircraft drifts or otherwise moves in a way that seems abnormal.

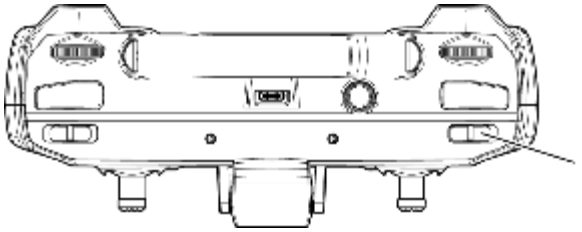
ADVISORY

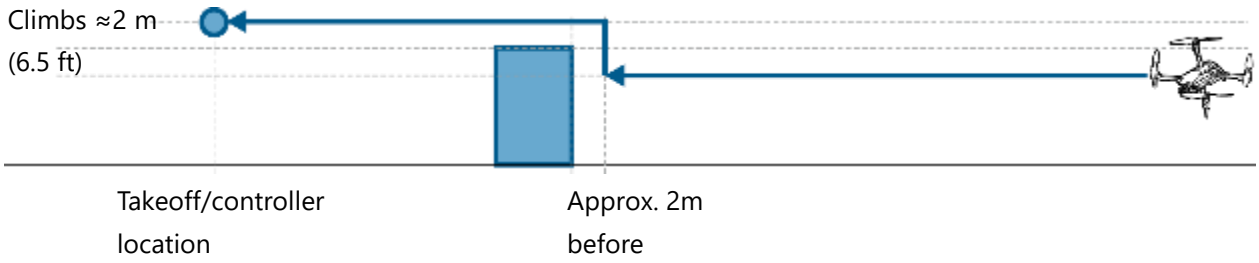
- The aircraft will proceed to the controller location in a straight line from its current location. Please confirm in advance whether there are any obstacles in the way. If necessary, increase the aircraft's altitude prior to engaging Go to Transmitter mode.
- In Go to Transmitter mode, the pilot can regain control of the aircraft at any time by switching the flight mode on the controller.
- In Go to Transmitter mode, the motion of the aircraft can be paused and resumed using the pause button on the controller.

- In Go Home mode, commands may be issued from the command menu in the ACSL TAKEOFF ground control application. For details, check the ACSL TAKEOFF ground control application User Manual.

6.3.9. Obstacle Avoidance

- When the controller's Collision Avoidance switch is set to the ON position, the aircraft will climb to avoid obstacles that are detected while executing Go Home or Go to Transmitter functions.
- As the aircraft climb to avoid an obstacle, once it is detected that the obstacle has been cleared, the aircraft will continue to climb an additional 2 m (6.5 ft) before resuming the return, maintaining the new altitude.



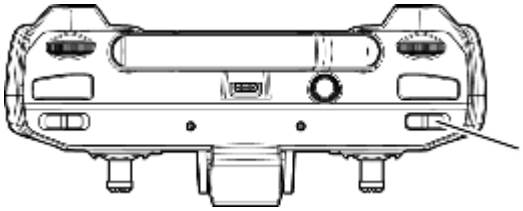


CAUTION

The obstacle avoidance function can help but the pilot is ultimately responsible for obstacle avoidance. Keep a close eye on the aircraft and switch to manual (MAN) mode in an emergency.

6.3.10. Collision Avoidance

- After takeoff, setting the controller's Collision Avoidance switch to the ON position activates the collision avoidance function to avoid collisions with obstacles ahead of and above the aircraft. (The distance to the detected obstacle is displayed on the controller and the ACSL TAKEOFF ground control application.)
- When an obstacle is detected to be closer than the collision avoidance distance, the aircraft will no longer proceed in the direction of the detected obstacle.
- There is no function to maintain a constant collision avoidance distance when progress in the direction of an obstacle is stopped (i.e. the aircraft will not back away from obstacles).



Example controller display

Example ACSL TAKEOFF ground control application display

Collision avoidance direction	Collision avoidance distance	Sensor(s)
Ahead	Approx. 2m (6.5 ft)	Stereo camera
Above	Approx. 1m (3 ft)	Stereo camera or infrared sensor

CAUTION

- The collision avoidance function can help but the pilot is ultimately responsible for collision avoidance.
- Obstacles may not properly be detected depending on environmental factors such as lighting and visibility and the shape and color of the obstacles. Always fly with sufficient distance from obstacles.

ADVISORY

- The collision avoidance function is inhibited in manual (MAN) mode.
- The collision avoidance function is always disabled when the collision avoidance switch on the controller is turned off. If collision avoidance is desired during a planned flight in auto (AUT) mode, the collision avoidance switch on the controller must be turned on.
- When the collision avoidance switch is turned on, the controller will display the symbol "Example controller display" shown above.

6.3.11. Camera/Gimbal Operation

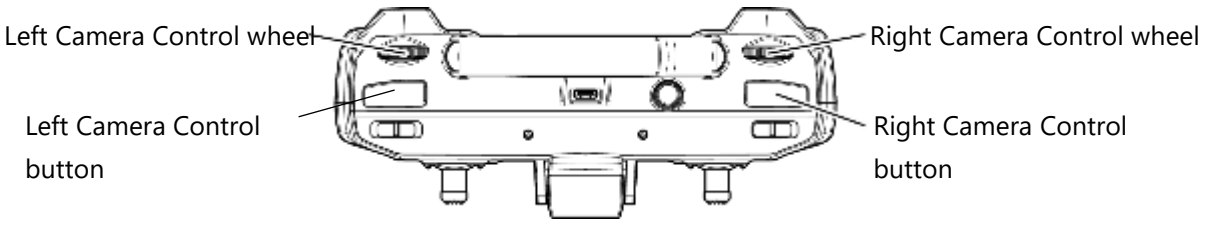
- Camera operation is performed using the right and left Camera Control button and wheels, or the camera control buttons and sliders on the ACSL TAKEOFF ground control application.
  *For details on camera/gimbal operation with the ACSL TAKEOFF ground control application, refer to the ACSL TAKEOFF ground control application user manual.

ADVISORY

- Upon startup, the gimbal performs a self-calibration. If the gimbal touches the ground or any other object during this process, the calibration will fail and the gimbal will cease to operate. Always place the aircraft on a flat, level surface before starting up.
- The aircraft will not maintain its position in manual (MAN) mode. The pilot must make continuous corrective inputs to maintain the aircraft's position in manual (MAN) mode, even while manipulating the gimbal.
- Video recording and interval shooting can only be stopped by the controller if started by the controller, or by the ACSL TAKEOFF ground control application if started by the ACSL TAKEOFF ground control application.

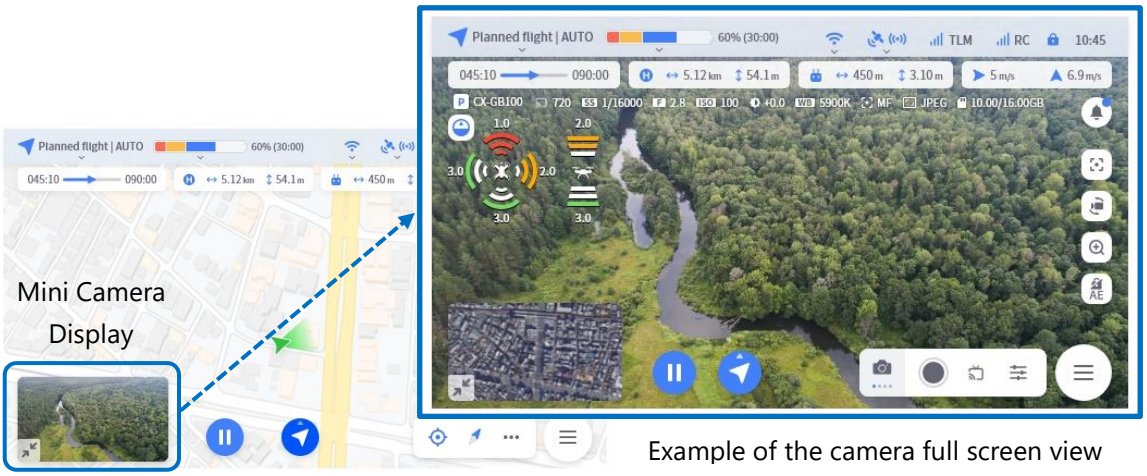
① **Camera/gimbal operation via the controller**

- Push and hold the right camera control button to start/stop a video recording.
- Briefly push the right camera control button to starts/stop interval still image capture.
- Briefly push the left gimbal control button to point the gimbal forward. Push and hold to turn the gimbal downward.
- The left gimbal control wheel is used to control the gimbal tilt (up and down).
- The right gimbal control wheel is used to control the gimbal pan (left and right).



② **Camera/gimbal operation via the ACSL TAKEOFF ground control application**

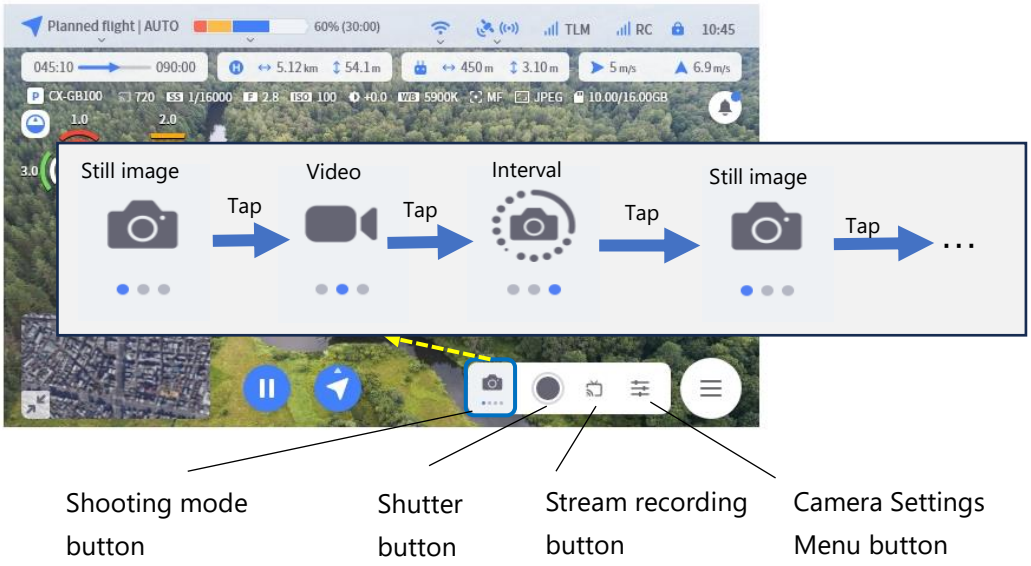
- If the map is displayed full screen, tap the Mini Camera Display at the bottom-left of the screen to switch to the camera full screen view.



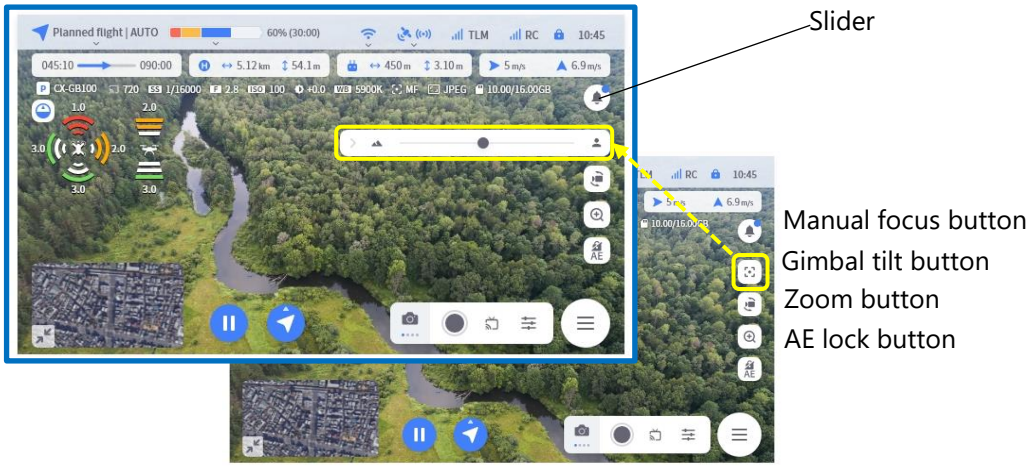
Example of the map full screen view

Example of the camera full screen view

- The camera control buttons at the bottom-right of the camera full screen view are used to perform the following functions.
  - Selecting the shooting mode: video, still image, and interval still image.
  - The shutter button is used to start and stop shooting.
  - The stream record button is used to start and stop the recording of the video stream to the mobile device.
  - The camera settings menu button opens the camera settings menu for advanced camera settings.

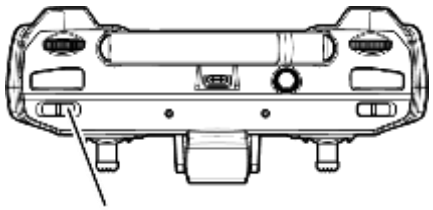


- The camera control buttons at the right of the camera full screen view are used to perform the following functions.
  - Display the camera manual focus slider.
  - Display the gimbal tilt slider.
  - Display the camera zoom slider.
  - Locks/unlock the exposure (auto exposure lock).



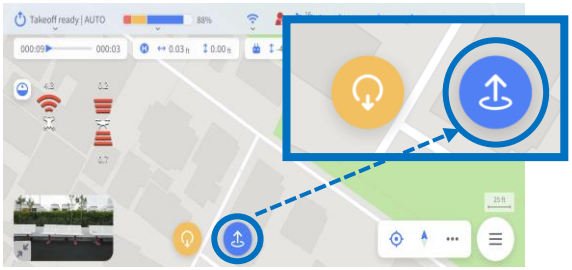
6.3.12. Planned Flight

- To use the planned flight function, a flight plan must first be created then uploaded to the aircraft using the ACSL TAKEOFF ground control application.
  *For details on how to create a flight plan and upload it to the aircraft, please refer to the ACSL TAKEOFF ground control application user manual.
- Complete the preflight checklist in the ACSL TAKEOFF ground control application.
- Panned flight will commence immediately following automatic takeoff, or when the controller's control mode switch is set to the AUT position while in flight.
- Upon completing the planned flight, the aircraft will initiate a hover at the final waypoint and Directional Pad (D-Pad) control will be initiated.
- At any time during a planned flight, it is possible to pause/resume execute a go home, Go to Transmitter, or emergency landing, or switch to Directional Pad (D-Pad) control.
- To resuem the planned flight after a Pause, Go Home, Go to Transmitter, or Emergency Landing, toggle the controller's flight mode switch to POS or MAN and then back to AUT. The controller will return to the aborted position of the planned flight and resume the planned flight.



AUT

Take-off button



WARNING

There is a risk of flyaway or loss of control when flying in winds that are faster than the specified wind speed limit.

➔ Refer to 1.2.3. Limitations. Abort flight immediately if the wind speed exceeds the limit.

CAUTION

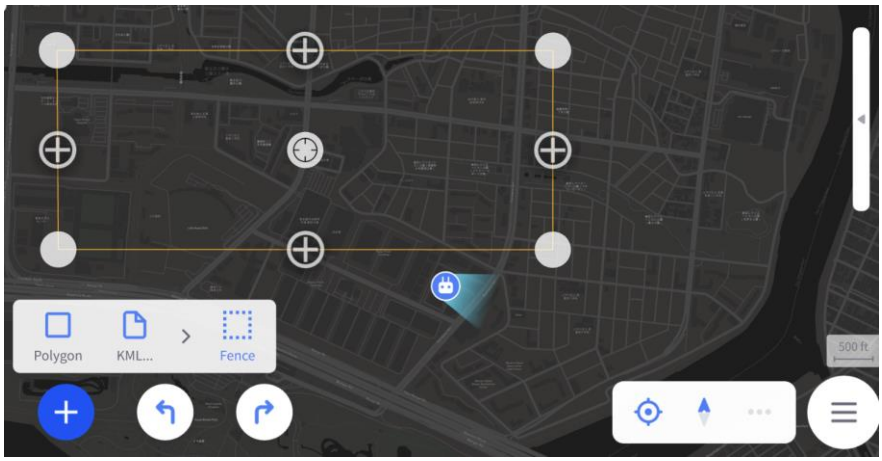
- Planned flights in auto (AUT) mode can only be performed when reception of GPS signals is good (as indicated by a blue GPS icon in the ACSL TAKEOFF ground control application).
- If GPS reception deteriorates during a planned flight in auto (AUT) mode[1], the planned flight will automatically be suspended, the aircraft will initiate a hover, and "Forced pausing" will be displayed in the ACSL TAKEOFF ground control application. If the aircraft's position and speed can be measured by visual odometry using the on-board stereo cameras[2], then the hovering state will be continued using visual odometry. Immediately switch to manual (MAN) mode and land the aircraft in a safe location. Continuation of flight is not recommended.

  Note 1: Deterioration of GPS reception may be indicated by the status LED flashing red, a "GPS accuracy low" notification on the ACSL TAKEOFF ground control application or the controller, the GPS icon in the ACSL TAKEOFF ground control application turning red, or if the aircraft drifts or otherwise moves in a way that seems abnormal.

  Note 2: Refer to Section 7. Abnormal Operating Procedures for the recommended procedures when visual odometry cannot measure the aircraft's position or speed.
- The pilot is ultimately responsible for safety during all phases of flight, including planned flight in auto (AUT) mode. Always be aware of the aircraft's position and condition, work to ensure its safety, and be prepared for unforeseen circumstances.

6.3.13. User-Defined Geofence

- To enforce a user-defined geofence, the geofence must first be created then uploaded to the aircraft using the ACSL TAKEOFF ground control application.
  *For details on how to create a geofence and upload it to the aircraft, please refer to the ACSL TAKEOFF ground control application user manual.
- The user-defined geofence function is only enforced in position (POS) and auto (AUT) modes.
- When approaching a no-fly zone, the aircraft begins to slow down, the ACSL TAKEOFF ground control application and controller display the alert message "No-fly area," the controller vibrates to warn the user, and the aircraft comes to a stop prior to crossing the boundary to a no-fly zone.



Geofence creation screen of the ACSL TAKEOFF ground control application

WARNING

Do not switch from manual (MAN) mode to position (POS) mode or auto (AUT) mode while the aircraft is flying in a no-fly zone of the user-defined geofence. The aircraft will automatically move horizontally to exit the no-fly area to the nearest allowable area and will not respond to inputs from the controller or the ACSL TAKEOFF ground control application.

ADVISORY

When the aircraft is located in a no-fly zone of the user-defined geofence, the controller and ACSL TAKEOFF ground control application will display “No-fly area” notification. Starting the motors while in position (POS) mode or auto (AUT) mode will be inhibited.

In Manual (MAN) Mode

[On ground]

The motors cannot be started when located within a no-fly zone of the user-defined geofence.
The motors cannot be started if a GPS location fix has not yet been achieved (i.e. it cannot be determined whether or not the aircraft is within a no-fly zone of the user-defined geofence).

[In flight]

The user-defined geofence is not enforced in manual (MAN) mode so flight into a no-fly zone of the user-defined geofence is allowed.

*The warning message “No-fly area” will be displayed when within a no-fly zone.

In Position (POS) Mode / Auto (AUT) Mode

[On ground]

The motors cannot be started when located within a no-fly zone of the user-defined geofence.
The motors cannot be started if a GPS location fix has not yet been achieved (i.e. it cannot be determined whether or not the aircraft is within a no-fly zone of the user-defined geofence).

[In flight]

When approaching a user-defined no-fly area, the warning message “No-fly area” will be displayed and speed will be reduced.
Upon reaching the boundary of the user-defined no-fly area, the warning or message “No-fly area” is displayed and the aircraft initiates a hover.
If the aircraft penetrated a user-defined no-fly area, the warning message “No-fly area” is displayed and the aircraft automatically moves toward the closest boundary of the no-fly area at a speed of 2 m/s (4.5 mph).

6.3.14. Altitude Limitations

- The maximum allowable altitude above takeoff location can be set in advance in the range of 5 to 3000 m using the ACSL TAKEOFF ground control application.
  *For details on how to set the altitude limit, please refer to the ACSL TAKEOFF ground control application user manual.
- The altitude limitation is only enforced in position (POS) and auto (AUT) mode.
- When approaching the altitude limit, the aircraft begins to decelerate, the ACSL TAKEOFF ground control application and controller display the warning message "No-fly area," the controller vibrates to warn the user, and the aircraft comes to a stop prior to crossing the altitude limit.

In Manual (MAN) Mode

The altitude limit is not enforced in manual (MAN) mode so flight above the altitude limit is allowed.
*The warning message "No-fly area" will be displayed when within a no-fly zone.

In Position (POS) Mode / Auto (AUT) Mode

[in flight]

When approaching the altitude limit, the warning message "No-fly area" will be displayed and speed will be reduced.

Upon reaching the altitude limit, the warning or message "No-fly area" is displayed and the aircraft initiates a hover.

6.3.15. Emergency Landing

➔ Refer to Section 7.1.6: Ground Control Application Emergency for more information.

6.3.16. Emergency Landing

➔ Refer to Section 7.1.9: Low-Battery Emergency for more information.

6.3.17. Forced Stop

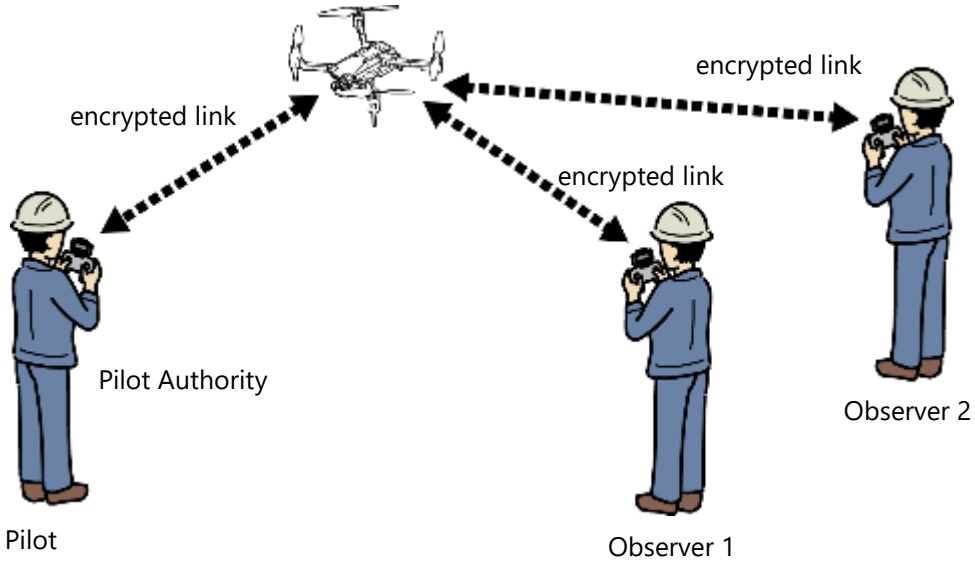
➔ Refer to Section 0:

➔ Forced Stop Using the Controller or Section 7.1.8: Forced Stop Using the Ground Control Application for more information.

6.4. Controller Multicast

6.4.1. About Multicast

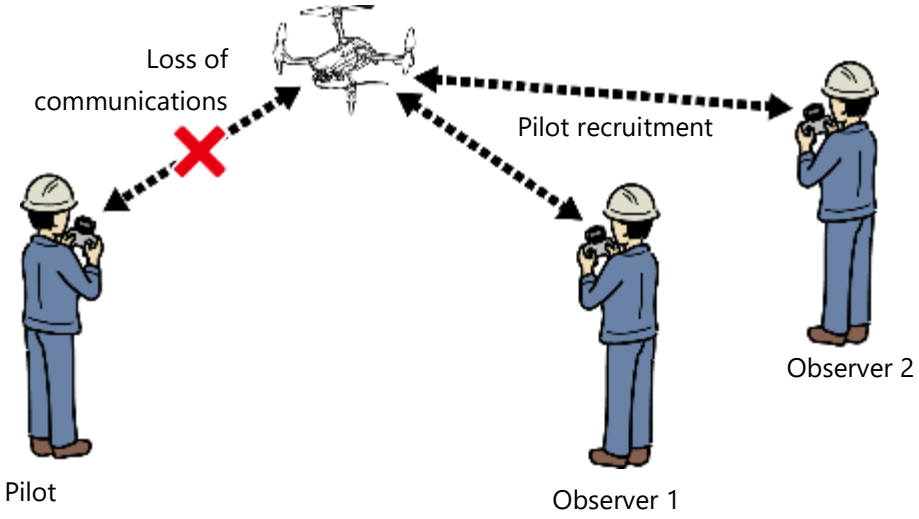
This product is equipped with a multicast communication function. This function allows up to three controllers to be bound to one aircraft to simultaneously receive telemetry and video from the aircraft. While pilot authority is granted to only one controller at a time, it is possible to monitor the telemetry and video with up to two other controllers as long as the radio signal from the aircraft is within range.



6.4.2. Fail-Safe when Multicasting

A fail-safe function is provided to allow transfer of pilot authority to an observe in the event of a loss of communication between the aircraft and the pilot controller. When the observer's controller displays "TO BE PILOT PUSH ENTER," the observer can obtain pilot authority by pressing and holding the Enter button.

Controller display	Details
CONNECTION CHECKING	A communications failure has occurred and the aircraft is attempting to re-establish a connection.
TO BE PILOT PUSH ENTER	The aircraft is recruiting any bound controller within communication range to be granted pilot authority.
PILOT REQUESTING	The operator has pushed the Enter button and the controller is attempting to request pilot authority from the aircraft. The aircraft grants pilot authority to the controller whose request was received first.



6.4.3. Switching Pilots

When at least 2 controllers are bound to the aircraft, the pilot may release pilot authority at any time by simultaneously pushing the Enter and Pause buttons.
The aircraft then begins recruiting for a new pilot.
If no controller requests pilot authority, then no pilot authority will be granted.

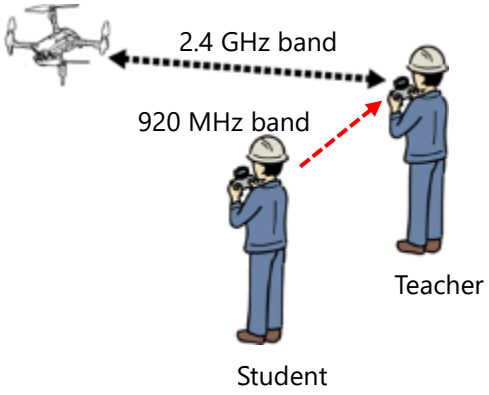
Controller display	Details
QUIT PILOT REQUESTING	Requesting release of pilot authority

CAUTION

Switching from pilot mode to observer mode is inhibited while in lesson mode (optional, Japan only) and during a firmware update.

6.5. Lesson Mode (Japan only)

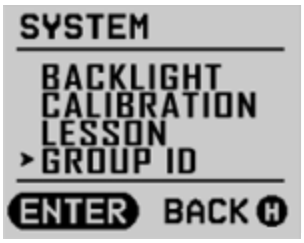
- Flight training can be performed using a pair of controllers that are equipped with 920 MHz training radios (Japan only). To do this both controllers must be set to “lesson mode”.
- In the lesson mode, one controller is set to teacher mode and the other to student mode. The teacher can transfer/retrieve pilot privileges at any time.

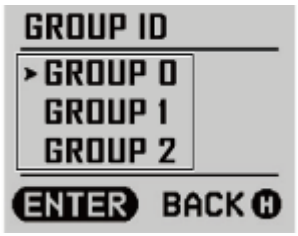


6.5.1. Setup

1. Setting GROUP ID

- From the “GROUP ID” setting in the system setup screen, select a group ID so that the teacher and student are using the same group ID.



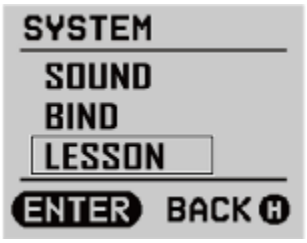


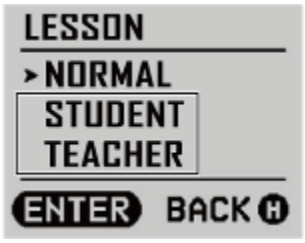
CAUTION

If multiple aircraft in the vicinity are to operate in lesson mode simultaneously, make sure that each aircraft is set to a different Group ID.

2. LESSON Setup

- From the “LESSON” setting in the system setup screen, select “TEACHER” for the teacher’s controller and “STUDENT” for the student’s controller.



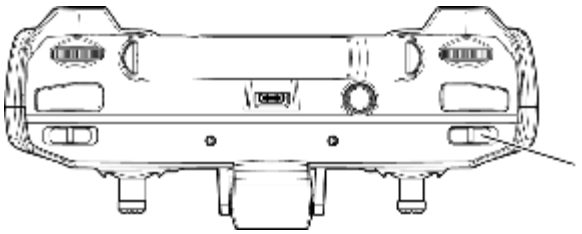


6.5.2. How to Operate

- Verify that the status LED on the teacher's controller is solid purple.
- Verify that the status LED on the student's controller is on undulating purple.

Teacher's controller: solid purple, student's controller: undulating purple

- When lesson mode is enables, the obstacle avoidance switch is used by the teacher to switch between granting (ON) and revoking (OFF) pilot authority to the student.
- If the teacher senses any abnormality or danger in the student's operation, the teacher can forcibly take pilot authority at his/her discretion.



CAUTION

- The collision avoidance function is inhibited during lesson mode.
- If communication between the student's and teacher's controllers is interrupted, pilot authority is automatically transferred to the teacher's controller. On the other hand, if communication between the teacher's controller and the aircraft is lost, pilot authority is not transferred to the student and the aircraft will enter emergency mode.
- If communication between the student's and teacher's controllers is interrupted, pilot authority is automatically transferred to the teacher's controller. On the other hand, if communication between the teacher's controller and the aircraft is lost, pilot authority is not transferred to the student and the aircraft will enter emergency mode.
- When using lesson mode, make sure that any other SOTEN in the vicinity of the planned training location (within 150 m or 500 ft) are not being used for training or that they are set to use a different Group ID.
- The maximum number of SOTEN that can be used for training in the same vicinity simultaneously is 3 (3 controllers for 3 teachers and 3 controllers for 3 students).
- Since information regarding the transfer of pilot authority between teacher and student in lesson mode is not encrypted, accidental use of the same group ID by 2 teacher-student pairs in the same vicinity may result in inadvertent switching between teacher and student of one pair due to switching by the other pair. However, since the control signals are encrypted, the control signals of each pair will not interfere with each other.
- Do not attempt multicast (connecting a third controller) during training sessions. Only two controllers (teacher and student) should be connected to one aircraft for training.
- When the lesson is complete, return the controller to the "NORMAL" setting from the "LESSON" setting in the controller's SYSTEM settings menu.

6.6. Regional Market Geofence

- The aircraft is pre-programmed with a regional market geofence to prevent use outside the boundaries of the region of authorized use. For example, ACSL SOTENs that are sold in the United States contain a regional market geofence to prevent use outside of the United States and U.S. Territories.
- If the aircraft approaches the regional market geofence within 100 m (330 ft), the controller vibrate to alert the user, and the controller and ACSL TAKEOFF ground control application will display the following caution: "Nearing unpermitted area".
- If the aircraft approaches the regional market geofence within 30 m (98 ft) while operating in position (POS) or auto (AUT) mode, the aircraft will automatically enforce a reduced speed limit and will come to a complete stop (hover) when it reaches the geofence.
- If the aircraft approaches the regional market geofence within 30 m (98 ft) while operating in manual (MAN) mode, the aircraft will automatically initiate a hover and enter emergency mode.

ADVISORY

If the aircraft is carried outside of the regional market geofence, the controller and ACSL TAKEOFF ground control application will display the warning: "Entered unpermitted area" and the ability to start the motors will be inhibited.

With a GPS location lock (indicated by a blue GPS icon in the ground control application), the conditions for takeoff are:

- In manual (MAN) mode, the aircraft must be within and at least 30 m (98 ft) away from the regional market geofence.
- In position (POS) or auto (AUT) mode, the aircraft must be within the regional market geofence.

Without a GPS location lock (indicated by a red or yellow GPS icon in the ground control application), the conditions for takeoff are:

- Manual (MAN) and position (POS) modes only.
  *In position mode, the aircraft can take off with visual odometry only when the vision accuracy is good (indicated by a blue vision icon in the ground control application).
- The aircraft must have acquired a GPS location lock at some point since powering on, and that location lock must have been within and at least 30 km (19 miles) from the regional market geofence.

DISCLAIMER:
As described in Section 1.1.1 above, ACSL does not warrant or guarantee the "reginal market geofence" functionality described in this Section 6.6 nor assume any liability for any damage(s) or injuries caused to you, to any other party or any property or have any legal responsibility, directly or indirectly, from the use of this product and for any violations of applicable laws, rules and regulations. You are solely responsible for

complying with all laws, rules and regulations applicable to the operation of the aircraft near national borders and in restricted areas.

Chapter 7

Abnormal Operating Procedures

7.1. Emergency Procedures for Abnormalities 124

7.1. Emergency Procedures for Abnormalities

This section describes emergency procedures in the event of an abnormality with the aircraft in flight.

Failure to comply with the following precautions and instructions may result in an unexpected collision or crash that could cause injury, fire, or damage.

- Pilots should carefully read and fully understand the contents of this chapter and be prepared to respond to any malfunction that may occur while the aircraft is in flight.

7.1.1. Definition of Terms

The emergency procedures used in this section are defined as follows:

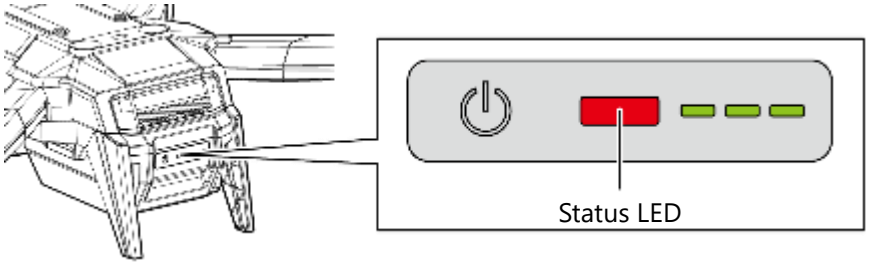
- **Drop the aircraft immediately.**
  Immediately after confirming the safety of the area directly under the aircraft, use the “forced stop” function of the controller or ACSL TAKEOFF ground control application to force the motors to stop and the aircraft to drop on the spot.
  If not dropping immediately, injury or damage to the pilot and third parties may result.
- **Immediately land the aircraft at a safe location.**
  Land the aircraft immediately at the nearest safe location.
  Continued flight beyond the nearest safe location may result in the aircraft crashing.
- **Land the aircraft in a safe place as soon as possible.**
  Land the aircraft at the takeoff position or at a pre-determined emergency landing point.
  Do not take off again until the cause of the aircraft abnormality is determined and resolved.

7.1.2. Manual (MAN) Flight Mode (using the controller)

- Manual mode should be used whenever the aircraft cannot reliably measure its position or velocity with GPS or visual odometry.
- Land the aircraft in a safe place as soon as possible. Do not continue the flight in manual mode.
- For information on how to operate the aircraft in manual mode, refer to Section 6.2.2: Basic Manual Mode (MAN) Operations.

7.1.3. GPS and Visual Odometry Accuracy Degradation

- If the accuracy of GPS and visual odometry degrade during flight, the status LED on the aircraft will flash red and a message will appear on the ACSL TAKEOFF ground control application and controller LCD display screen.
  ➔ Refer to Section 7.1.11: Indications of an Abnormality.
- Not a suitable place for flying.



■ On the ground

The ability to take off (i.e. the ability to increase motor speed above idle) is inhibited in position (POS) mode while the status LED is flashing red.

■ In Flight

- **Manual (MAN) mode**

  Continuation of flight is possible.

  ➔ Refer to Section 6.2.2 .Basic Manual Mode (MAN) Operations.

- **Position (POS) mode**

  Switch to manual mode and land the aircraft in a safe location as soon as possible.

CAUTION

・If GPS accuracy deteriorates while flying in position (POS) mode, the aircraft will automatically switch its source of position information from GPS to visual odometry if the speed is lower than around 1 m/s (2.2 MPH) and vision accuracy is good.
*When switching to visual-odometry-based position mode, the maximum speed limited becomes 0.8 m/s (1.8 MPH).

・If vision accuracy deteriorates while flying in visual-odometry-based position mode, the status LED on the aircraft will flash red. Control will fall back to a mode similar to manual (MAN) mode due to loss of position information. Do not continue flight and land the aircraft at a safe location as soon as possible.
*To suppress erratic movements and to aid maneuverability during the transition, the maximum tilt angle is limited to approximately 13° in position (POS) mode when GPS and vision accuracy is degraded.

・If the controller's flight mode switch is set to position (POS) mode, when GPS or vision accuracy is restored, the aircraft's status LED will cease flashing red and the aircraft will automatically return to position control with either GPS or visual odometry.

- **Auto (AUT) mode**
  ➔ Refer to Section 7.1.10: Degraded GPS Reception in Auto .

7.1.4. Emergency Menu

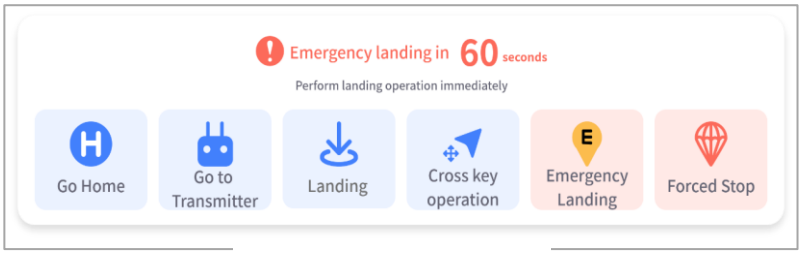
- If, for example, communication between the controller and the aircraft is disrupted, the aircraft will transition to emergency mode and hover in place for one minute.
  Note: Refer to Section 7.1.5: Communications Disruption for information on what to do in the event of communication interruption.
- While hovering for one minute, maneuver the aircraft according to the following emergency mode operating procedure.

■ Emergency Mode Operating Procedure

Select one of the following operations

① **Piloting with the ACSL TAKEOFF ground control application.**

- The Emergency Menu (6 buttons) will appear automatically on the ACSL TAKEOFF ground control application.
- Select the following normal or emergency operating procedure.
  *For details of each function, refer to Section 7.1.6: Ground Control Application Emergency Button or Section 0:
  Forced Stop Using the Controller.
  *If an electrical abnormality is detected during flight while in position (POS) or auto (AUT) mode, only automatic landing, emergency landing, and forced stop may be selected. The emergency menus is not shown in manual (MAN) mode.



Emergency Menu-1

Emergency Menu-2

(When an electrical abnormality is detected during flight in POS or AUT mode)

Please land aircraft immediately

Emergency Menu-3

(When an electrical abnormality is detected during flight in MAN mode)

② **After switching the controller's flight mode switch to another mode, return to the originally selected mode and continue piloting with the controller.**

Feature		Controller button	Description
Normal operation	Go home	Go home	Return and hover at a height of 10 meters above the takeoff point.
	Go to Transmitter	RTC	Return and hover at a height of 10 meters above the controller.
	Auto landing	Land	Automatically land on the spot.
	Directional Pad	D-Pad	Manual operation using the D-Pad. Pressing any button once will result in a certain amount of motion. Holding it down will not cause any further changes.
Emergency operation	Emergency landing	ELS	The aircraft moves to the ELS point or takeoff point and lands automatically.
	Forced stop	Forced stop	Stops the motor.

ADVISORY

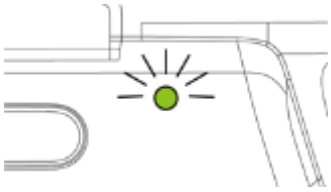
- If the aircraft does not receive any commands from the pilot within 60 seconds, then the aircraft will automatically either go home or proceed to an emergency landing site (ELS).
- Plan your flight and make sure that the altitude settings are high enough so that the aircraft will not encounter any obstacles should it need to go home or proceed to an emergency landing site (ELS).

7.1.5. Communications Disruption

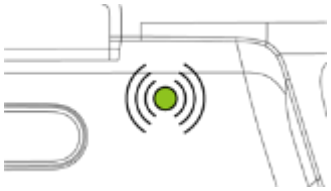
When the SOTEN is in flight operation and the distance between the aircraft and controller is within the communication distance (SOTEN Operation Manual "1.2.3 Limitations"), but reception is interrupted (communication interruption) or the camera view image on the TAKEOFF application is interrupted and "Waiting for video" is displayed (video interruption), the signal interruption may be recovered by changing the distance between the aircraft and the controller while moving the pilot's standing position.
When radio communication is interrupted, the operator should attempt to restore radio communication by referring to the following procedure.

1. Signal interruption has occurred

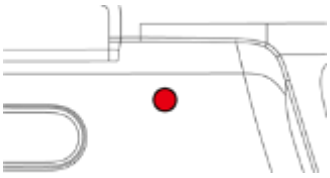
- When communication is lost, the status LED on the controller turns solid red.
- When the controller status LED is blinking or undulating green, the controller and TAKEOFF cannot be piloted. Please recover "3.



Blinking green: during POSW (Switching Pilot/Observer)

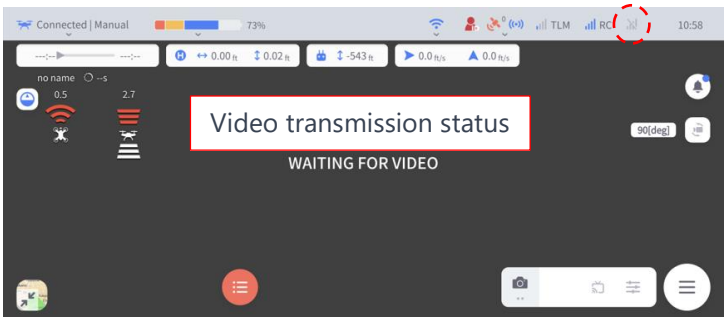


Undulating Green sweep: during observer



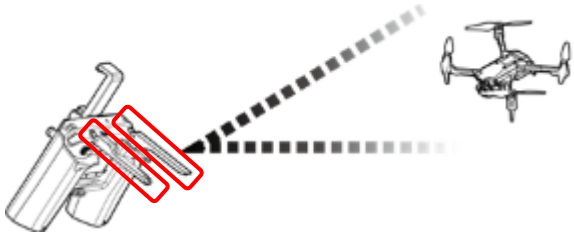
Solid Red redlight: during no communications

- When a video interruption occurs, the antenna display in the video transmission status on the TAKEOFF screen indicates the interruption status, and the message "Waiting for video" is displayed on the camera view.

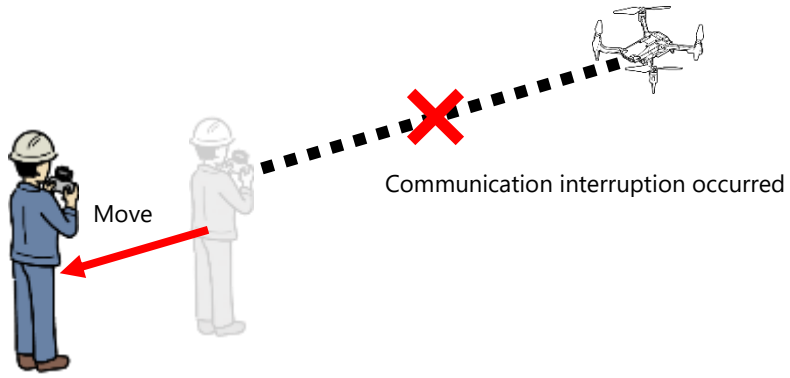


2. While pointing the controller's antenna plane toward the aircraft, the operator should move to a position where radio communication is restored.

- Pointing the flat portions of the controller's two antennas toward the aircraft facilitates communication recovery.
- When the controller status LED goes from solid red to blinking green or undulating green, communication has been restored.

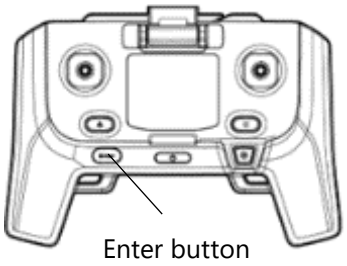


- Adjusting the direction of the antenna and at the same time moving the pilot's standing position relative to the aircraft will help to get out of areas prone to signal interruption and make it easier to recover radio communication. (See note).



3. Restoration of control

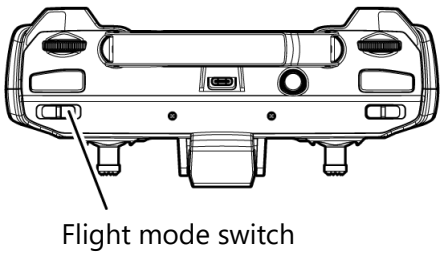
- Once communication is lost, control of the aircraft via the controller is no longer possible. After the controller status LED blinks green and you see "TO BE PILOT PUSH ENTER" on the controller LCD display screen, press and hold the Enter button on the controller to regain control of the aircraft.



- When pilot authority is restored, the controller status LED will return to a solid green.

4. Emergency mode deactivated

- Emergency mode can be deactivated by toggling flight modes with the controller's flight mode switch. Note: See 7.1.4. Emergency Mode.



ADVISORY

Effects of multipath-induced fading

Radio waves are emitted from the controller's antennas in all directions (with varying amplitude). If there is no obstruction, then some waves will reach the aircraft in a straight line (direct waves). Some other waves may reach the aircraft by bouncing off the ground, trees, buildings, uneven terrain, other objects, etc. (reflected waves). The phenomenon of some combination of direct and reflected waves arriving at the same location is called "multipath".

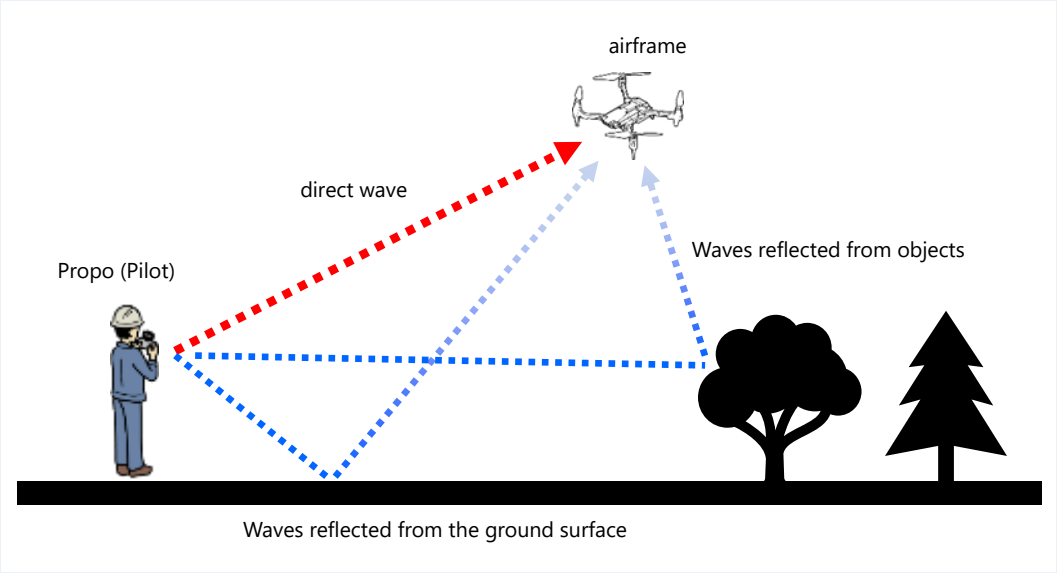
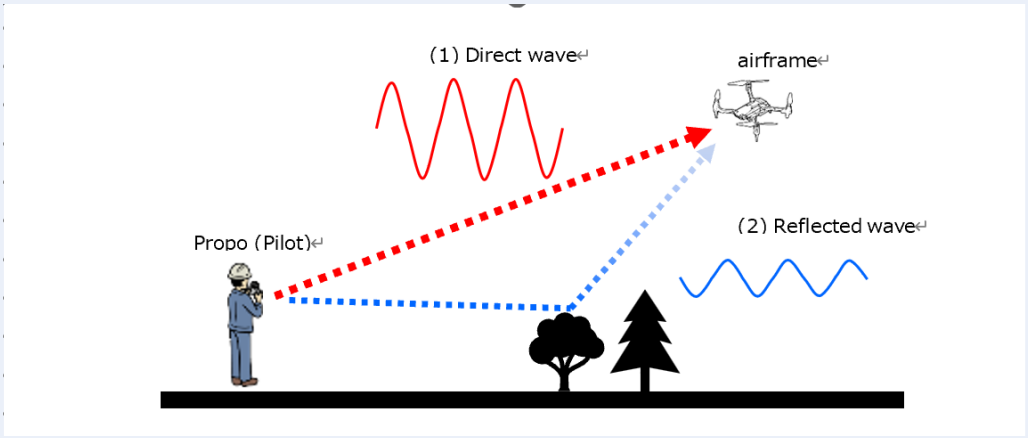


Figure . Conceptual diagram of multipath

Since direct waves and reflected waves travel different distances to arrive at the same location, reflected waves will arrive with a phase delay compared to direct waves. If the reflected waves arrive at the aircraft with nearly the same phase as the direct waves, then the waves will combine into a strengthened, or amplified, wave. If the reflected waves arrive at the aircraft with nearly opposite phase from the direct waves, then the waves will cancel each other into a weakened, or attenuated, wave. This phenomenon of multipath waves cancelling is called "multipath-induced fading".



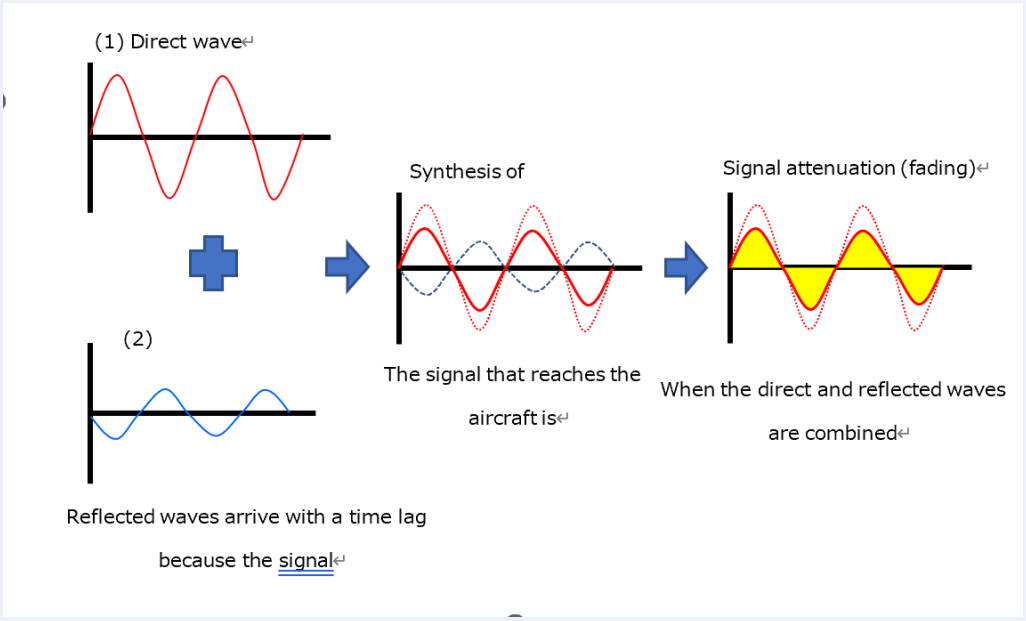


Figure . Conceptual diagram of multipath-induced fading

A location where multipath waves completely cancel each other out is called a "null point". If the aircraft happens to move into a null point of the controller, then the signals for the controller will be too weak to be received, resulting in a communications disruption. The same is true for the controller receiving signals from the aircraft.

ADVISORY

Signal strength vs. distance and recovery from communications disruption

The relationship between received signal strength and distance from the transmitter for unobstructed line-of-sight without any reflected waves is shown by the black line in the figure below. Notice that the received signal becomes weaker as distance increases. In reality, however, multipath-induced fading may cause received signal strength to decrease suddenly at a certain distance only to strengthen again at a slightly further distance. It is difficult to predict at what location this could occur, since multipath-induced fading is a complex phenomenon that is influenced strongly by the composition and geography of the surroundings, the characteristics of the aircraft and controller antennas, radios, and internals, environmental conditions, etc.

If the aircraft approaches a null point of the controller, or vice-versa, the signal may become too weak, resulting in a communications disruption. The aircraft may automatically halt its motion in response to the communication disruption, thereby remaining in the null zone. As can be seen from the figure below, an effective way to recover from a communication disruption caused by entering a null zone is for the pilot to simply move to a different location, particularly toward or away from the aircraft, thereby changing the location of the null zone.

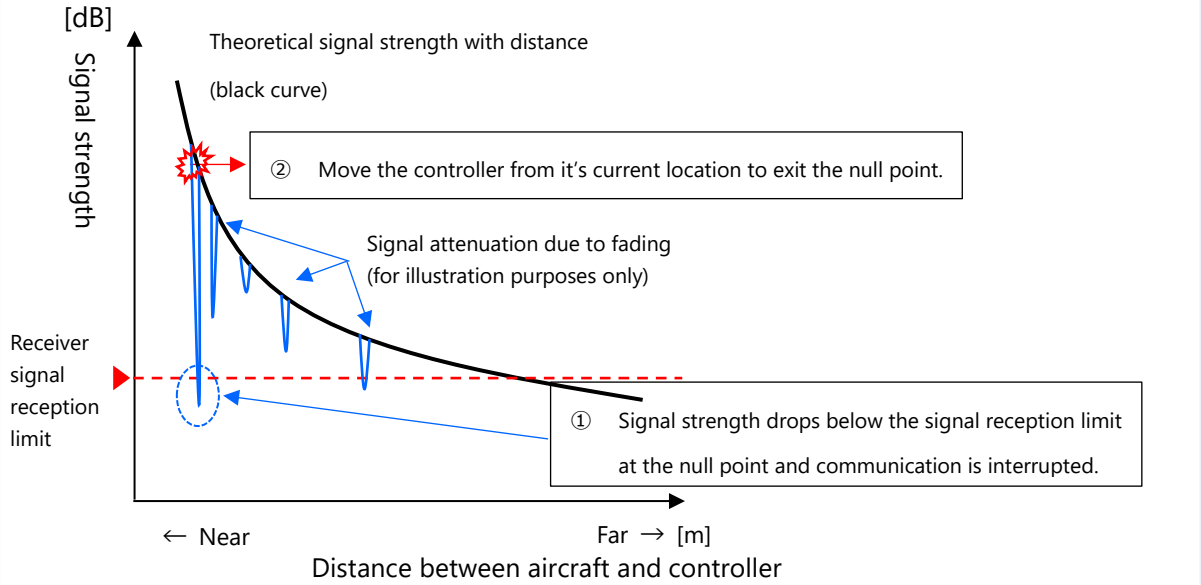


Figure . Relationship between signal strength, distance, and null points.

7.1.6. Ground Control Application Emergency Button

- If an abnormality is detected in the aircraft during flight and it becomes difficult to continue the flight, the system has a function to return the aircraft to the emergency landing site (ELS) or takeoff point in order to land the aircraft safely.
- Please refer to the ACSL TAKEOFF ground control application user manual for the ELS setting method.
- If an ELS is not set, or when in manual (MAN) mode or position (POS) mode, the aircraft returns to the takeoff point.

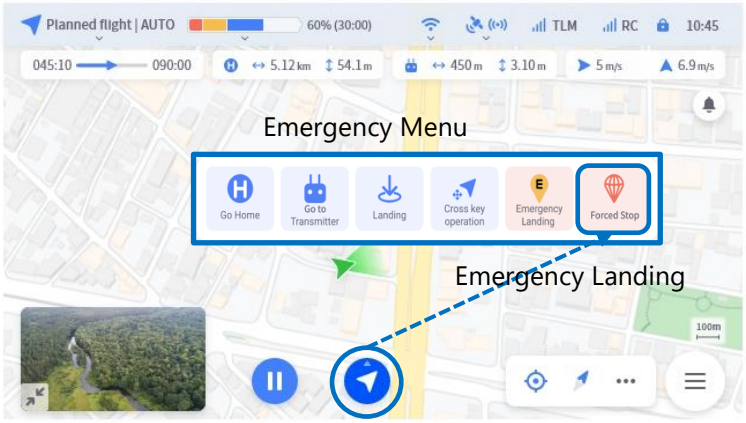
Emergency landing procedures

① **Press the Command button on the ACSL TAKEOFF ground control application to display the Emergency Menu.**

② **Press the Emergency Landing button and confirm the instructions in the modal dialog.**

Situations requiring an emergency landing

- When the remaining battery power is too low to reach the destination
- When weather conditions along the flight path are likely to exceed operational limits
- When communication between the controller and the aircraft is lost



Command button

■ *Emergency Landing Site (ELS) Type*

type	travel route
Direct	• Moves along a straight path to the ELS while descending.
Via an approach point	• Moves along a straight path relative to the ELS while maintaining the current altitude. • From the approach point (20 m horizontal distance from the ELS), descend to the specified altitude. • If the altitude of the ELS is higher than the current altitude, moves in a straight line to the ELS.
Routing	• Specify the waypoints to each ELS when creating the flight plan. • After moving the flight plan route to the specified waypoint, moves in a straight line to the ELS.

ADVISORY

- An emergency landing can be initiated from any flight mode, but an emergency landing to an emergency landing site (ELS) can only be initiated during planned flight in auto (AUT) mode.
- Plan your flight and make sure that the altitude settings are high enough so that the aircraft will not encounter any obstacles should it need to go home or proceed to an emergency landing site (ELS).

7.1.7. Forced Stop Using the Controller

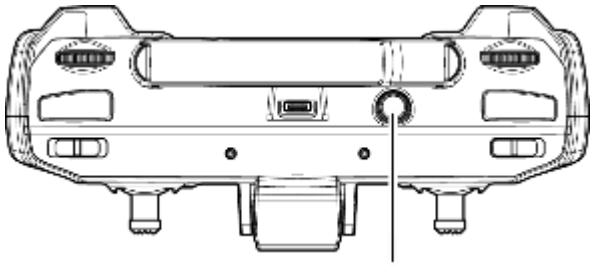
- To ensure maximum safety for pilots and third parties, the aircraft is equipped with a “forced stop” function that forcibly stops the aircraft's motors.
- In the unlikely event of unintended movement of the aircraft, or if the surrounding environment changes significantly or otherwise becomes unsafe, check the safety of the surroundings and immediately drop the aircraft.

■ Forced stop procedure

① **Press the EMERGENCY (force stop) button on the controller.**

Possible situations requiring a forced stop

- When an unintended movement takes the aircraft out of the safety zone
- When there is a possibility of coming into contact with people or property
- When people or objects are approaching rapidly



EMERGENCY BUTTON

WARNING

Failure to comply with the following may result in an unexpected collision or crash that could cause injury, fire, or damages.

- In the case of a forced stop, make the utmost effort to drop the aircraft where there are no people or structures.

CAUTION

- Even after the emergency button is pressed, the motors will continue to rotate with inertia and will not stop instantly.
- Familiarize yourself with the location of the emergency button on the controller before flight.
- Be careful not to push the emergency button unintentionally during flight. It will result in crash.

7.1.8. Forced Stop Using the Ground Control Application

- To help provide maximum safety for pilots and third parties, the aircraft is equipped with a “forced stop” function that forcibly stops the aircraft's motors.
- In the unlikely event of unintended movement of the aircraft, or if the surrounding environment changes significantly or otherwise becomes unsafe, check the safety of the surroundings and immediately drop the aircraft.

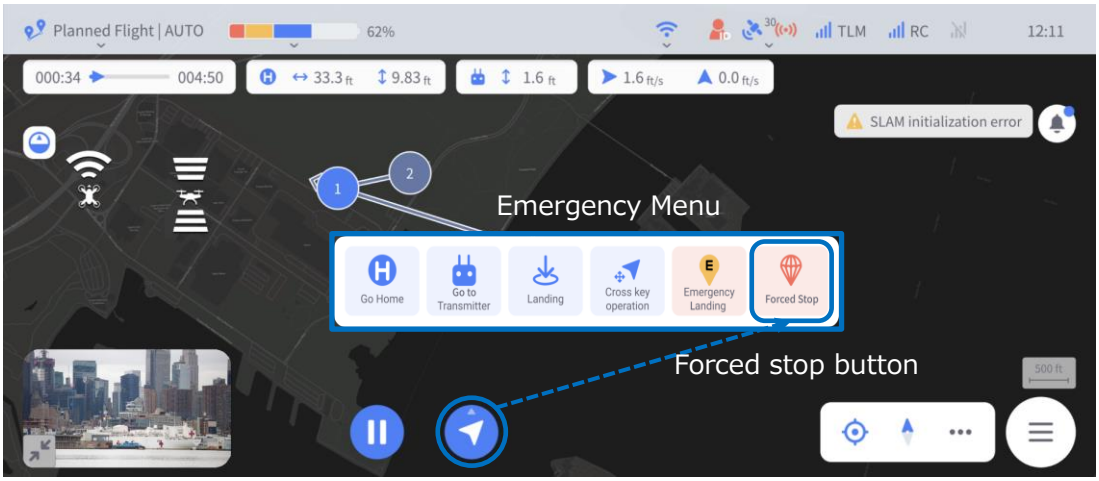
Forced stop procedure

① **Press the Command button on the ACSL TAKEOFF ground control application to display the Emergency Menu.**

② **Press the Forced Stop button and confirm the instruction in the modal dialog.**

Examples of possible situations requiring mandatory suspension

- When an unintended movement takes the aircraft out of the safety zone
- When there is a possibility of coming into contact with people or property
- When people or objects are approaching rapidly



Command button

WARNING

Failure to comply with the following may result in an unexpected collision or crash that could cause injury, fire, or damage.

- In the case of a forced stop, make the utmost effort to drop the aircraft where there are no people or structure.

CAUTION

- Even after the emergency button is pressed, the motors will continue to rotate with inertia and will not stop instantly.
- Familiarize yourself with the location of the emergency button in the ACSL TAKEOFF ground control application before flight.
- Be careful not to push the emergency button unintentionally during flight.

7.1.9. Low-Battery Emergency Landing

- If the battery power drops below 6%, an emergency landing function automatically lands on the spot to ensure maximum safety for the pilot and third parties in the event of a crash.
- Automatically lands on the spot if GPS reception deteriorates while in emergency mode.
- The status LED on the aircraft blinks white and “Battery voltage low” is displayed on the controller and ACSL TAKEOFF ground control application.

ADVISORY

- Injury to the pilot or third parties or damage to the aircraft caused by a low-battery emergency landing is not covered by the warranty.

CAUTION

- Continually monitor the battery level during flight and land the aircraft in a safe location before the battery level falls to 6%.
- The emergency landing cannot be cancelled by the user, and all controls will be locked out.
- An emergency landing on uneven ground may cause the aircraft to tip over.

7.1.10. Degraded GPS Reception in Auto Flight Mode

- If GPS reception deteriorates during a planned flight (see note), the planned flight is automatically aborted and the aircraft hovers in place.
  Note: If the status LED flashes red, the base station app or controller displays a “GPS accuracy low” error, or the aircraft becomes unstable, GPS reception may have deteriorated.
- If the aircraft's position and speed can be measured by visual odometry using the stereo cameras, the aircraft will continue the hovering condition using visual odometry (see note). Switch to position (POS) or manual (MAN) mode and land the aircraft in a safe location as soon as possible.
  Note: See ‘2.3.2. Overview of the Visual System.’
- When visual odometry cannot measure the position or speed of the aircraft, it cannot hold the position of the aircraft. The aircraft will move slowly, subject to wind and other factors. Switch to manual mode and immediately land the aircraft in a safe location.

CAUTION

- Continued flight to any site other than a safe landing site is not recommended.
- If the aircraft's position and speed cannot be measured by visual odometry, the aircraft's position will not be displayed on the ACSL TAKEOFF ground control application. The pilot should continuously, visually track the aircraft and be prepared to visually navigate the aircraft at any time.

7.1.11. Indications of an Abnormality

There are three types of indications in the event of an abnormality.

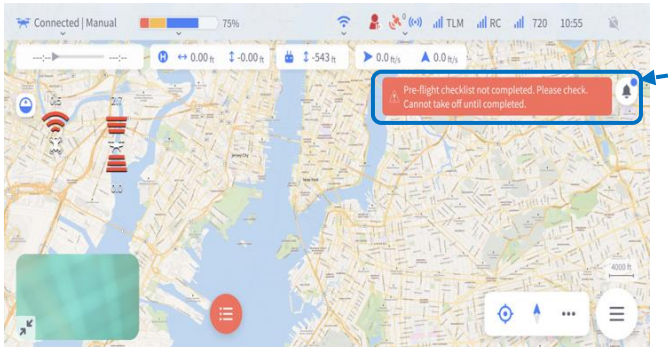
① **The Aircraft's Status LED**

- When the aircraft is unable to accurately determine its location with GPS and visual odometry, the status LEDs will indicate the following patterns.

Status LED indication when the aircraft is powered on			
Flight mode	Mode indication	GPS and visual odometry abnormality	Aircraft abnormality
Manual mode Switch position: MAN	Blinking yellow	Blinking red	Blinking white
Position mode Switch position: POS	Blinking green		
Auto mode Switch position: AUT	Blinking blue		
Manual mode Position mode Auto mode Switch position: MAN/POS/AUT (Auto takeoff and landing)	Blinking purple		

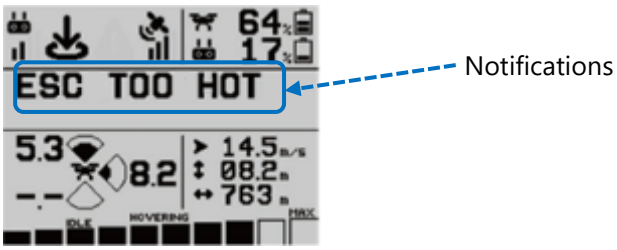
② **ACSL TAKEOFF ground control application**

- A message will appear on the right side of the screen. For details, please refer to the ACSL TAKEOFF ground control application user manual.



③ **Controller LCD screen**

- The center of the controller's LCD screen displays warning messages and other information about the aircraft and controller.

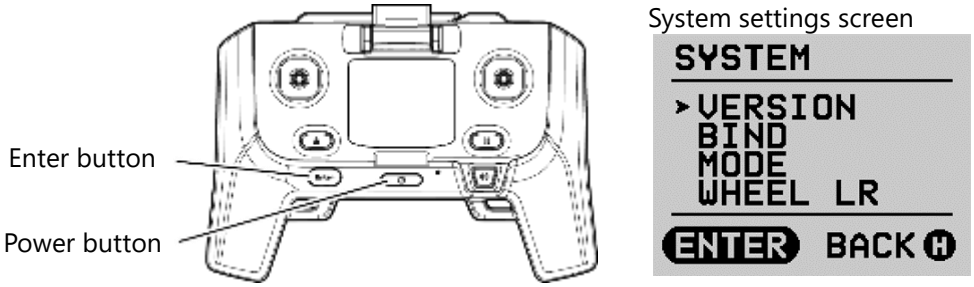


7.1.12. Stick Calibration

If the warning message “INIT NEUTRAL FAILURE” appears even though the controller's left and right sticks are in the center position, perform stick calibration.

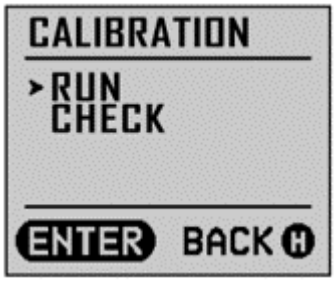
> ADVISORY
>
> If you are unable to start the motors, even after successfully completing the troubleshooting steps described in Section 9.1.1: Aircraft Troubleshooting, it may be an indication that the sticks are out of calibration.

1. With the controller powered off, press the power button while simultaneously pressing the Enter button to activate the system setup screen.



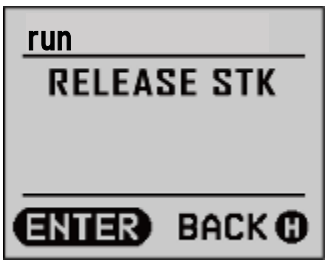
2. Move the cursor to “CALIBRATION” by operating the left stick on the controller and then press the Enter button.

3. Move the cursor to “RUN” by operating the left stick on the controller and then press the Enter button.

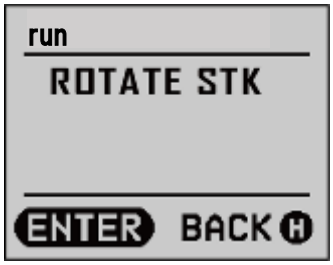


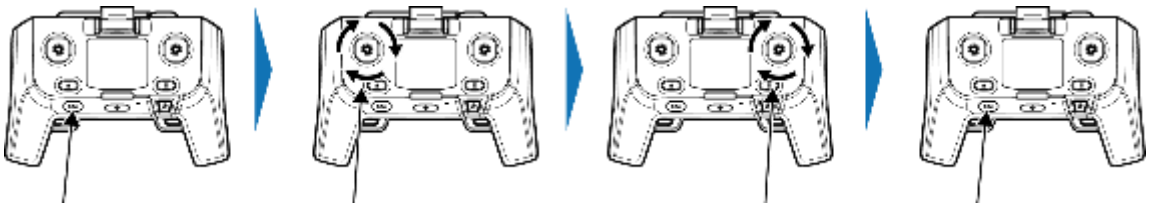
4. When "RELEASE STK" appears, release the left and right sticks and press the Enter button.

Wait until "ROTATE STK" is displayed.



5. When "ROTATE STK" is displayed, rotate the left along the limits of its range of motion at least three times at a speed of about 5 seconds per revolution.



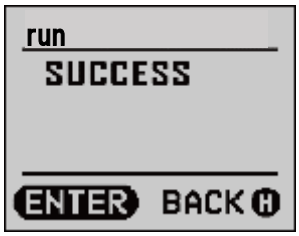


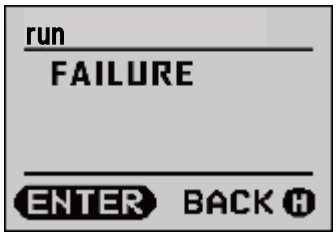
Enter button　Left stick　Right stick　Enter button

6. Rtoate the right stick in the same way. Then press the Enter button.

7. "SUCCESS" is displayed when the trim function is successfully completed.

If the message "FAILURE" is displayed, repeat the above procedure.

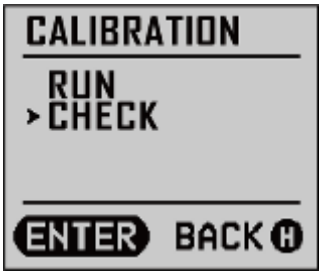




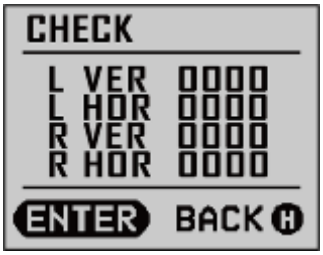
8. Press the Enter button to return to the system menu.

9. To confirm that the calibration was successful, move the cursor to "CALIBRATION" by operating the left stick on the controller, and press the Enter button.

10. **Move the cursor to “CHECK” by operating the left stick on the controller and press the Enter button.**



11. **A screen will appear on which you can check the stick position numerically, so be sure to check that it is “0000” with your hands off the sticks.**



display	Contents	Details
L VER	Left stick up/down	[Lower] -1000 to 1000 [Upper]
L HOR	Left stick left/right	[Left] -1000 to 1000 [Right]
R VER	Right stick up/down	[Lower] -1000 to 1000 [Upper]
R HOR	Right stick left/right	[Left] -1000 to 1000 [Right]

ADVISORY

- If “0000” is not shown when the sticks are released, control of the aircraft will be affected. Start the calibration procedure over from the beginning.
- If, after repeating the calibration procedure, “0000” is still not shown when the sticks are released, or if calibration fails, a stick may be malfunctioning.
- If stick malfunction is suspected, discontinue use immediately and contact your dealer.

7.1.13. Warning Messages

- The following pages list all of the warning messages that can appear in the ACSL TAKEOFF ground control application and on the controller. Also included is an explanation and required actions.
- When a warning message is issued, the controller alerts the user with sound and vibration.
  *For safety reasons, the warning sound cannot be muted even when SOUND is set to OFF in the controller settings.

Warning message	Explanation and required action
Camera not connected	The aircraft has not detected the presence of a camera. On ground: The ability to start the motors is inhibited. Attach a camera. In flight: Land the aircraft in a safe place as soon as possible. After landing reattach the camera.
GNSS is not measured	The aircraft has not successfully achieved a GPS lock since powering on. On ground: The ability to stat the motors is inhibited. Make sure that this aircraft is in a location suitable for the reception of GPS signal and wait for GPS lock as indicated by a blue GPS icon on the ACSL TAKEOFF ground control application. (This warning only occurs while on ground)
No airspace boundary data	The regional market geofence data cannot be retrieved from the aircraft's memory. On ground: The ability to start the motors is inhibited. If the warning persists, contact your dealer.
Nearing unpermitted area	The aircraft's GPS sensor is reporting that the aircraft is within 30 m (100 ft) of the regional market geofence, or the aircraft no longer has a GPS position lock and the most recent GPS position lock was within 30 km (19 miles) of the regional market geofence. On ground: • The ability to start the motors is inhibited unless reception of GPS signals is good (as indicated by a blue GPS icon in the ACSL TAKEOFF ground control application) and the flight mode is either position (POS) or auto (AUT). In flight: • Be aware that the aircraft will transition to emergency mode if the regional market geofence is crossed.
Entered unpermitted area	The aircraft's GPS sensor is reporting that the aircraft is outside of the regional market geofence. On ground: • The ability to start the motors is inhibited in position (POS) and auto (AUT) mode. Relocate the aircraft inside and further away from the regional market geofence. In flight: • The aircraft will automatically control its motion to stay within the regional market geofence. • If GPS reception is poor, control of the horizontal motion of the aircraft will not be possible.

Warning message	Explanation and required action
Failed Preflight Self-Test	The on-board remote ID module has either failed or not yet completed its self-test. On ground: • The ability to start the motors is inhibited. Make sure that the mobile device that is running the ACSL TAKEOFF ground control application is equipped with a GPS, has location services enabled, and is connected properly to the controller. If the warning persists, discontinue use and contact your dealer. In flight: • Flight may be continued but the aircraft may not be properly broadcasting its remote ID. If the warning persists, land as soon as is safely possible and restart the aircraft. If the warning persists, discontinue use and contact your dealer.
Improper RC configuration	The controller has detected that the sticks are not centered. Correct stick positions. If the warning persists, perform a stick calibration.
SD card access failure	Restart the aircraft. *If the warning message appears again, discontinue use, and contact your dealer.
EEPROM access failure	EEPROM access failed. Restart the aircraft. *If the warning message appears again, discontinue use and contact your dealer.
Radio comms interrupted	On ground: Controller signal has been lost. Turn on the controller. In flight: Land the aircraft in a safe place as soon as possible. • Manual (MAN) or position (POS) mode The aircraft is not receiving signals from the controller and will transition to emergency mode. • Auto (AUT) mode The aircraft is not receiving signals from the controller and will transition to emergency mode after 30 seconds. ➔ p. 126 '7.1.4 .Emergency Menu Emergency Menu" for details. *When the signal interruption is restored, the emergency mode can be canceled by toggling the controller's flight mode switch.
System error	A system error has occurred. On ground: Restart the aircraft. *If the warning message appears again, discontinue use and contact your dealer. In flight: Immediately land in a safe location.
Radio binding underway	The aircraft and controller are in the process of binding to each other. If connection is not established, perform the bind operation again. ➔ p. 59 '3.5 .First Connection (binding) See "3.5.

Warning message	Explanation and required action
Nav calculation error	There is an abnormality in the speed or navigation calculations used in auto mode. Restart the aircraft. *If the warning message appears again, discontinue use and contact your dealer. On ground: The ability to idle is inhibited. In flight: • Switch to manual mode and immediately land the aircraft in a safe location. • If you are unable to maneuver in manual mode, check the safety of your surroundings and drop the aircraft immediately with the forced stop function. ➔ p.133 'The0 ➔ Forced Stop Using the Controller See "7.1.7 Forced Shutdown (Controller Operation)". ➔ p.135 '7.1.8Forced Stop Using the See "7.1.8 Emergency Menu".
Battery voltage low	The aircraft's battery level is below 13%. On ground: The ability to idle is inhibited. Replace the aircraft's battery with a fully charged battery. In flight: • Manual (MAN) or position (POS) mode Land in a safe place as soon as possible. • Auto (AUT) mode The aircraft will transition to emergency mode.
	The aircraft's battery level is below 6%. In flight: The aircraft will initiate an emergency landing on the spot. ➔ p.136 '7.1.9Low-Battery Emergency See "7.1.9 Emergency Landing
No data from IMU	There is an error in communication between the flight controller and the IMU. Restart the aircraft. *If the warning message appears again, discontinue use and contact your dealer. On ground: The ability to idle is inhibited. In flight: There is a high possibility of a crash. Alert others and land in a safe location immediately.
Acceleration data unreliable	Attitude and acceleration data quality has degraded. Restart the aircraft. *If the warning message appears again, discontinue use and contact your dealer. On ground: The ability to idle is inhibited. In flight: Immediately land in a safe location.
Gyro data unreliable	Angular rate data quality had degraded. Restart the aircraft. *If the warning message appears again, discontinue use and contact your dealer. On ground: The ability to idle is inhibited.

	In flight: Immediately land in a safe location.
Warning message	**Explanation and required action**
Barometer data unreliable	The quality of the barometric pressure data has deteriorated. Restart the aircraft. *If the warning message appears again, discontinue use and contact your dealer. On ground: The ability to idle is inhibited. In flight: Immediately land in a safe location.
ESC CAN comms error	An abnormality in the communications between the flight controller and ESCs has occurred. Restart the aircraft. *If the warning message appears again, discontinue use and contact your dealer. On ground: The ability to idle is inhibited. In flight: There is a high possibility of a crash. Alert others and land in a safe location immediately.
Attitude angle limit	The aircraft has detected an abnormal attitude, indicating a loss of control. In flight: The motors will stop and the aircraft will drop. Alert people in the vicinity.
No data from batt monitor	Data cannot be received from the battery monitor. Replace the battery. On ground: The ability to idle is inhibited. In flight: Land the aircraft in a safe place as soon as possible.
Attitude init error	Failed to calculate the initial attitude of the aircraft at startup. Place the aircraft on a level, stable surface and restart. *Do not jostle the aircraft when starting up.
Cannot maintain altitude	Operational limits (wind speed/airframe weight) may have been exceeded. In flight: The aircraft will transition to emergency mode. ➔ p. 126 '7.1.4 .Emergency Menu Emergency Menu" for details. Immediately land the aircraft in a safe location.
Vehicle temperature	The aircraft's internal temperature may be about to exceed the upper or lower limit. After landing, avoid direct sunlight to cool the aircraft. On ground: On ground: The ability to idle is inhibited. In flight: Land the aircraft in a safe place as soon as possible.
ESC too hot	The temperature of the ESC may be about to exceed the upper temperature limit. After landing, avoid direct sunlight to cool the aircraft. On ground: The ability to idle is inhibited. In flight: Immediately land the aircraft in a safe location.

Warning message	Explanation and required action
Position control disabled	There is a problem with GPS or visual odometry location information. The environment may not be suitable for flight. On ground: The ability to idle is inhibited in position (POS) or auto (AUT) mode. In flight: • Manual (MAN) mode Continuation of flight is possible. • Position (POS) mode or auto (AUT) mode Switch to manual mode and land the aircraft in a safe location as soon as possible.
No data from barometer	No response from the barometric sensor. Restart the aircraft. *If the warning message appears again, discontinue use and contact your dealer. On ground: The ability to idle is inhibited. In flight: Land in a safe place as soon as possible.
Battery half locked	The battery is not locked. Check battery installation. On ground: The ability to idle is inhibited. In flight: Land in a safe place as soon as possible.
Battery temperature high	Battery temperature is elevated. Remove the battery from the aircraft and store it at room temperature. On ground: The ability to idle is inhibited. In flight: Immediately land in a safe location.
AP-Vision ver mismatch	The firmware versions of the flight computer and the visual odometry computer do not match. Refer to the ACSL TAKEOFF ground control application instruction manual to update the firmware. On ground: The ability to idle is inhibited in position (POS) or auto (AUT) mode in a non-GPS environment. In flight: • Manual (MAN) mode Continuation of flight is possible. • Position (POS) or auto (AUT) mode In a non-GPS environment, switch to manual mode and land the aircraft in a safe location as soon as possible.
Emergency mode high load	The load on the battery is abnormally high (Level 2). The aircraft will transition to emergency mode. ➢ If warning persists: The aircraft will execute an emergency landing after 60 seconds. During the emergency landing, all pilot inputs will be ignored except for forced stop and automatic landing. If warning ceases: Emergency mode may be cancelled by toggling the controller's flight mode switch. Immediately land the aircraft in a safe location.

Warning message	Explanation and required action
Flight Restricted high load	The load on the battery is abnormally high (Level 1). Take the following actions. • Manual (MAN) mode Climb speed is limited but horizontal speed is not limited. Decelerate immediately. ➢ If warning persists: Land the aircraft in a safe place as soon as possible. ➢ If warning ceases: Flight may continue. • Position (POS) mode Horizontal and climb speeds are limited. Decelerate immediately. ➢ If warning persists: Land the aircraft in a safe place as soon as possible. ➢ If warning ceases: Flight may continue. • Auto (AUT) mode Horizontal and climb speeds are limited. Decelerate immediately. (e.g., pause, etc.) ➢ If warning persists: Land the aircraft in a safe place as soon as possible. ➢ If warning ceases: Flight may continue.
Flight Restricted ESC speed	Motor RPM is abnormally high (level 1). The aircraft will enforce the following restrictions for 30 seconds: • Manual (MAN) mode Climb speed is limited but Horizontal speed is not limited. Decelerate immediately. ➢ If warning persists: Ascent speed is limited for 30 seconds. Decelerate. ➢ If warning ceases: Flight may continue. • Position (POS) mode Horizontal and climb speeds are limited. Decelerate immediately. ➢ If warning persists: Horizontal and climb speeds are limited for 30 seconds. Decelerate. ➢ If warning ceases: Flight may continue. • Auto (AUT) mode Horizontal and climb speeds are limited. Decelerate immediately. (e.g., pause, etc.) ➢ If warning persists: Horizontal and climb speeds are limited for 30 seconds. Decelerate (e.g., pause, etc.). ➢ If warning ceases: Flight may continue.

Warning message	Explanation and required action
Emergency mode ESC speed	Motor RPM is abnormally high (level 2). The aircraft will transition to emergency mode. Immediately land the aircraft in a safe location. ➢ If motor RPM remains high, an emergency landing will occur. (All operations are disabled during emergency landing). ➢ Emergency mode may be cancelled by toggling the controller's flight mode switch . *Restriction continues. If the ESC speed error occurs frequently, the aircraft is under excessive load during flight. Review your flight plan, reduce the aircraft weight, or lower the flight altitude. An airspeed limit may have been exceeded. Check the limits.
ESC current error	A motor current error was detected during idling. Repair is required. Contact your distributor.
Motor error detection	A motor current error was detected during flight. Land the aircraft in a safe location immediately. Repair is required. Contact your dealer.
Vision cam connect error	Unable to connect to an on-board stereo camera. Please restart the aircraft. Manual (MAN) mode Continuation of flight is possible. Position (POS) or auto (AUT) mode In a GPS environment, continuation of flight is possible, but forward and upward collision avoidance may not work properly. Use caution. In a non-GPS environment, switch to manual mode and land the aircraft in a safe location as soon as possible.

Warning message	Explanation and required action
Battery Memory Error	The battery software has detected an anomaly. Land in a safe place immediately. After landing, turn off the battery power. If the warning appears again during operation, discontinue use and contact your dealer.
Old Battery FW detected	Battery firmware is too old for use. Replace the battery. On ground: The ability to start the motors is inhibited.
Battery FW Updating	Battery firmware is being updated. Do not turn off the power until the FW update is completed.
Battery update failed	Battery firmware update failed. Remove the battery from the aircraft and reattach it to the aircraft to re-attempt to update. If the update fails after retrying, discontinue use and contact your dealer.
Battery Failed Force Shut	Old type of battery is used. Restart using a new battery.
Low temperature No takeoff	Battery temperature is too low. The ability to idle is inhibited. Wait for the battery temperature to rise before attempting a takeoff again.
No-fly area	The aircraft position is outside of a user-defined geofence or altitude limit. Check the geofence. Geofence On ground: • The ability to start the motors is inhibited. In flight: • In position (POS) or auto (AUT) mode, the aircraft will toward the nearest boundary of the no-fly area at a speed of 2 m/s. • If necessary, switch to manual (MAN) mode to ensure safety. Altitude limit In flight: • The aircraft will no longer climb.

7.1.14. Caution Messages

- The following pages list all of the caution messages that can appear in the ACSL TAKEOFF ground control application and on the controller. Also included is an explanation and required actions.
- When a warning message is issued, the controller alerts the user with sound.
  *The sound will be muted if SOUND is set to OFF in the controller settings menu.

Caution message	Explanation and required action
No airspace boundary data	The regional market geofence data cannot be retrieved from the aircraft's memory. In flight: • A speed limit will be imposed. Please land in a safe place as soon as possible. (This caution only occurs while in flight)
Nearing unpermitted area	The aircraft's GPS sensor is reporting that the aircraft is within 100 m (330 ft) of the regional market geofence. In flight: • A speed limit will be enforced in position (POS) and auto (AUT) mode.
Failed Preflight Self-Test	The on-board remote ID module has either failed or not yet completed its self-test. On ground: • The ability to start the motors is inhibited. Make sure that the mobile device that is running the ACSL TAKEOFF ground control application is equipped with a GPS, has location services enabled, and is connected properly to the controller. If the warning persists, discontinue use and contact your dealer. (This caution only occurs while on ground)
Self-check error	Indicates that an abnormality has been detected in the aircraft's attitude sensor or in the operation of the controller. • Place the aircraft on a stable surface and restart it. • During takeoff, keep the roll, pitch, and yaw sticks in the center position and avoid excessive throttle operation.
ESC nearing life limit	The ESCs have accumulated more than 285 hours of operation. Contact your dealer for ESC replacement. ➔ p. 168 '8.8 .Periodic Parts Replacement See "8.8.
ESC lifetime exceeded	The ESCs have accumulated more than 300 hours of operations. Replace before further use. Contact your dealer for ESC replacement. ➔ p. 168 '8.8 .Periodic Parts Replacement See "8.8.

Caution message	Explanation and required action
No-fly area	The aircraft position is outside of a user-defined geofence or altitude limit. Check the geofence. On ground: • The ability to start the motors is inhibited. • The aircraft may not have a GPS location fix due to poor GPS reception. In flight: • Approaching a no-fly area or altitude limit. A speed limit will be enforced in position (POS) or auto (AUT) mode.
GPS accuracy low	GPS accuracy is low. On ground: The ability to idle is inhibited in position (POS) or auto (AUT) mode. In flight: • Manual (MAN) mode Continuation of flight is possible. • Position (POS) mode ➔ p. 99 '6.2.3 .Basic See "6.2.4. • Auto (AUT) mode ➔ p. 136 '7.1.10 .Degraded GPS Reception in Auto See "7.1.11.
Battery voltage low	Battery level is below 24%. In flight: Battery power is low. Continue to monitor the remaining battery level.
Battery temperature low	Battery temperature is low. Remove the battery from the aircraft and store it at room temperature.
Warm up the battery	Battery temperature is low. Please warm up the battery to room temperature.
Battery voltage unreliable	An abnormal battery voltage was reported by the battery. Replace the battery. On ground: The ability to idle is inhibited. In flight: Immediately land the aircraft in a safe location.
RID System Error	There is a malfunction in the remote ID system. Please restart the aircraft. *If the caution message appears again, discontinue use and contact your dealer. *It is not legal to fly a drone without a properly functioning remote ID.
RID No Heartbeat	No response from remote ID device. Please restart the aircraft. *If the caution message appears again, discontinue use and contact your dealer. *It is not legal to fly a drone without a properly functioning remote ID.
RID BLE FW Old Version	The firmware version of the remote ID Bluetooth module is out of date. Please update the firmware of the aircraft. *If the caution message appears again, discontinue use and contact your dealer. *It is not legal to fly a drone without a properly functioning remote ID.

Caution message	Explanation and required action
No data from GPS	There is an error in communication between he flight controller and the GPS sensor. Restart the aircraft. *If the caution message appears again, discontinue use and contact your dealer. On ground: The ability to idle is inhibited in position (POS) or auto (AUT) mode. In flight: • Manual (MAN) mode Continuation of flight is possible. • Position (POS) mode ➔ p. 99 '6.2.3 .Basic See "6.2.4. • Auto (AUT) mode ➔ p. 136 '7.1.10 .Degraded GPS Reception in Auto See "7.1.11.
Magnetometer unreliable	The quality of the magnetomer (magnetic compass) data has deteriorated. *If the caution message appears again, discontinue use and contact your dealer. On ground: Not recommendable to take off in position (POS) or auto (AUT) mode. In flight: Switch to manual mode and land in a safe location as soon as possible.
No data from magnetometer	There is an error in communication between he flight controller and the magnetometer (magnetic compass). Restart the aircraft. *If the caution message appears again, discontinue use and contact your dealer. On ground: Not recommendable to take off in position (POS) or auto (AUT) mode. In flight: Switch to manual mode and land in a safe location as soon as possible.
Azimuth error increased	An inconsistency between the readings from the magnetometer (magnetic compass) and the motion of the aircraft has been detected. This may indicate magnetic interference from objects in the environment, that the magnetometer (magnetic compass) is faulty, or that compass calibration is needed. On ground: • Not recommendable to take off in position (POS) or auto (AUT) mode. • Perform magnetic field calibration when a camera is switched or optional equipment is added or removed. • If none of the above apply, flying in position (POS) or auto (AUT) mode in the area is not recommended. In flight: Switch to manual mode and land in a safe location as soon as possible.
Home position unknown	Displayed when the Home location is unknown during Go Home operation. ➔ p. 107 '6.3.7 .Go Home See "6.3.8. In flight: Abort Go Home and switch to another mode.

Caution **message**	Explanation and required action
No data from GCS	There is no communication between the ACSL TAKEOFF ground control application and the aircraft. Check the connector connection between the mobile device and the controller. • Manual (MAN) or position (POS) mode Continuation of flight is possible. • Auto (AUT) mode Switch to position mode and promptly land in a safe location.
No data from dist sensor	There was an error in communication between the flight controller and a distance sensor. Upward obstacle detection, upward obstacle avoidance, and/or soft-landing assist may not function properly.
Throttle control saturated	Operational limits (wind speed/airframe weight) may have been exceeded. In flight: Reduce speed and land in a safe location as soon as possible.
Vehicle temperature	The aircraft's internal temperature may be about to exceed the upper or lower limit. After landing, avoid direct sunlight to cool the aircraft. On ground: Not recommendable to take off. In flight: Land the aircraft in a safe place as soon as possible.
Position drift increasing	Operational limits (wind speed) may have been exceeded. In flight: Reduce speed and land in a safe location as soon as possible.
Flight speed is limited	Operational limits (wind speed) may have been exceeded. • Auto (AUT) mode There is a possibility that the aircraft may not have enough remaining battery charge to reach its destination. Check the remaining battery level and determine whether or not to continue the flight.
Collision avoidance active	An obstacle is detected near the aircraft. On ground: The ability to idle is inhibited in position (POS) or auto (AUT) mode. In flight: Keep a safe distance from obstacles.
Navigation source switched	While flying with GPS in position (POS) or auto (AUT) mode, GPS reception degraded and the aircraft switched the source of position and velocity data to visual odometry. OR While flying without GPS in position (POS) or auto (AUT) mode, GPS reception improved and the aircraft switched the source of position and velocity data to GPS. ➔ p. 99 '6.2.3 Basic See also ➔ p. 101 The following is a brief description of the "The6.2.4 .Basic Auto Mode (AUT) See "6.2.5.

Caution message	Explanation and required action
Radio not responding	There is an error in communication between the aircraft and the controller. On ground: Restart the aircraft and controller. In flight: Land the aircraft in a safe place as soon as possible. • Manual (MAN) or position (POS) mode If the communications error persists, the aircraft will transition to emergency mode. • Auto (AUT) mode If the communications error persists, the aircraft will transition to emergency mode after 60 seconds. ➔ p. 126 '7.1.4 .Emergency Menu Emergency Menu" for details. *When radio wave interruption is restored, the emergency mode can be canceled by switching the mode switch of the controller to another mode.
Forced pausing	While flying in auto mode, GPS reception was poor and switched to visual odometry. Please switch to Position or Manual mode and land the aircraft in a safe place as soon as possible. ➔ p. 101 The following is a brief description of the "The6.2.4 .Basic Auto Mode (AUT) See "6.2.5. *When switched to visual odometry, free flight, Go Home and other operations are not available. *The forced pause function does not work with active marker tracking.
Propeller not detected	The ESC has detected that the motor does not have a propeller (propeller). All motors should be equipped with a propeller.
Battery temperature high	Battery temperature is elevated. Remove the battery from the aircraft and store it at room temperature. On ground: Not recommendable to take off. In flight: Land in a safe place as soon as possible.
Battery use limit nearing	The number of times the battery has been charged and discharged is approaching the limit of use. Contact your dealer for battery replacement.
Improper flight plan	There is an abnormality in the received planned flight. Please review the planned flight. • Reduce the number of waypoints • Check for unassigned emergency landing points.
Obstacle detected	An obstacles near the aircraft is detected. Fly with caution.

Caution message	Explanation and required action
No data from vision unit	The flight controller is not receiving any data from the vision computer. If the caution persists, restart the aircraft. *If the caution message appears again, discontinue use and contact your dealer. On ground: The ability to idle is inhibited in position (POS) or auto (AUT) mode in a non-GPS environment. In flight: • Manual (MAN) mode Continuation of flight is possible. • Position (POS) mode In a non-GPS environment, switch to manual (MAN) mode and land the aircraft in a safe location as soon as possible.
Vision accuracy low	This environment is not suitable for visual odometry. ➔ p. 31 The following is a brief description of the "A."2.3.2 .Overview of See "2.3.3. On ground: The ability to idle is inhibited in position (POS) or auto (AUT) mode in a non-GPS environment. In flight: • Manual (MAN) mode Continuation of flight is possible. • Position (POS) mode In a non-GPS environment, switch to manual (MAN) mode and land the aircraft in a safe location as soon as possible.
Too dark for vision	There is not enough light for the stereo cameras to capture properly exposed images and some functions may not work properly. Manual (MAN) mode Continuation of flight is possible. Position (POS) or auto (AUT) mode Forward and upward collision avoidance may not work in GPS environments. Use caution. In a non-GPS environment, switch to manual mode and land the aircraft in a safe location as soon as possible.
Vision initialization error	Vision could not initialize. Please restart. On ground: The ability to idle is inhibited in position (POS) or auto (AUT) mode in a non-GPS environment. In flight: -Manual (MAN) mode Continuation of flight is possible. -Position (POS) or auto (AUT) mode In a non-GPS environment, switch to manual mode and land the aircraft in a safe location as soon as possible.

Caution message	Explanation and required action
Vision performance error	Vision has a low frame rate. Please restart. On ground: The ability to idle is inhibited in position (POS) or auto (AUT) mode in a non-GPS environment. In flight: -Manual mode Continuation of flight is possible. -Position mode/Auto mode In a non-GPS environment, switch to manual mode and land the aircraft in a safe location as soon as possible.
No camera SD	No SD card was detected in the camera. Make sure an SD card is inserted in the camera Format the SD card.
Lens error	There is a problem with the focus/zoom function of the camera. Please power off the aircraft, reinsert the camera, then power the aircraft back on. *Do not reinsert the camera while the aircraft is powered on. *If the caution message appears again, discontinue use and contact your dealer.
Gimbal init error	Gimbal initialization failed. Please power off the aircraft, reinsert the camera, then power the aircraft back on. *Do not reinsert the camera while the aircraft is powered on. *After the aircraft is powered on, initialization of the gimbal will begin. Please make sure that there are no obstacles or other objects that may interfere with the gimbal initialization. *If the caution message appears again, discontinue use and contact your dealer.
Gimbal motor error	An abnormality has occurred in the gimbal motor. Please power off the aircraft, reinsert the camera, then power the aircraft back on. *Do not reinsert the camera while the aircraft is powered on. *If the caution message appears again, discontinue use and contact your dealer.
Gimbal ctrl error	An abnormality has occurred in the gimbal motor. Please power off the aircraft, reinsert the camera, then power the aircraft back on. *Do not reinsert the camera while the aircraft is powered on. *If the caution message appears again, discontinue use and contact your dealer.

7.1.15. Advisory Messages

- The following pages list all of the advisory and informational messages that can appear in the ACSL TAKEOFF ground control application and on the controller. Also included is an explanation and required actions.

Advisory message	Explanation and required action
Camera connected	No camera is detected. Attach a camera.
Takeoff command rejected	Not ready for automatic takeoff. • Verify that GPS accuracy is good. • Verify that throttle stick is in the center position. • Verify that communication between the controller and the aircraft has not been disrupted.
EEPROM reloading	One or more settings values in the aircraft's internal memory has been changed and is being reloaded.
Camera heat warning	Camera temperature is rising. Stop shooting. After landing, avoid direct sunlight and lower the temperature of the camera. *If the warning message appears again, discontinue use and contact your dealer.
Excess number of RCs paired	More than 3 controllers have been bound to the aircraft. From the ACSL TAKEOFF ground control application, perform a controller binding erase.
Waiting	The current waypoint included a wait time. The number of seconds of wait time will also be indicated.
Log write failure	Failed to write to the aircraft's internal log. Restart the aircraft. *If the warning message appears again, discontinue use and contact your dealer.

7.1.16. Messages Displayed on the Controller

Warning messages

- The following lists all of the warning messages that can appear only on the controller. Also included is an explanation and required actions.
- When a warning message is issued, the controller alerts the user with sound and vibration.
  * The sound will be muted if SOUND is set to OFF in the controller settings menu.

Warning message	Explanation and required action
SWITCH STICK FAILURE	A controller stick malfunction was detected. Discontinue use contact your dealer. On ground: Not recommendable to take off. In flight: Immediately land the aircraft in a safe location.
COMM FAILURE	An abnormality in the radio has been detected. Discontinue use and contact your dealer. On ground: Not recommendable to take off. In flight: Immediately land the aircraft in a safe location.
SUB-G COMM ERROR	An abnormality has occurred with the training radio. Discontinue use and contact your dealer. On ground: Not recommendable to take off. In flight: Immediately land the aircraft in a safe location. (Only for controllers equipped with a 920 MHz radio, Japan only)
PLEASE CHARGE CTRL	The controller's battery level is below 5%. On ground: Not recommendable to take off. In flight: Immediately land the aircraft in a safe location.
HIGH TEMP CTRL	The controller's internal battery temperature is too high. Allow it to cool down immediately. On ground: Not recommendable to take off. In flight: Immediately land the aircraft in a safe location.
INIT NEUTRAL FAILURE	Make sure the left and right sticks are in the center position.
BIND FAILURE	Binding failed. Reattempt binding.
LOW VOLTAGE CTRL	Controller battery voltage is low. Charge the battery or, if it is cold, bring it up to the appropriate temperature.
DISCONNECT DRONE	Communication with the drone has been lost.
WARM UP THE BATTERY	Battery temperature is low. Please warm up the battery to room temperature.

Caution messages

- The following lists all of the warning messages that can appear only on the controller. Also included is an explanation and required actions.
- When a warning message is issued, the controller alerts the user with sound and vibration.

  * The sound will be muted if SOUND is set to OFF in the controller settings menu.

Warning message	Explanation and required action
PLEASE CAHRGE CTRL	The controller's battery level is below 10%. On ground: Not recommendable to take off. In flight: Find a possible landing site and land the aircraft in a safe place as soon as possible.
HIGH TEMP CTRL	The controller's internal battery temperature is high. Allow it to cool down as soon as possible.
LOW TEMP CTRL (CANNOT CHG)	Controller temperature has dropped below the operating temperature range. Warm up the controller. When charging: When this message is displayed, charging is stopped to protect the battery.
LEAVING ALONE	The controller has been inactive for an extended period of time.
CHARGER COMM ERROR	A communication error between the battery and charger has occurred. If this occurs more than once even after replacing the charger, contact your dealer.

Advisory messages

- The following lists all of the advisory messages that can appear only on the controller. Also included is an explanation and required actions.

Advisory message	Explanation and required action
CONNECTION CHECKING	A communication connection is being prepared between the aircraft and the controller. When a radio fail-safe occurs, this message is displayed on all bound controllers that have successfully reconnected with the aircraft.
QUIT PILOT REQUESTING	This message is displayed on the pilot's controller when releasing pilot authority by simultaneously pressing the Enter and Pause buttons. When this occurs, the aircraft will immediately begin recruiting for a new pilot and a notification will appear on all controllers that are currently receiving telemetry from the aircraft in observer mode.
PILOT REQUESTING	This message is displayed when attempting to gain pilot authority by pressing the Enter button when the message "TO BE PILOT PUSH ENTER" is displayed on the controller. The aircraft checks the order of the requests and grants pilot privileges to the controller with the earliest request.

Chapter 8

Maintenance, Inspection and Disposal

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8.1. Post-Flight Inspection

- Perform the following inspections after each flight.
- When flying, dust, insects, pollen, and other microscopic debris adhere to the aircraft. If left unattended, these particles can cause chemical changes that lead to deterioration and discoloration of parts.
- To prevent these problems, clean and care for the equipment after each flight, and check each part for stains, damage, or wear.

1. Post-flight battery inspection

- Clean battery 8-2-1
- Confirm level of charge 8-2-2
- Inspect exterior 5-2-2

2. Post-flight aircraft inspection

- Clean aircraft 8-3-1
- Inspect exterior ..... 5-3-1.
- Inspect battery terminals and locking mechanism 5-3-2
- Inspect camera terminals and locking mechanism 5-3-3
- Inspection air intake 5-3-4
- Inspect motors 5-3-5
- Inspect propeller mounts and arms 5-3-6
- Inspect arm locking mechanisms 5-3-7
- Inspect stereo cameras and infrared sensors 5-3-10

3. Post-flight propeller inspection

- Clean propellers 8-4-1
- Inspect propellers 5-4-1

4. Post-flight controller inspection

- Clean controller 8-5-1
- Confirm level of charge 8-5-2

8.2. Post-Flight Battery Inspection

WARNING

If the battery has experienced a severe impact, there is a risk of it swelling or self-igniting. In such cases, discontinue its use immediately, place it in a fire-safe place away from flammable materials and ensure it has stabilized before proceeding further.

CAUTION

If any abnormality is found during the battery inspection, do not install it onto an aircraft or attempt to charge it. Contact your dealer.

8.2.1. Clean Battery

- Wipe the battery clean with a soft, slightly damp cloth.

ADVISORY

- Water splashed onto the battery terminals may cause a malfunction. Do not pour water directly onto the battery.
- Only clean the battery with it removed from the aircraft.

8.2.2. Confirm Level of Charge

- Ensure that the battery has a level of charge that is suitable for storage. Refer to Section A-1-1 Specifications.

8.3. Post-Flight Aircraft Inspection

CAUTION

- If the aircraft experienced a crash or other impact during flight, do not attempt to fly it again. Contact your dealer.
- If any abnormality is found during the aircraft inspection described in the following pages, do not attempt to fly it. Contact your dealer.

8.3.1. Clean Aircraft

- Wipe the dirt off each part of the fuselage with a soft, slightly damp cloth.

ADVISORY

- Water splashed onto electrical components may cause malfunction. Do not pour water directly onto the aircraft.
- Only clean the aircraft with the battery removed.

8.4. Post-Flight Propeller Inspection

CAUTION

- If the aircraft experienced a crash or other impact during flight, discontinue the use of all propellers that were installed. Separate them from propellers that are in good conditions, and dispose of them.
- If any abnormality is found during the propeller inspection, do not use them for flight. Contact your dealer.

8.4.1. Clean Propellers

- Wipe the propeller clean with a soft, slightly damp cloth.

ADVISORY

Only clean the propellers when they are removed from the aircraft.

8.5. Post-Flight Controller Inspection

CAUTION

- If the controller is dropped or experiences impact during use, discontinue use and contact your dealer.
- If any abnormality is found during the controller inspection described in the following pages, discontinue use. Contact your dealer.

8.5.1. Clean Controller

- Wipe the controller clean with a soft, slightly damp cloth .
- In particular, do not allow moisture or dust to remain on the moving parts of the antenna.

8.5.2. Confirm Level of Charge

- Ensure that the controller is in the recommended storage condition as described in Section A-1-1 Specifications.

8.6. Storage

- Ensure that the aircraft, battery, and controller are in the recommended condition for storage, as described in Section 8.1: Post-Flight Inspection.
- In addition to the recommended storage temperatures listed in Section A-1-1 Specifications, avoid storage locations with a fire hazard, high humidity, dust, and weak shelving.
- To prevent theft, store the aircraft, batteries, and controller in separate, lockable locations.

CAUTION

- The batteries include a built-in battery management system (BMS) that continuously monitors the conditions of the internal lithium-ion cells. If the battery is left in a high-temperature environment, such as the inside of a car on a hot sunny day, with full charge, the battery management system may sense an overcharge condition and engage a safety lock, rendering the battery unusable.
- If the aircraft is dropped or experiences a shock during storage, contact your dealer.

ADVISORY

- To maximize battery life, it is recommended to store batteries with around 50% charge.
- Storage at low battery levels is effective in reducing battery degradation. However, over-discharge can also cause battery degradation. The built-in battery management system (BMS) continuously consumes a small amount of energy causing the batteries to discharge very slowly over time. If the BMS detects an extreme over-discharge condition it may engage a safety lock, rendering the battery unusable. Always store batteries with around 50% remaining charge to avoid this situation. If you know in advance that you will not be able to charge a battery for a long period of time, charge the battery to a level a little higher than 50% before storing it.
- Charge batteries once every three months to prevent over-discharge.
- Store batteries disconnected from the aircraft.
- If batteries are stolen, promptly file a report with the local police and contact your dealer.

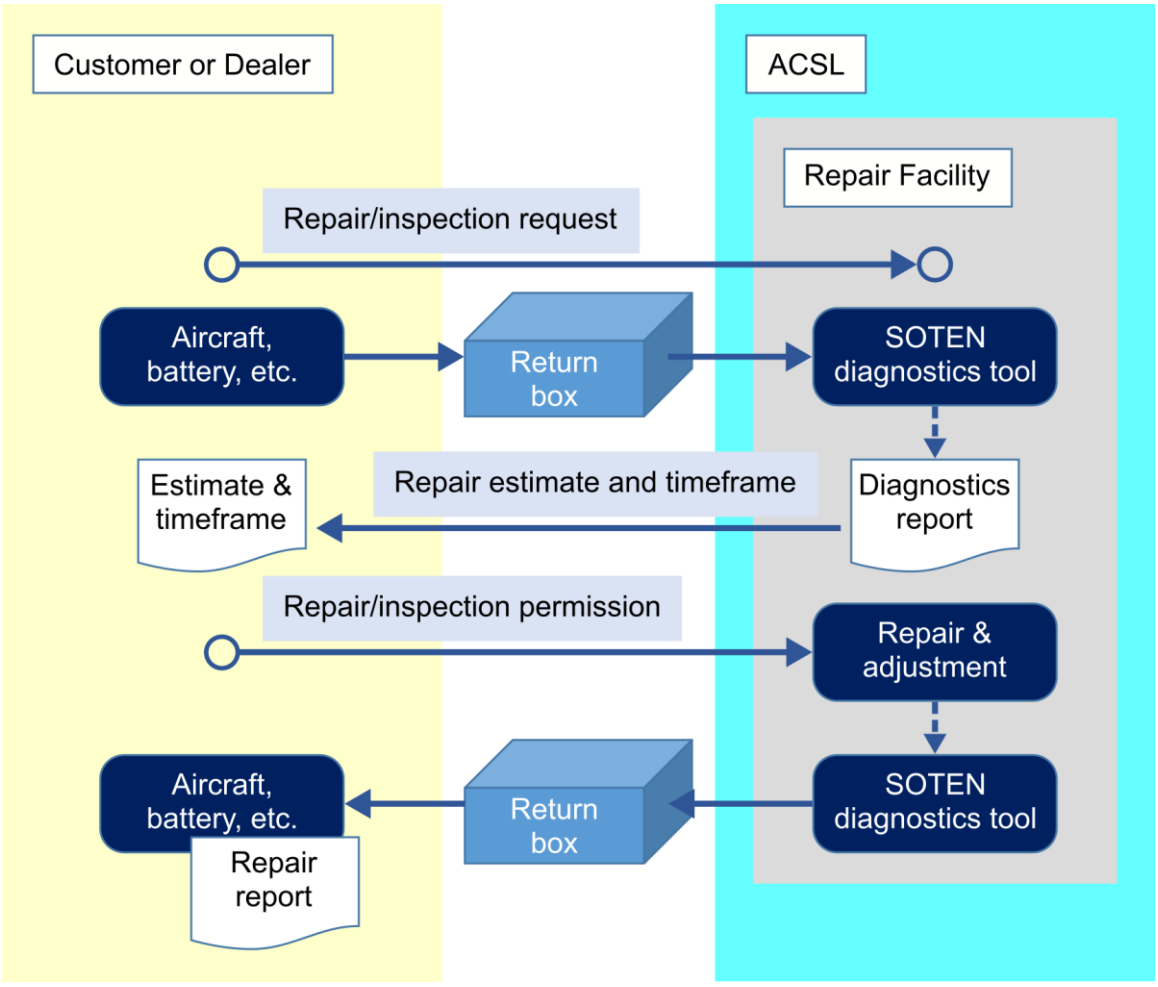
8.7. Periodic Inspection, Repair and Maintenance

- To maintain maximum performance, it is recommended that periodic inspections be performed on the aircraft and controller.
- At the time of repair or periodic inspection, the SOTEN Diagnostics Tool is used at a designated maintenance facility to check the accumulated flight time and inspect the functions of onboard equipment to identify areas in need of overhaul or repair.
- Please consult your dealer for periodic inspections.

ADVISORY

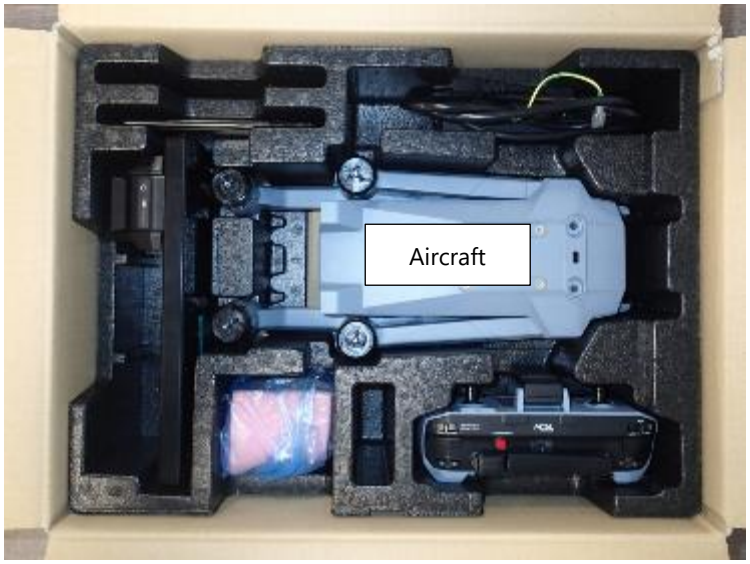
- Repair or replacement of parts may be necessary following regular inspections. Repair or replacement of parts will only be done in consultation with the customer.
- If, upon inspection, it is found that the battery is no longer usable, an inspection report will be submitted to the customer and it will be disposed of as industrial waste.

SOTEN Repair, Periodic Inspection, and Maintenance (Summary)



Shipping SOTEN for Repair, Periodic Inspection and Maintenance

- When shipping an aircraft for repair or inspection, please ship the aircraft and parts in a storage case or return box (see photo below).
- When shipping an aircraft for defect analysis, we ask that you mark it with a sticky note or similar item so that we can identify the battery that was in use at the time the defect occurred.
- Following the occurrence of abnormal behavior, do not repeatedly turn the aircraft on and off. S hip the aircraft as soon as possible.



WARNING

If the battery is cracked or otherwise damaged, it cannot be shipped because it could cause a fire or other accident while in transit. Dispose of the battery yourself in accordance with the battery disposal rules at your location.

CAUTION

After experiencing a severe impact, such as a crash, there is a risk of fire or other hazards if the aircraft is powered on. Promptly power off the aircraft and refrain from powering it on again. Contact your dealer.
In addition, repeatedly powering the aircraft on and off following a malfunction could lead to the on-board flight logs of the malfunction event, which are necessary for analysis, to be overwritten, making it difficult for ACSL to determine the cause of the malfunction.

ADVISORY

- When shipping SOTEN, remove the battery and camera from the aircraft.
- When shipping the aircraft in the carrying case, do not place additional components such as batteries in the excess space around the aircraft. There is a risk that they may knock together and cause damage to each other.
- If there are batteries, cameras, or other item that cannot fit in the carrying case, forcing them in may result in damage to these items or to SOTEN. Prepare separate packaging for these items.
- For third-party equipment, such as an anemometer, do not include them in the shipment as they may be lost. Keep such items under your own management and supervision.

8.8. Periodic Parts Replacement

- For safe use, the aircraft should be properly cared for and parts should be replaced periodically. Replacement parts should be periodically replaced in accordance with the following standards.
- Replace parts based on total flight hours or date of purchase, whichever comes first.

Replacement Parts	Total flight time	From the date of purchase
Motors	250 hours	3 years
Propeller	250 hours	3 years
Propeller mounting base	250 hours	3 years

WARNING

Failure to perform the periodic replacement of parts, as specified in this section, may result in risk of in-flight malfunction or crash.

8.9. Product Transfer

- If you wish to transfer this product to a third party, please contact your dealer.
- After the transfer of this product, after-sales support, including the notification of urgent service bulletins, will be provided to the new customer through your distributor.
- Since this product is an industrial unmanned aircraft, ACSL will not provide any after-sales support if the product is transferred to an individual customer.
- For operators in the US, upon transfer of the drone to a new owner, the previous owner must remove the registration number label from the aircraft and the new owner must re-register the aircraft themselves.

Transfer of this product to criminal entities is prohibited.

8.10. Disposal and Recycling

ADVISORY

When this product is disposed of, it is classified as industrial waste. If the product is improperly dumped or disposed of as general waste, you will be subject to punishment according to the local regulations.

8.10.1. Disposal of airframe and controller

- When disposing of the aircraft and controller, please dispose of them properly as industrial waste.

8.10.2. Battery Disposal and Recycling

- Batteries that have been involved in a crash or strong shock, or that have been submerged, damaged, or have swollen should be disposed of properly by the customer according to the disposal method specified by the local government in your area.
- Please contact your dealer for recycling of used batteries.
- For a battery that has been safety-locked, contact your dealer. A functional inspection will be performed at an authorized maintenance facility to determine whether the battery should be repaired or disposed of or recycled. In the case of disposal or recycling, a diagnostic report will be issued to the customer and the battery will be disposed of properly.

CAUTION

The transportation of batteries that have been subjected to a crash or severe shock, or batteries that have been submerged in water, damaged, or swollen, should only be done upon consultation with the carrier.

Chapter 9

Troubleshooting

9.1. Troubleshooting 172

9.1. Troubleshooting

This section describes troubleshooting actions for common problems. If you do not find a problem listed below, or if the problem persists, contact your dealer. Do not attempt to fly the aircraft until the problem has been resolved.

9.1.1. Aircraft Troubleshooting

Issue	Action
The aircraft has fallen or crashed.	Stop flying and contact your dealer. Information on inspections of the aircraft will be provided.
The BIND button cover has come off.	The waterproofing and dustproofing performance is degraded. Discontinue use and contact your dealer for repair.
No power to the aircraft.	Replace the battery.
The aircraft status LED blinks red for more than 5 minutes in a GPS environment.	Move the aircraft to a location with more unobstructed sky.
The aircraft status LED blinks red in non-GPS environment.	Move the aircraft to a location with a wall or ceiling surfaces within 3 m (10 ft) of the aircraft and restart it.
Cannot start the motors.	• Ensure that the controller is bound to the aircraft and that pilot authority has been gained. • Perform stick calibration according to '7.1.12 Stick Calibration.
Cannot start the motors. (position (POS) or auto (AUT) mode)	Move the aircraft to a location where the status LED on the aircraft does not flash red.
Strange noise when starting the motors.	Turn the motor by hand and check for foreign objects or snagging.
Certain motors do not rotate.	Discontinue use and contact your dealer for repair.
Can't take off.	Operate the controller throttle above the center position.
Cannot take off automatically. (auto (AUT) mode)	• Set the controller flight mode switch to the “AUT” position. • Complete the preflight checklist on the ACSL TAKEOFF ground control application. • Ensure that the throttle stick is in the center position.

Issue	Action
Aircraft shakes when hovering. (manual (MAN) mode)	Land the aircraft and check for any abnormalities in the aircraft, arms, or propeller attachments.
Aircraft shakes when hovering in a GPS environment. (position (POS) auto (AUT) mode)	• Ensure that there are no objects on or around the drone that may interfere with the geomagnetic compass. • Move the aircraft to a location with more unobstructed sky. • Turn off the collision avoidance switch on the controller.
Aircraft shakes when hovering in a non-GPS environment, (Position mode/Auto mode)	• Move the aircraft to a location with a wall surface within 3 m in front of the aircraft and restart it. • Turn off the collision avoidance switch on the controller.
Cannot go straight or turn right or left. (position (POS) auto (AUT) mode)	If there are any objects on or around the drone that may interfere with the geomagnetic compass, discontinue the flight.
The speed is too slow. (position (POS) mode)	The aircraft may have switched to visual odometry as a result of poor GPS reception. The notification “Navigation soured switched” is displayed when the aircraft switches from GPS to visual odometry.
I can’t land. (manual (MAN) mode)	• This product uses a barometric pressure sensor for altitude control. Changes in air pressure near the ground, etc., may affect throttle operation. • Select auto-landing on the controller or ACSL TAKEOFF ground control application.
I can't land. (position (POS) mode)	• This product uses a barometric pressure sensor for altitude control. Changes in air pressure near the ground, etc., may affect throttle operation. • Select auto-landing on the controller or ACSL TAKEOFF ground control application.
Can't auto-land.	• Check that the controller status LED is solid green and that the notification “Radio comms interrupted” is not displayed. • Land it in position (POS) mode or manual (MAN) mode.

9.1.2. Controller Troubleshooting

Issue	Action
The controller does not respond when plugged into a USB charger.	• Check if the controller temperature is appropriate. • The charging port is located on the bottom of the controller. Connecting a charger to the data communication port on the top of the controller will not recharge the battery. • Try a different USB charger. • If the problem persists, contact your dealer.
Charging is not complete after a long period of time.	If this occurs even after replacing the charger, contact your dealer.
Controller housing section is bulging. There is a strong chemical odor.	Do not touch the controller with your bare hands. Temporarily place the controller in a fire-safe location that is as far away as possible from flammable materials, buildings, or crowded places, and away from rainwater or other water sources. If you have an explosion-proof case, temporarily store the controller in the explosion-proof case.
The controller was dropped and the casing was damaged/deformed. The controller was submerged in water. Seawater splashed onto the controller.	There is a possibility that the controller could start to smoke or catch fire. Temporarily place the controller in a fire-safe location that is as far away as possible from flammable materials, buildings, or crowded places, and away from rainwater or other water sources. If you have an explosion-proof case, temporarily store the controller in the explosion-proof case.
The controller is submerged in seawater	If the controller behaves strangely, do not force it out of the seawater. It is extremely dangerous.

9.1.3. Battery Troubleshooting

Issue	Action
The battery does not respond at all when plugged into a charger.	If you have more than one battery, check that the charger is not defective. If the charger is defective, contact your dealer immediately.
The status LED is lighting or flashing in a pattern not described in this manual	Please contact your dealer as soon as possible.
The safety lock has engaged. ➔ See '2.6.3 .Battery Modes'	The battery's internal battery management system (BMS) has determined that the battery is no longer safe for continued use. This battery will no longer power on. The cause of the safety lock can be diagnosed by an authorized maintenance facility. For more information, contact your dealer.
The battery is swollen.	Do not touch the battery with your bare hands. Temporarily place the battery in a fire-safe location that is as far away as possible from flammable materials, buildings, or crowded places, and away from rainwater or other water sources. If you have an explosion-proof case, temporarily store the battery in the explosion-proof case.
There is a strong chemical odor.	Do not touch the battery with your bare hands. Temporarily place the battery in a fire-safe location that is as far away as possible from flammable materials, buildings, or crowded places, and away from rainwater or other water sources. If you have an explosion-proof case, temporarily store the battery in the explosion-proof case.
The battery has been submerged in water.	There is a possibility that the controller could start to smoke or catch fire. Do not touch the battery with your bare hands. Temporarily place the battery in a fire-safe location that is as far away as possible from flammable materials, buildings, or crowded places, and away from rainwater or other water sources. If you have an explosion-proof case, temporarily store the battery in the explosion-proof case.
Seawater splashed onto the battery.	There is a possibility that the controller could start to smoke or catch fire. Do not touch the battery with your bare hands. Temporarily place the battery in a fire-safe location that is as far away as possible from flammable materials, buildings, or crowded places, and away from rainwater or other water sources. If you have an explosion-proof case, temporarily store the battery in the explosion-proof case.
The battery is submerged in seawater.	If the battery behaves strangely, do not force it out of the seawater. It is extremely dangerous.

A Appendix

A-1 Specification 177
A-2 Change History 184

A-1 Specifications

A-1-1 Specifications

Aircraft		
Model		L14 (without LTE) L22 (equipped with LTE)
Dimensions	When arms are extended	Overall length 560 mm / width 637 mm / height 153 mm (Overall length 22.0" / width 25.1" / height 6.0") (including propellers)
	Arms retracted	Overall length 363 mm / width 162 mm / height 144 mm (Overall length 14.3" / width 6.4" / height 5.7")
Weight (without battery or camera)		L141 (without LTE): approx. ≈ 1,050 g (2.31 lbs) L221 (equipped with LTE): ≈ 1,070 g (2.36 lbs)
Number of propellers		4
Maximum takeoff weight		2,000 g (4.41 lbs)
Flight time	High capacity battery	29 minutes (conditions: without standard camera, wind speed 8 m/s)
Altitude limit		2,000 m (6,560 ft)
Ingress protection rating		IP43 (with camera, gimbal and battery installed) *Flying in the rain is not recommended.
Operating environment temperature		-20 to 40°C (-4 to 104°F) *Conditions apply for use in low-temperature environments.
Obstacle detection system		Stereo cameras: 3 directions (forward, upward, downward)
Laser distance sensor		Class 1 laser equipment
External power supply capability		USB type-C® 5V 500mA or less *Since the aircraft is electrically connected to the internal system, it may be affected by external equipment. In principle, please do not feed power to external devices during flight.

Controller	
Built-in battery nominal voltage	7.2 V
Rated current capacity	5,000 mAh
Rated energy capacity	36.0 Wh
Dimensions	194 mm x 129 mm x 84 mm (7.6″ x 5.1″ x 3.3″)
Weight	≈ 500 g (1.1 lbs)
Mobile device port	USB 2.0 Full Speed
Charging standards	USB BC (Battery Charging Specification 1.2)
Rated voltage for charging	5 V
Maximum charging current *1	• SDP standard charger max 5 V 0.5 A • CDP standard charger max 5 V 1.5 A • DCP standard charger max 5 V 1.5 A • Standard charger, etc. max 5 V 2.4 A • Chargers not applicable to the above max 5 V 1.0 A
Maximum charging power *1	• SDP standard charger max 2.5 W • CDP standard charger max 7.5 W • DCP standard charger max 7.5 W • Standard charger, etc. max 12.0 W • Chargers not falling under the above max 5.0 W
Recommended charging temperature (ambient)	0 to 40°C (32 to 104°F)
Recommended operating temperature (ambient)	0 to 40°C (32 to 104°F)
Recommended storage temperature (ambient)	Less than 3 months: -10 to 45°C (14 to 113°F) More than 3 months: -10 to 20°C (14 to 68°F), no condensation
Recommended storage conditions	Battery level: ≈ 30% Ambient temperature: ≈ 20°C (68°F) Humidity: ≈ 45%
Only models equipped with a 920 MHz training radio (Japan only)	
Training radio frequency band	920.6 to 927.8 MHz (L-band) 928.15 to 929.65 MHz（H band)
Training radio power (EIRP)	1.2 mW (L band) 0.8 mW (H-band)
Japan technical standards compliance certification	001-A11789

Controller	
Maximum transmission distance between training radios *2	100 m (330 ft) (open area with no radio interference and good visibility)

High-Capacity Battery (aircraft)	
Nominal voltage	23.1 V
Maximum charge voltage	26.4 V
Rated current capacity	4,075 mAh
Rated power capacity	94.1 Wh
Dimensions	Overall length 107 mm / width 75 mm / height 53 mm (Overall length 4.2″ / width 3.0″ / height 2.1″)
Weight	≈ 480 g (1.1 lbs)
Approximate charging time	≈ 2 hours (indoors at 25°C)
Ingress protection rating	IP43 (The terminal should not be wetted by water or condensation.)
Chargeable temperature (internal temperature)	0 to 45°C (32 to 113°F)
Recommended charging temperature (ambient)	0 to 40°C (32 to 104°F)
Recommended operating temperature (ambient)	0 to 40°C (32 to 104°F)
Recommended storage temperature (ambient)	Ambient temperature 0 to +35°C (-22 to +140°F) 0 to 35°C (32 to 95°F) , no condensation
Recommended storage conditions	Battery level: ≈ 50% (first two battery level indicator LEDs lit)
Normal charging (3.0 A)	Pack internal temperature: +5 to +45°C (41 to 113°F)
Low speed charging (0.8 A)	Pack internal temperature: 0 to +5°C (32 to 41°F)

Battery Charger	
Voltage	100 to 240V, 2A, 50 to 60Hz
Rated output	26.4V @ 3A, 5V @ 2A 33.6V @ 2.4A, 5V @ 2A, 90W total maximum

Wireless Communications	
Controller	
Communication frequency band	2,412 to 2,477 MHz
Power	0.009 W/MHz
Bandwidth	14 channels, 5 MHz spacing
Modulation	G1D
Encryption	AES256
Japan technical standards compliance certification	Aircraft: 001-X00399 Controller 001-X00400
Specified radio equipment type (Japan)	Article 2, Paragraph 1, Item 19 of the Certification Regulations 2.4GHz Band Advanced Small Power Data Communication System
Maximum transmission distance *2	4 km (2.5 miles), line-of -sight (open area with no radio interference and good visibility)
Bluetooth	
Bluetooth Version	Bluetooth 4.0 and 5.0
Japan technical standards compliance certification	001-A14398
Maximum transmission distance *2	300 m (1,000 ft), Bluetooth 5.0
Remote ID standard	ASTM F3411-22A Broadcast Type

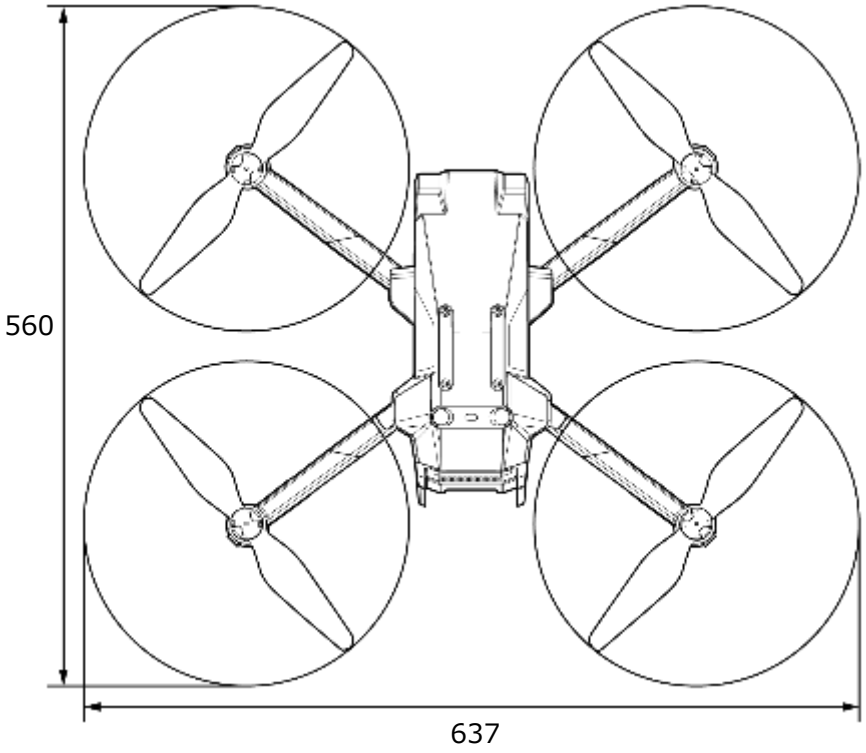
1 The values may vary depending on the compatible standard and power supply capacity of the charger used to supply power. Please check the user manual of the charger used.

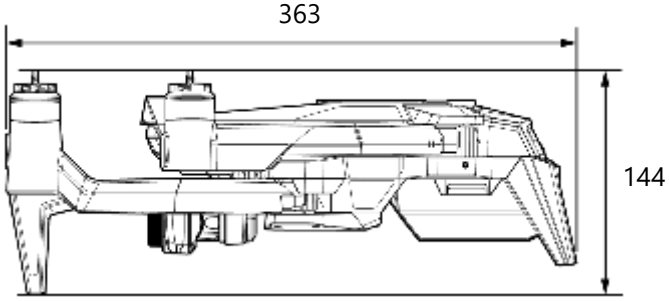
2 The maximum transmission distance is the transmission distance under favorable conditions and does not guarantee performance under actual operating conditions. It depends on the surrounding radio environment, line-of-sight conditions, and the orientation of the controller.

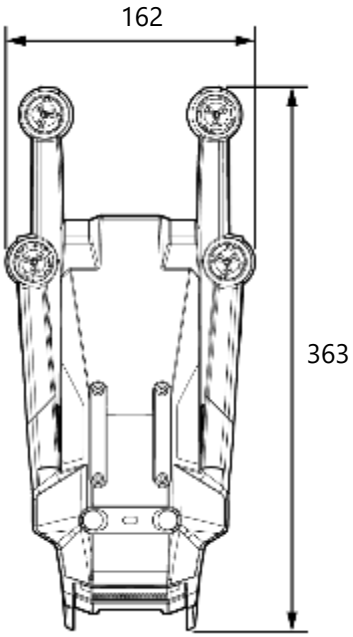
A-1-2 Dimensions

Aircraft

Unit: mm



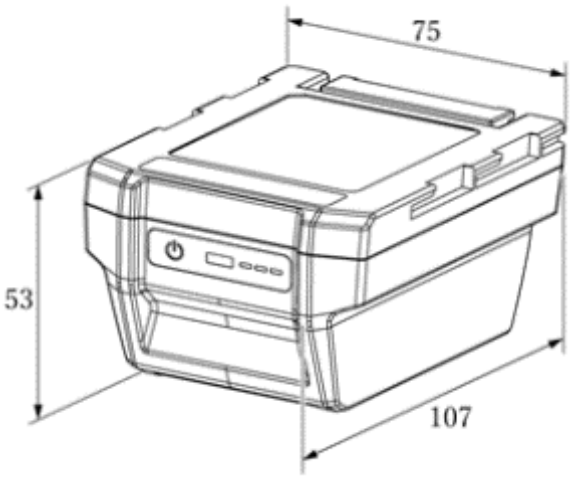




Battery

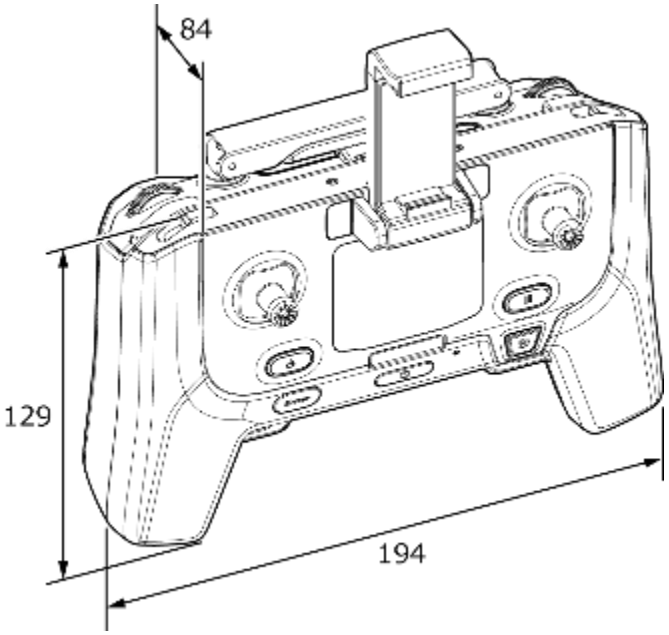
Unit: mm

High-capacity battery



Controller

Unit: mm



A-2 Change History

Version	Date	Details of Revision	Editor
2.11-US1	5/17/2024	First edition	ACSL Ltd. Production Unit

Manufacturer Information

Manufacturer

ACSL Ltd.
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3-6-4 Rinkai-cho, Edogawa-ku
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For individual questions, please contact the distributor listed on the back cover of this manual.

Specifications are subject to change without notice due to product improvement.

First edition May 2024

Distributor Contact