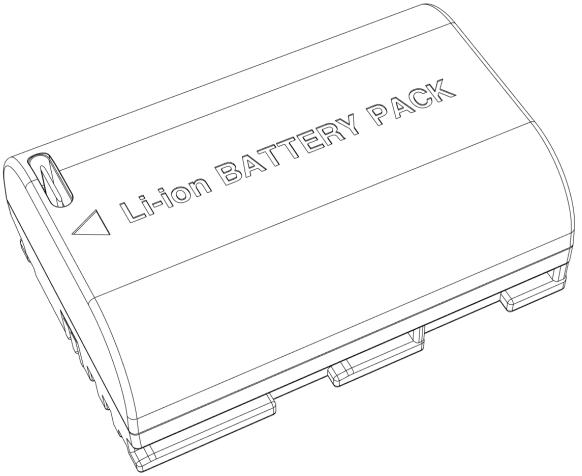
mathorn

INSTRUCTION MANUAL



Models:

MB-201, MB-211, MB-221

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1. Introduction

We thank you very much for choosing our product and wish you satisfaction with its use. For the sake of your safety and the safety of your loved ones, we ask you to carefully read the instruction manual we have prepared. From it you will learn how to safely use lithium-ion batteries and take advantage of their unique properties. By following the recommendations in this manual, as well as the instructions of the device for which this battery is intended, you will significantly extend its service life and contribute to environmental protection by reducing pollution from used products.

2. Safety

Your safety is of paramount importance to us, so our battery has a number of active and passive safety features. Nevertheless, before each use of the battery, make sure that its housing and connectors do not bear signs of damage, have not deformed, and do not leak electrolyte. If you have any doubts about the condition of the battery, immediately refrain from using it and contact your dealer or distributor, whose address can be found on the packaging or on the website www.mathorn.com.

The battery is intended only for compatible devices, the current list of which can be found at www.mathorn.com/support. By using it contrary to the instructions for use and intended use, you may cause

it to wear out prematurely, void the warranty, and in extreme cases bring danger to yourself and bystanders.

Basic safety rules

- Due to the danger of short-circuiting and explosion of the lithium-ion cells contained in the battery, any tampering with the battery, including opening the case, making repairs or modifications, is not permitted. Only a factory-assembled, properly used and stored battery is safe for the equipment and the user.
- Do not short-circuit the battery terminals, which can occur through contact with water, a damaged device or charger, or other electrically conductive elements.
- Protect the battery from falling, crushing and strong vibrations.
- Keep the battery away from fire and heat sources that can heat the battery to temperatures above 60 degrees Celsius, leading to an increased risk of damage or even explosion. Also, don't expose it to direct sunlight so that it doesn't heat up uncontrollably.
- Protect the battery from water, splashing and high humidity to prevent short-circuiting and corrosion of its components.
- Do not allow water vapor to condense on the battery casing due to changes in ambient temperature, which may cause the battery and the device to short circuit.

- Keep the battery away from heat sources during the charging process and do not expose it to direct sunlight.
- Keep the battery out of the reach of children and pets.
- Do not dispose of the battery in the trash with mixed waste. Dispose of a used or damaged battery according to local ordinances on electronic waste segregation, or return it to the store where it was purchased.

3. Compatibility

We do our best to ensure that Mathorn batteries provide the best compatibility with the devices for which they are intended. The compatibility list may change, for example, as a result of firmware updates or the arrival of new device models. Before purchasing a battery, make sure that the model you choose is compatible with the device you own. You can find this information on the battery packaging and on the website www.mathorn.com/support, where you will find a continuously updated list of compatible device models.

4. Charging

The battery is designed to work with most dedicated chargers on the market, including those with increased charging speed (up to 1400mA) and those that monitor cell temperature (most chargers with a three-pin connector). The battery additionally has a USB type C socket, through which it can be charged with a USB charger or powerbank with a capacity of at least 1000mA.

Note: The USB charger and USB cable are optional items and may not be included with the battery.

First battery charge

The lithium-ion battery is partially charged at the factory, which increases safety in transport and slows down the aging of the device. The first full charge can be made as soon as the battery is removed from its packaging, as well as when it is previously placed in the device and the stored energy is used.

Note: Mathorn lithium-ion batteries do not require formatting, as such a process is already done at the stage of cell production and verification of their declared capacity.

Charging with a dedicated charger

The process of charging batteries in a dedicated charger depends on the design and capabilities of the charger. In this process, the battery's electronics operate in passive mode, protecting only the cells from overcharging, overvoltage, excessive charging current and excessive temperature. Instructions for charging with a dedicated charger can be found in the accompanying documentation. We recommend reading its contents before charging the battery.

Charging via USB port

Mathorn batteries are equipped with a USB Type C connector, so that the device can also be charged using a USB charger or other power source in this standard. In this configuration, the battery's electronics independently control the charging process and take care of both battery and user safety. The current drawn by the battery during charging is up to 1000mA, and this is the minimum recommended current capacity of the USB power source.

Note: Using a charger, powerbank or other USB power source, not equipped with a current limiter, with a capacity of less than 1000mA (including the USB cable), may lead to overheating, permanent damage, or even ignition.

USB charging instructions:

1. Connect a charger or other USB voltage source of min. 5V 1000mA to the USB Type C connector on the battery, using a suitable cable.
2. After a while, the battery charging process will begin, which will be indicated by the LED on the battery case turning **RED**. This color will be visible until the battery is fully charged.
3. The charging process can be interrupted at any time by disconnecting the USB cable from the battery.
4. Changing the color of the LED to **GREEN** indicates that the charging process has successfully completed and the battery is fully charged.

Safety rules when charging batteries (any type of charger):

- ➢ If the battery has been extensively used, it is recommended to leave it off the charger for at least 15 minutes before charging so that the voltage on the cells stabilizes. Starting the charging process immediately after discharging the battery will accelerate the aging of the cells and the decrease in total capacity.
- ➢ Before you start charging with a dedicated charger, make sure that the charger is in working order and that its technical specifications match those of the battery.

- When choosing to charge via USB Type C, please check that the power source has the appropriate current capacity and that the USB cable is suitable for equally high current transmission.
- We do not recommend using a USB charger or other USB power source whose current capacity is lower than 5V 1000mA. Induced overload can lead to excessive heating and damage to the device, or even ignition.
- Make sure that the dedicated charger and the USB power source have adequate current and voltage protections that will protect the battery cells from overcharging and overvoltage. Lack of such protections may lead to the tripping of the protection circuit in the battery, and as a result, prevent its further use.
- Charging the battery at temperatures below 0 degrees Celsius can lead to damage to the cells and loss of capacity. Before charging, we recommend gradually warming the battery to a temperature above +10 degrees Celsius, while protecting it from condensing water vapor.
- The optimal battery temperature during charging should be between +15 and +35 degrees Celsius to ensure the best working conditions for the cells and extend their life.
- In higher temperatures and warm climates, the charging process may cause stronger heating of both the charger and the battery. For the sake of your safety and the condition of the cells, we recommend using dedicated chargers that support cell temperature

measurement. In the case of USB charging, the battery's built-in temperature monitoring system will try to reduce the charging current so as to prevent overheating.

5. Battery life

Mathorn batteries, based on NCR lithium-ion cells, have no memory effect and do not need to be fully discharged before recharging. To extend battery life, avoid discharging the battery to the end, as well as charging it to full.

The nominal life of Mathorn lithium-ion batteries is about 500 cycles of full charge and discharge, after which the capacity of the cells drops to 70%. Actual battery life may vary depending on storage conditions and use. Moderate use of batteries, while using incomplete charging cycles (starting charging at 20% charge and ending at 80% full charge) can extend battery life up to twice as long.

6. Battery capacity

The nominal capacity of a lithium-ion battery is given as standard for a discharge current of 1/5 of the theoretical capacity (0.2C). For the Mathorn MB-201, MB-211 and MB-221 batteries, it is 450mA. When

filming with the camera in 8K standard, streaming or serial shooting in very high resolution, the discharge current resulting from the power consumption of the device can reach more than 2000mA. Batteries with a higher claimed capacity having a low capacity, with a high discharge current, may have a noticeably shorter operating time under heavy load. The minimum capacity of Mathorn batteries is always quoted for the maximum expected load occurring continuously. The batteries are manufactured based on cells whose current capacity meets the actual demand of the latest cameras and camcorders, while leaving a margin for future and more demanding devices.

7. Battery storage

How the battery is stored has a significant impact on the life of the cells and the rate of self-discharge. If you will not use the battery for more than a month, discharge it to about 50% and remove it from the device. The optimal battery storage temperature is between +10 and +20 degrees Celsius with moderate humidity. Storing a fully charged battery, over a long period of time and under other than recommended thermal conditions, accelerates the natural aging process of the cells and leads to a gradual loss of capacity.

8. Self-discharge of batteries

Self-discharge is a natural chemical process that characterizes lithium-ion technology and beyond. The average rate of discharge of a battery equipped with a protection circuit is 2% to 3% of capacity per month, with the battery losing the first 5% of its energy in the first 24 hours after a full charge. If the battery will not be used for more than a month, it is recommended to remove it from the device to reduce the load and slow down the discharge process. This will prevent possible damage to both the battery and the device it is in.

> Note: Leaving a fully discharged battery in the device risks discharging the battery beyond the safe range, which can lead to permanent damage to both the battery and the device.

9. Best practices in battery use

Mathorn batteries are made from the best available lithium-ion cells, and their performance is verified in the lab, using the equipment for which they were designed. When selecting their components, we take into account the harshest conditions in which they will operate, both in terms of increased power consumption (up to 20 watts when filming in 8K) and climatic conditions from -20 to +60 degrees Celsius. Thanks to this,

we know that we have done everything to ensure that the product we put in your hands will perform in the most demanding situations. Lithium-ion technology, in addition to its advantages, also has limitations, so it is worth knowing how to deal with them. Proper use of a lithium-ion battery allows it to maintain its high performance for up to 10 years from the date of manufacture. Since it's all up to you from now on, read the following set of recommendations to enjoy your purchase for as long as possible.

Recommendations:

- If it is not necessary, try not to use all the available capacity of the battery. Several battery charges between 30% and 70% of capacity cause less wear and tear on battery components than one full cycle from 0% - 100%.
- By charging a battery to 90% (instead of 100%), you extend its life by 50% and reduce charging time by 30%. The last 10% of the charging process allows you to use all the available capacity, but puts the most strain on the battery.
- The Mathorn battery supports fast charging with up to 1400mA of current. To extend the life of the battery, we recommend using chargers with a charging current of up to 1000mA, which results in less heating of the battery.
- After heavily discharging the battery, we recommend waiting 15 minutes before recharging to cool the cells and stabilize their voltage.

- Charging the battery at temperatures below freezing can lead to faster battery wear and even damage. Before charging, warm the battery to a temperature of about 10 degrees Celsius

10. Troubleshooting.

While operating a battery, you may encounter situations that may worry you or require appropriate action. Review the following list of cases to learn how to act appropriately with your safety and comfort in mind.

Problem	Solution
Battery is not recognized when placed in the camera	Check if the battery you purchased is compatible with your camera model. For a list of compatible devices, visit www.mathorn.com/support

The battery does not charge when placed in a dedicated charger.	Check the compatibility of the charger with the battery and that it is properly attached. Read the instruction manual of the charger.
The battery does not charge when plugged into a USB power outlet.	Check that the USB power socket provides the required charging current and is turned on. Check that the USB cable is not damaged and that it provides the required current flow.
The battery heats up during charging.	In the process of rapid charging or heavy discharging, the battery may heat up due to increased current flow. If the battery temperature exceeds 50 degrees Celsius, you should absolutely disconnect the charger
The battery light flashes orange and does not charge.	The charging module via the USB Type C socket has been overloaded and disconnected for safety reasons. We recommend using a dedicated charger.

11. Battery disposal and environmental concerns.

The symbol of the crossed-out trash garbage can informs that due to the content of hazardous substances, the used battery belongs to waste hazardous to human health and life and the environment. Never dispose of used or damaged batteries in the garbage, but place it in the selective battery collection container located in stores and public buildings. You can also return the battery to the seller, who will forward it for disposal at a certified facility.

12. Technical specification

Parameter	Value
Nominal capacity	2250 mAh
Minimum capacity under load 1C	2150 mAh
Nominal voltage	7.2 V

Maximum charging voltage	8.4 V
Standard charging current	450 mA
Maximum charging current via USB-C	1100 mA
Maximum charging current	1400 mA
Energy	16.2 Wh
Range of charge temperatures	+0° ~ +40°C
Range of discharge temperatures	-20° ~ +60°C