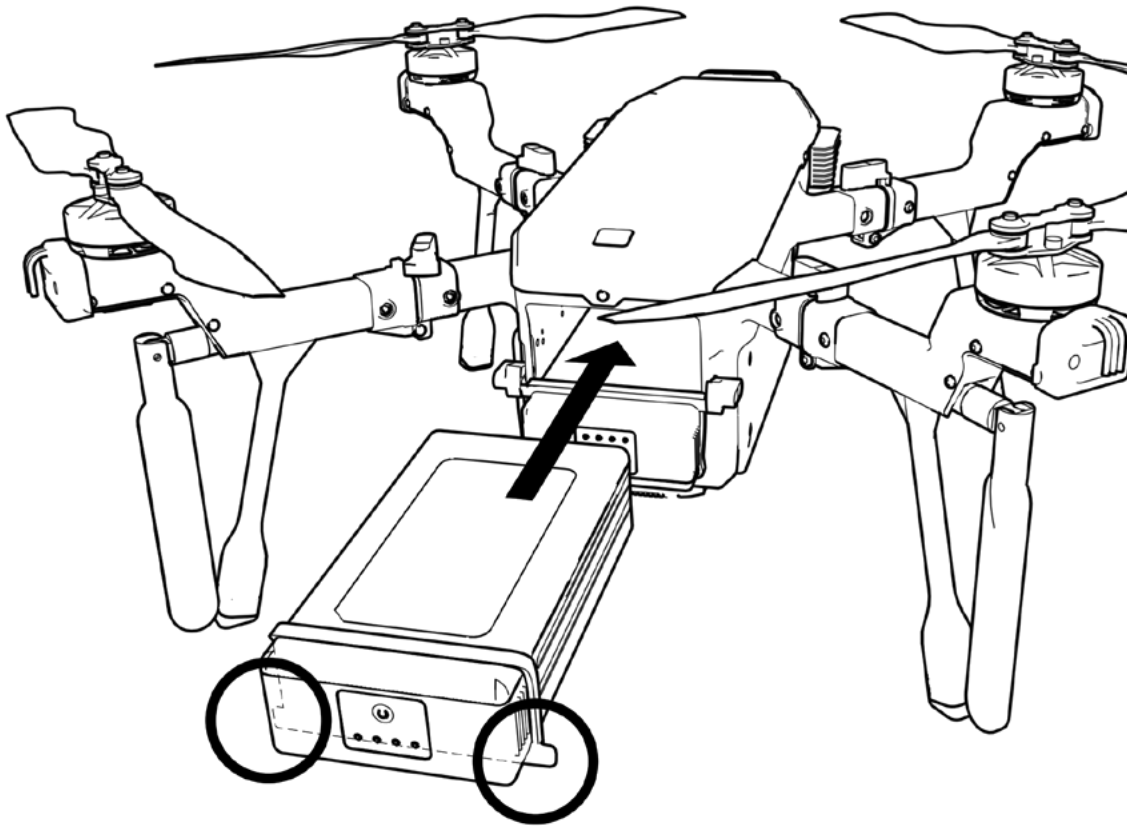
TELEDYNE FLIR

SIRAS™

Battery Safety Instruction Guide



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Key to Symbols:

⚠ **This is a warning notice. Failure to heed warnings can lead to damage or injury.**

ⓘ **This is an informational notice, calling attention to an important detail.**

☛ **This is a tip that can improve your effectiveness in using the product.**

1. INTRODUCTION

The SIRAS™ mobile drone is a professional aircraft, intended to be operated by USA FAA Part 107 certified pilots or pilots holding equivalent certifications. By operating the SIRAS drone, you agree to abide by and be bound by the requirements and limitations set forth in the SIRAS Standard Bundle User Manual. Please carefully note the contents of this manual and the safety warnings in the *SIRAS User Manual*.

This manual focuses on the proper care and safe handling of the SIRAS batteries, as well as flight dynamics influenced by the state of a given battery pair. Proper care prolongs the life of the batteries and enhances flight safety. Inappropriate use, charging, or battery storage may cause a fire, property loss, or injury to oneself and/or others.

The SIRAS aircraft uses two batteries that are specifically designed with side gaskets and locking tabs to fit into the upper and lower battery compartments of the aircraft. The batteries are identical except for these surface features, which ensure their proper orientation and water ingress protection. SIRAS is IP 54 rated only when these gaskets are in place and in good condition.

FIGURE 1.A SIRAS BATTERY

2. BATTERY STORAGE AND USE REQUIREMENTS

A. Battery Storage Temperature and Charge Level

SIRAS batteries must always be stored outside of the airframe in a cool, dry environment. The ideal battery storage temperature is at 20ºC – 25ºC (68ºF – 77ºF) with the battery charge level at 40% to 60%. If storing for a prolonged period, check the batteries every few weeks and recharge them to 60% if they are below 30%.

Avoid storing batteries in hot vehicles, direct sun light, on hot surfaces. See Storage and Battery Management System (BMS) for more information.

⚠ **Do not store batteries in temperatures at or warmer than 32ºC (90ºF).**

⚠ **Do not get batteries wet or store near liquids.**

⚠ **Store batteries in an appropriate battery storage box.**

⚠ **Storage above 25ºC (77ºF) and/or with charge levels consistently greater than 60% will shorten battery life.**

⚠ **A battery with 0% charge may sustain damage and lose its ability to be recharged.**

B. Battery Discharge in Hot Ambient Weather

When flying SIRAS in ambient conditions 27ºC – 40ºC (80ºF – 105ºF), land SIRAS when the battery level reaches 20%. The highest internal battery temperatures are reached in the final phase of discharge when batteries are below 20% charge level. The 20% rule is not required when the ambient temperature is less than 27ºC (80ºF).

⚠ **Repeated discharging to less than 20% charge during flight in temperatures greater than 27ºC (80ºF) can cause a battery to exceed its design threshold temperature and swell.**

⚠ **Never fly SIRAS when the ambient temperature is 40ºC (105ºF) or above. Routine flying at temperatures below but near to this limit may over time shorten battery life.**

ⓘ **Keep batteries cool until right before operation using a battery or AC powered cooler set to 18ºC (65ºF)**

ⓘ **Remove the batteries and cool them immediately after landing**

ⓘ **Plan mission to land with greater than 20% charge level remaining.**

ⓘ **Avoid using Sport mode in warm or hot weather.**

C. Battery Discharge and Return to Home (RTH) Function

SIRAS will RTH when the battery levels reach 15%. RTH at 15% remaining battery charge is highly recommended at any ambient temperature. RTH can be stopped by switching the flight mode from Position to Sport and back Position again. SIRAS will auto-land if the battery charge level is 5% or less. During this safety mode, the pilot can control the drone in the horizontal plain, as well as accelerate the descent. But the pilot cannot command the drone to ascend when the batteries reach 5% charge or less. Use the horizontal controls to assure you are landing in a safe place.

⚠ **Do not fly in Attitude Mode to avoid RTH.**

⚠ **SIRAS will auto-land wherever it is if the battery levels are allowed to reach 5%.**

D. Version 1 and Version 2 Battery Drain and Recovery

SIRAS batteries must always be stored outside of the airframe in a cool, dry environment. The ideal battery storage temperature is at 20ºC – 25ºC (68ºF – 77ºF) with the battery charge level at 40% to 60%. SIRAS batteries lose approximately 1% charge per day when not stored in the drone and 3% per day if mistakenly stored in the drone or on the battery charger.

There are two versions of the SIRAS battery: version 1 (V1) and version 2 (V2). V1 batteries do not include a “V1” marking on the battery label. V2 batteries include a large “V2” on the battery label. The V1 battery cannot be recovered if they drain to 0%. V2 batteries can be recovered for up to 30 days after they drain to 0%. See Storage and Battery Management System (BMS) for more information.

⚠ **V1 batteries cannot be recovered if they drain to 0%.**

ⓘ **V2 batteries can be recovered for up to 30 days after they drain to 0%.**

ⓘ **Check and maintain battery charge levels routinely during storage to optimize battery life.**

E. Special Use Case: Flying, Landing, and Flying Again

The SIRAS airframe checks the battery temperature prior to takeoff. It assumes the batteries are fresh and their temperature is the same as the ambient air temperature. If the measured battery temperature is above 105F, SIRAS assumes the ambient temperature is above 105F and will prevent takeoff, issuing a warning to the pilot.

A warm battery warning can occur when a pilot in less than 105F ambient temperature flies for a few minutes then lands and then desires to takeoff again. During the initial flight, especially on a warm day (e.g., 90F+) the battery

temperature may rise above 105F, which is normal and safe. However, SIRAS misinterprets this measurement and assumes the ambient temperature is above 105F and prevents takeoff.

In this situation, where landing and sitting for a few minutes followed by another takeoff is desired, it is best to check the battery temperature on the Safety Menu. If they are above 105F, remove the batteries and let them cool for 5-minutes. Alternatively, swap in a new pair of batteries and top off charge the original pair. Generally speaking, these circumstances only occur on very warm days and after about 10-minutes of initial flight.

3. INDICATOR LIGHTS AND CONTROL BUTTON

A. Battery Indicator Lights

The top of the battery, illustrated in Figure 2.A, has a button and four LEDs.

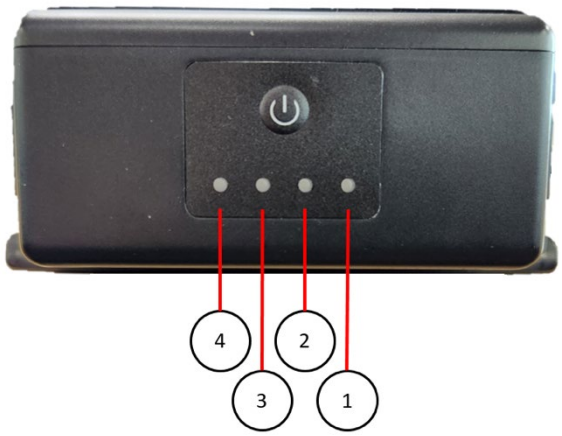

FIGURE 2.A BUTTON AND LEDS ON SIRAS BATTERY

B. Battery Button

B1. Check/Standby:

One short press of the Battery button will activate the battery from the Power-Off state and put it into Standby Mode. The LED display will then show the current battery charge level, as described in Table 2-A. The display turns off after five seconds and re-enters the Power-Off state after another five seconds.

B2. Power-On:

To power on the battery, start in the Power-Off state, and give the Battery button a short press (to enter the Check state). While the lights are still on, press and hold the Battery button for at least two seconds. The power indicator lights will be lit in order from LED1 to LED4, completing the Power-On action, after which the LED display will show the current power level.

Power-Off/Sleep:

When the battery is in the Power-On state, give the Battery button a short press. This will light the four LEDs. Then, press and hold the Battery button for more than two seconds. The power indicator lights will turn off, in order from LED4 to LED1. The battery will now be in the Power-Off state. The battery also enters the Power-Off state after ten minutes of inactivity.

C. Interpreting the Battery Indicator Lights

C1. Standby or Discharge Mode

In Standby Mode and when the batteries are installed in the aircraft with the power on, the four LEDs indicate one of eight battery levels, as shown in Table 2-A.

TABLE 2-A LEDS IN STANDBY OR DISCHARGE MODE

CAPACITY	LED4	LED3	LED2	LED1
0%~12%	○	○	○	✹
13%~24%	○	○	○	●
25%~37%	○	○	✹	●
38%~49%	○	○	●	●
50%~62%	○	✹	●	●
63%~74%	○	●	●	●
75%~87%	✹	●	●	●
88%~100%	●	●	●	●

✹ FLASH ○ OFF ● ON

C2. Charging Mode

When the battery is in charging mode, the four LEDs indicate one of the five battery levels shown in Table 2-B. (Charging is described in Chapter 0).

TABLE 2-B BATTERY LEDS DURING CHARGING

CAPACITY	LED4	LED3	LED2	LED1
0%~24%	○	○	○	✹
25%~49%	○	○	✹	✹
50%~74%	○	✹	✹	✹
75%~99%	✹	✹	✹	✹
100%	●	●	●	●

✹ FLASH ○ OFF ● ON

ⓘ **The charger has a different indicator lighting pattern—see Table 3-A and Table 3-B.**

ⓘ **The battery level indicator lights will turn off after being fully charged (100%) for 10 minutes.**

C3. Remaining Battery Life

As described in 2.B above, pressing the Battery button in the Power-Off state and holding it for approximately eight seconds causes the battery to enter the Health Indicator state, in which the LEDs indicate remaining useful battery life, as shown in Table 2-C.

TABLE 2-C. LEDS INDICATING REMAINING USEFUL LIFE

REMAINING USEFUL LIFE	LED4	LED3	LED2	LED1
88%~100%	●	●	●	●
75%~87%	✹	●	●	●
63%~74%	○	●	●	●
50%~62%	○	✹	●	●
38%~49%	○	○	●	●
25%~37%	○	○	✹	●
13%~24%	○	○	○	●
Below 12%	○	○	○	✹
✹ FLASH ○ OFF ● ON				

4. CHARGING INSTRUCTIONS

A. Using the Battery Charger

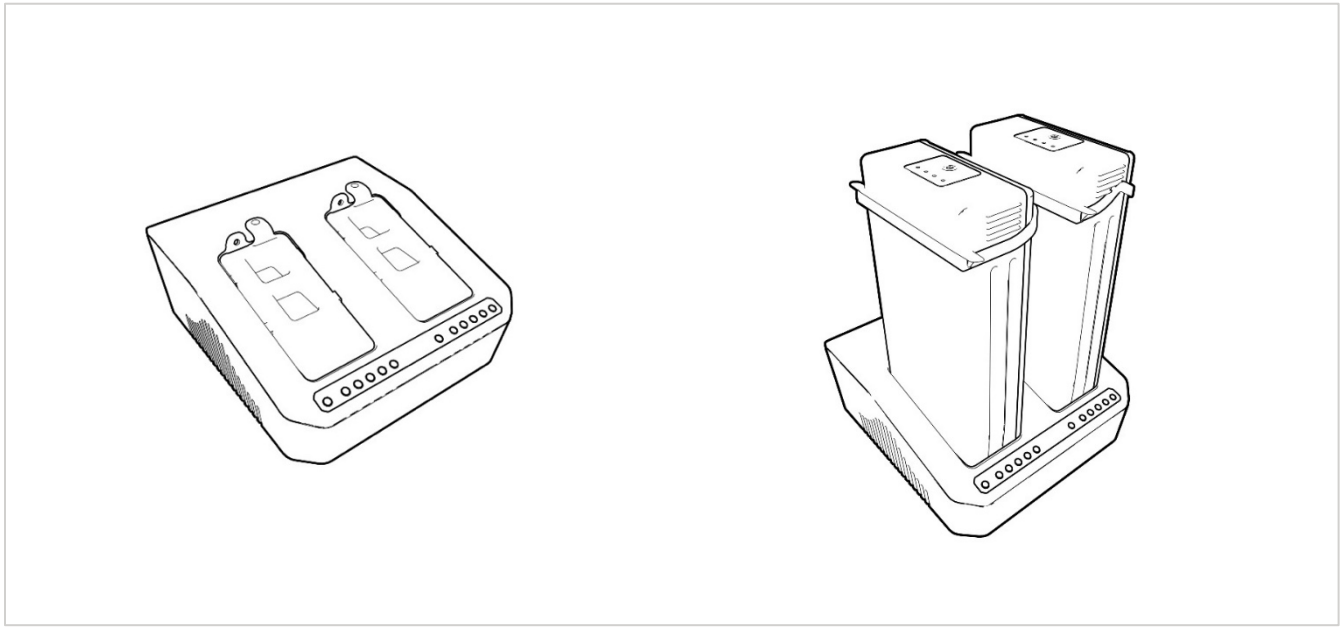

FIGURE 3.A BATTERY CHARGER

⚠ **Charge the batteries in a flat, open area.**

ⓘ **Immediately after a flight, the batteries will be warm. Allow them to cool to ambient temperature before charging. Charging the batteries while still warm will significantly reduce battery life.**

ⓘ **The battery charger will only operate in the temperature range 6 - 50ºC (42 – 122 °F) (see Table 3-C).**

⚠ **Use only the charger provided. Failure to do so could allow charging to exceed the maximum rated voltage. This could impair the battery's charge/discharge performance, mechanical performance, and safety, as well as cause overheating or leakage.**

ⓘ **Charge batteries in pairs. The two batteries should have charge levels within 5% of each other. Charge level differences greater than 5% can cause both batteries to wear more quickly and could diminish aircraft performance.**

Charge batteries according to the following steps:

1. Connect the aircraft battery charger to a power source.
2. Turn off the Power switch on the back of the charger.
3. Inspect the contact pins in the charger to ensure that they are straight (see Figure 3.B).

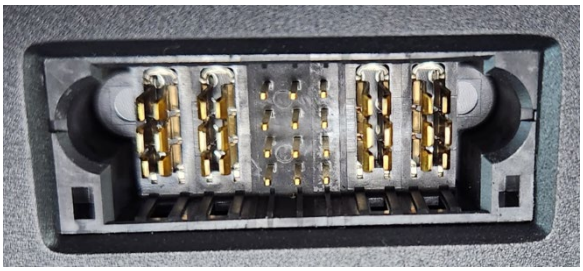

FIGURE 3.B CHARGER PINS

4. While the power is off, gently insert up to two aircraft batteries into the charger, making sure they are oriented correctly.

⚠ **The batteries only fit into the charger in one orientation. Do not force the batteries into the charger, as doing so will damage the charger pins. If the batteries do not slide into the charger, make sure you are inserting them in the proper orientation and that the pins are straight.**

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5. Flip the Power switch on the back of the charger to ON. The power-level indicator LEDs on the charger will begin to flash.
6. Check the charger lights as shown in Table 3-A and Table 3-B. Stop charging if the lights indicate an error.
7. Charge batteries to full capacity as indicated by all power level indicator LEDs on the charger being illuminated. When fully charged, the charger will also emit a completion sound.
8. Turn the charger off and unplug it from the power source.
9. Remove the batteries and store them in their storage unit or install and use them in the aircraft.
10. Do not store batteries in the aircraft—doing so will slowly drain them.

B. Battery Charger Display Lights

TABLE 3-A. AIRCRAFT BATTERY CHARGER POWER-LEVEL INDICATOR LEDS

CAPACITY	LED (100%)	LED (80%)	LED (60%)	LED (40%)	LED (20%)
<20%	○	○	○	○	✸
>20%	○	○	○	✸	●
>40%	○	○	✸	●	●
>60%	○	✸	●	●	●
>80%	✸	●	●	●	●
100%	●	●	●	●	●

○ OFF ✸ FLASH ● ON

Table 3-B provides diagnostic information for when batteries are not charging as expected. Often, these errors can be cleared by turning off the charger, removing the batteries, re-inserting them, and turning the charger back on. If errors persist, notify your customer service representative.

TABLE 3-B. CHARGER ERROR MESSAGES

LED (ERROR)	LED (100%)	LED (80%)	LED (60%)	LED (40%)	LED (20%)	DESCRIPTION OF THE INDICATOR LIGHTS
✸	○	○	○	○	●	Output overvoltage*
✸	○	○	○	●	○	Output overcurrent*
✸	○	○	●	○	○	Charger temperature is too high+
✸	○	●	○	○	○	Unmatched voltage of the balancing port and main port*
✸	●	○	○	○	○	Low voltage of AC power output*

LED (ERROR)	LED (100%)	LED (80%)	LED (60%)	LED (40%)	LED (20%)	DESCRIPTION OF THE INDICATOR LIGHTS
✸	○	○	●	○	●	Battery voltage is too low*
✸	○	●	○	○	●	Battery voltage is too high*
✸	●	○	○	○	●	Battery temperature is too low, <5 ºC (41ºF) **
✸	○	○	●	●	○	Battery temperature is too high, >50 ºC (122ºF) +

○ OFF ✸ FLASH ● ON

* Contact FLIR Service
\+ Allow cooling before charging batteries
** Warm batteries to at least 5 ºC (41ºF) before charging

C. Charger Performance as a Function of Temperature

Table 3-C details charger performance as a function of ambient temperature. Batteries should be kept between 16ºC and 45ºC (61ºF – 113ºF) for optimum charging performance.

TABLE 3-C. CHARGING PERFORMANCE AS A FUNCTION OF BATTERY TEMPERATURE

BATTERY TEMPERATURE	CHARGING PERFORMANCE
<5ºC (41ºF)	No Charge - Error LED will illuminate
6ºC ~ 15ºC (42ºF ~ 59ºF)	1.2A Slow Charge
16ºC ~ 45ºC (61ºF ~ 113ºF)	Normal 6A Charge
46ºC ~ 50ºC (115ºF ~ 122ºF)	1.2A Slow Charge
> 50ºC (122ºF)	No Charge - Error LED will illuminate

5. BATTERY MANAGEMENT SYSTEM (BMS)

The battery has a built-in Battery Management System (BMS) that automatically performs the operations described here.

A. Power-Off Mode

After the battery has been in Power-On mode for 10 minutes and not in use, the BMS will set the battery to Power-Off mode to reduce power consumption. As described in 2.B, Power-On mode can be reactivated by pressing the Battery button briefly.

B. Smart Storage

ⓘ **If the battery is not going to be used for more than 10 days, it is best to discharge it to approximately 40%-60% before storing it. This will prolong the battery's useful life even though the battery automatically performs its own charge level management.**

If the battery is stored with a high charge level, the Smart Storage function will automatically activate. A stationary battery wakes up from Sleep Mode once every two days to monitor its charge level. If the power level is below 50%, the battery will automatically enter Deep Sleep mode. If the power level is above 50%, the battery will return to Sleep mode. If on the tenth day of the battery being stationary, the power level is still above 50%, the battery will automatically discharge to 50% and then enter Deep Sleep mode. During the discharge process, the battery temperature may increase.

6. HANDLING, DISPOSAL, AND WARNINGS

A. Handling and Disposal

⚠ **If a battery catches fire, use a Type ABC extinguisher and give the battery time to cool.**

⚠ **Avoid touching a leaking or deformed battery. The liquid inside the battery is corrosive. If the liquid comes into contact with skin or eyes, rinse the affected area in water for at least 15 minutes and seek proper medical treatment.**

⚠ **Fully discharge a battery before disposal.**

⚠ **Dispose of a used battery at a hazardous waste facility. Do not discard with ordinary trash or with recycling materials.**

⚠ **Do not dispose of a battery by burning it.**

B. Transportation

⚠ **Do not transport damaged batteries. Instead, contact a company that handles hazardous materials professionally.**

ⓘ **Before a battery is transported via public transportation of any kind, discharge the battery to 30%, or to the level required by local regulations.**

⚠ **Do not transport a battery in close proximity to metal objects.**

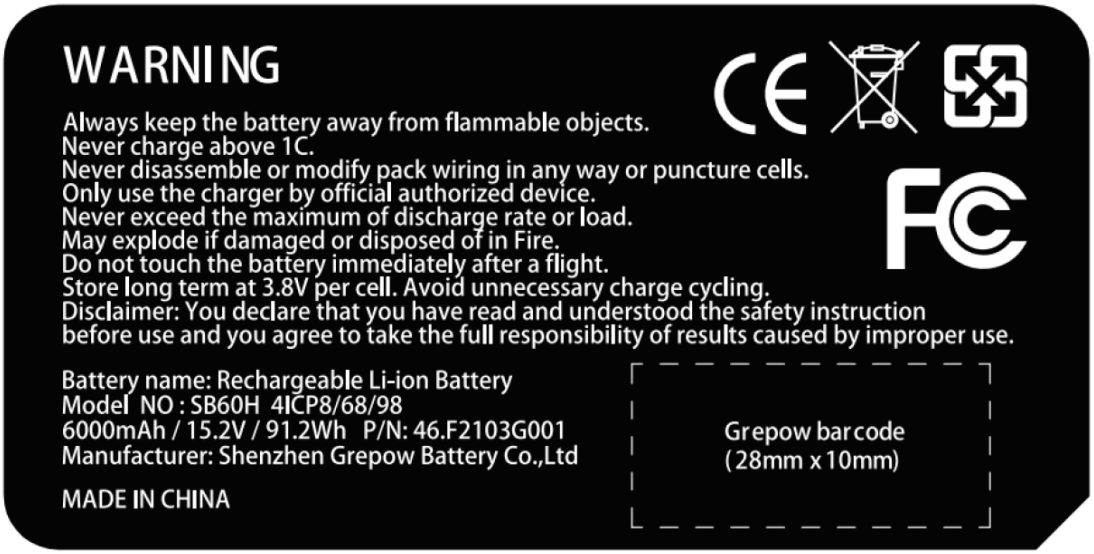
⚠ **When traveling by air, do not place batteries in checked baggage. Transporting in carry-on baggage is allowed (at the appropriate charge level).**

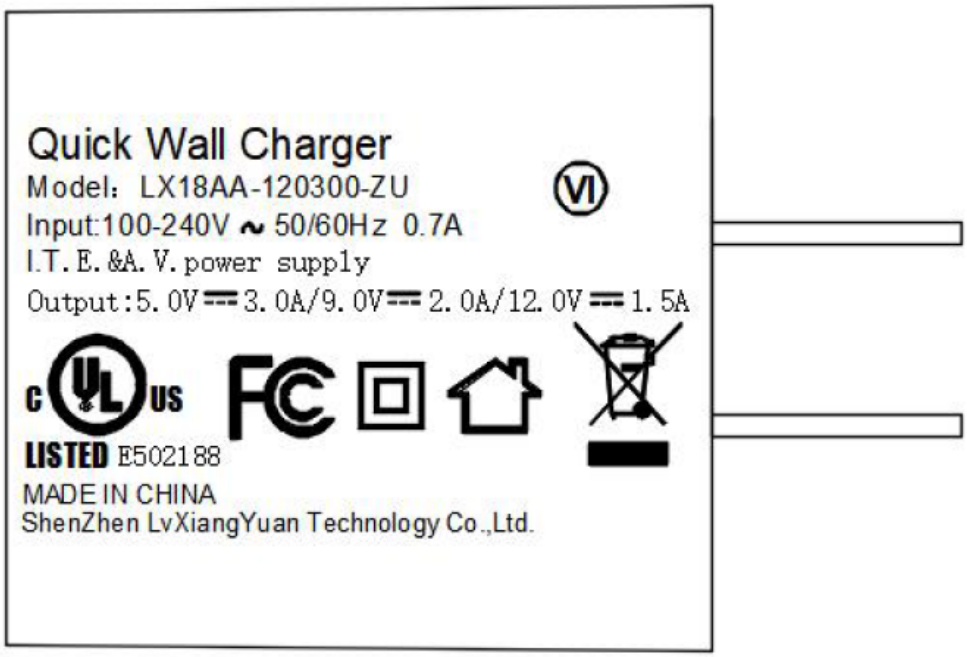
⚠ **Do not ship batteries by air.**

C. Warnings

1. Do not open or damage the battery's external case, as this may cause a short circuit or fire.
2. Do not get the battery wet or let the battery touch any form of liquid. Do not use the battery in the rain or in a humid environment. Doing so can cause spontaneous combustion, or possibly an explosion.
3. Do not use a swollen, leaking, or damaged battery—it could catch fire or explode.
4. If the battery drops from the airframe or is hit by an external force, do not use the battery again.
5. If the airframe falls into the water, retrieve the airframe, and remove the battery. Leave the battery in an open area until it is completely dry. Keep your distance from the battery, and after the battery has dried, never use it again.
6. Do not connect the battery directly to the socket on the wall or the socket in the car for charging.
7. Do not dispose of the battery in a fire or store it at a temperature higher than 45 °C (113 °F).
8. Do not use the battery when it smells foul or when it is hot, deformed, or discolored. If the battery is in use or is charging and is in any of these conditions, take it out of the airframe or charger. Allow it to cool, if necessary. Avoid touching a leaking battery.
9. Never use a wire or any other metal object to short circuit the positive and negative electrodes.
10. Do not store the battery near a microwave oven or pressure cooker.
11. Never place the battery on a conductive surface.
12. Do not hit the battery or put it under a heavy object.
13. Do not expose the battery to strong static electricity (e.g., lightning) or to a high magnetic field. This type of exposure could disable the built-in safety features of the battery and damage both the battery and the airframe.
14. The operating temperature of the airframe battery is −10ºC – 40ºC (14ºF – 104ºF). If the ambient temperature is above 60ºC (140ºF), the battery might catch fire. If the ambient temperature is below −10ºC, battery life will be significantly shortened.
15. In ordinary use, do not allow batteries to drain below a 5% charge, as this may permanently damage the batteries' ability to recharge. Exception: final disposal (see 6.A).
16. Remove and charge the batteries promptly after a flight. Batteries left in a powered-off aircraft will eventually drain down to 0% and will sustain damage.
17. Keep the batteries away from children. If children swallow parts of the battery, seek medical assistance immediately.

7. WARNING LABELS





If you have questions that are not covered in this manual contact FLIR Commercial Systems Customer Support (SBA-Cores@flir.com) for additional information. Contact Customer Support for questions related to the use of open-source software in this product. And contact Customer Support prior to returning a camera which is in need of service.

This documentation and the requirements specified herein are subject to change without notice.

This equipment must be disposed of as electronic waste.

Contact your nearest FLIR Commercial Systems, Inc. representative for instructions on how to return the product to FLIR for proper disposal.

FCC Notice. This device is a subassembly designed for incorporation into other products in order to provide an infrared camera function. It is not an end-product fit for consumer use. When incorporated into a host device, the end-product will generate, use, and radiate radio frequency energy that may cause radio interference. As such, the end-product incorporating this subassembly must be tested and approved under the rules of the Federal Communications Commission (FCC) before the end-product may be offered for sale or lease, advertised, imported, sold, or leased in the United States. The FCC regulations are designed to provide reasonable protection against interference to radio communications. See 47 C.F.R. §§ 2.803 and 15.1 et seq.

Industry Canada Notice. This device is a subassembly designed for incorporation into other products in order to provide an infrared camera function. It is not an end-product fit for consumer use. When incorporated into a host device, the end-product will generate, use, and radiate radio frequency energy that may cause radio interference. As such, the end-product incorporating this subassembly must be tested for compliance with the Interference-Causing Equipment Standard, Digital Apparatus, ICES-003, of Industry Canada before the product incorporating this device may be: manufactured or offered for sale or lease, imported, distributed, sold, or leased in Canada.

Avis d'Industrie Canada. Cet appareil est un sous-ensemble conçu pour être intégré à un autre produit afin de fournir une fonction de caméra infrarouge. Ce n'est pas un produit final destiné aux consommateurs. Une fois intégré à un dispositif hôte, le produit final va générer, utiliser et émettre de l'énergie radiofréquence qui pourrait provoquer de l'interférence radio. En tant que tel, le produit final intégrant ce sous-ensemble doit être testé pour en vérifier la conformité avec la Norme sur le matériel brouilleur pour les appareils numériques (NMB-003) d'Industrie Canada avant que le produit intégrant ce dispositif puisse être fabriqué, mis en vente ou en location, importé, distribué, vendu ou loué au Canada.

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