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# Ambient Weather BC-3000 Smart Battery Charger for LiIon NiCd NiMh Batteries User Manual



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## 1 Introduction

Thank you for your purchase of the Ambient Weather BC-3000 Smart Battery Charger. The following user guide provides step by step instructions for operation and troubleshooting. To download the latest manual and additional troubleshooting tips, please visit:

<http://ambientweather.wikispaces.com/bc3000>

## 2 Important Notes and Warnings

When used in the directed manner, this unit has been designed and manufactured to ensure your personal safety. However, improper use can result in potential electrical shock or fire hazards. Please read all safety and operating instructions carefully before use, and keep these instructions handy for future reference. Take special note of all warnings listed in these instructions.



### **Before using this product, please read the following warning and cautions:**

1. Read these instructions – All the safety and operating instructions should be read before the unit is operated.
2. Keep these instructions – The safety and operating instructions should be kept for future reference.
3. Heed all warnings – All warnings on the device and in the operating instructions should be adhered to.
4. Follow all instructions – All operation and use instructions should be followed
5. Operate and store in a dry location. Do not operate outside.
6. The product must be protected against electromagnetic fields, static electrical fields, extreme temperatures, direct sunlight and moisture. Only operate within specified temperature range.
7. Do not use this item near water – The device should not be used near water; for example, near a bath tub, washbowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool.
8. Clean only with dry cloth – The device should be cleaned only as recommended by the manufacturer.
9. Do not use near any heat sources such as radiators, heat registers, stoves, or other device (including amplifiers) that produce heat.
10. Do not place near a fire. The batteries can explode.
11. Only use attachments / accessories recommended by the manufacturer.
12. Refer all servicing to qualified service personnel. Servicing is required when the device has been damaged in any way, such as liquid has been spilled or the device has been exposed to rain or moisture, does not operate normally, or has been dropped.
13. This device shall not be exposed to dripping or splashing water and that no object filled with liquids shall be placed on the device.
14. Unplug immediately if liquid has been spilled or any object has fallen into the unit.
15. The product should not be connected immediately after it has been brought from an area of cold temperature to an area of warm temperature. Condensed water may destroy the product. Wait until the product adapts to the new ambient temperature before use.
16. Sufficient ventilation is essential when operating the charger. Never cover the ventilating slots of the charger. Please take notice of ambient temperature operation above 96 degF (35 degC). The device is more likely to enter the protection mode, and longer charging time is required. High ambient temperatures will not damage the charger, but it is less effective.

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17. If the fan fails, do not operate the charger.
  18. The device must be connected to a power supply only of the type described in the operating instructions or as marked on the device. Do not overload wall outlet.
  19. Unplug the AC adapter when not in use.
  20. Danger of explosion if battery is incorrectly installed (reverse polarity), non-rechargeable batteries are used, or a non-specified battery type is used.
  21. Do not attempt to dismantle, open or repair this product yourself. If a fault occurs, seek advice from Ambient Weather support only.
  22. The product must not be exposed to substantial mechanical strain or strong vibrations.
  23. Unauthorized conversion and/or modification of the device are inadmissible because of safety and approval reasons (CE, UL and FCC). Any usage other than described in this manual is not permitted and can damage the product and lead to associated risks such as short-circuit, fire, electric shock, etc.

## Battery Safety Instructions

1. If the battery electrolyte in the cells should get on your skin, thoroughly wash with soap and water. If in the eyes, rinse thoroughly with cool water. Immediately seek medical attention.
2. Leaking or damaged batteries might cause acid burns when in contact with skin, therefore use suitable protective gloves to handle corrupted batteries.
3. Charge batteries on a fireproof surface away from flammable items or liquids.
4. The battery manufacturer's instruction manual must be observed before they are charged.
5. Correct polarity must be observed while inserting the batteries.
6. Non-rechargeable batteries, rechargeable alkaline batteries (RAM), and lead acid batteries must not be charged with this product. **These batteries can explode.**
7. Batteries should be removed from the device if not used for a long period of time to avoid damage through leaking.
8. Keep batteries out of reach of children. Batteries can be swallowed and represent a choking hazard.
9. Batteries must not be dismantled, short-circuited or thrown into fire.

## Lithium Ion Battery Safety Instructions



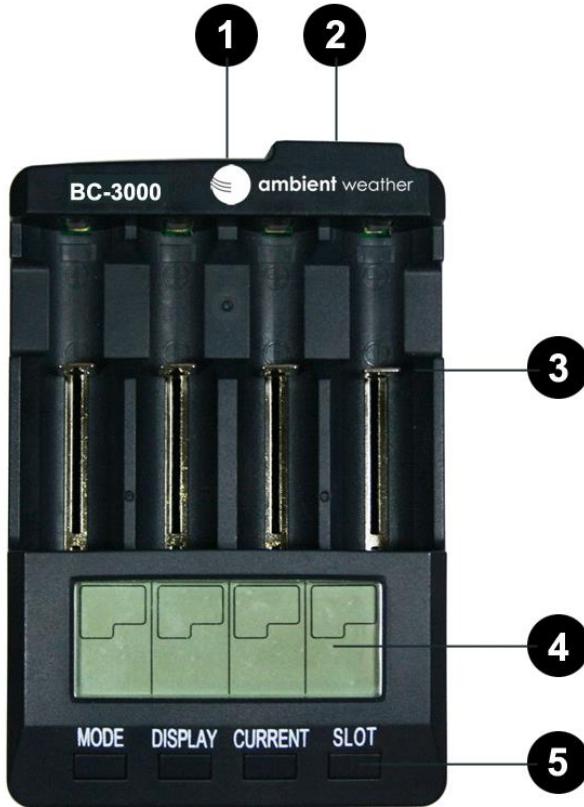
1. Lithium-Ion (LiIon) batteries are flammable if shorted or over charged. Although every precaution is taken to safely charge LiIon batteries, including overcurrent, overvoltage and temperature protection, it is possible that a deteriorated or improperly manufactured LiIon battery can catch fire.
2. Never charge LiIon batteries unattended.
3. Charge LiIon batteries on a fireproof surface away from flammable items or liquids.
4. Only charge LiIon batteries rated at 3.7V. In general, the voltage rating is printed on the battery case. The maximum charging voltage is 4.2V.

## 3 Getting Started

No	Description	No	Description
1	AC Adapter Connection	4	LCD Display
2	Cooling Fan	5	Function Keys
3	Battery Slots		



Figure 1 references the BC-3000 battery charger.



No	Description	No	Description
1	AC Adapter Connection	4	LCD Display
2	Cooling Fan	5	Function Keys
3	Battery Slots		

Figure 1

### 3.1 Parts List

QTY	Part Number	Item
1	BC-3000	Battery Charger
1	BC-3000-AC	AC Adapter
1	BC-3000-MANUAL	User Manual

### 3.2 Initial Operation

Plug the BC-3000 into wall power using the AC adapter (included). The backlight will turn on, the firmware version will be temporarily displayed, all segments are momentarily displayed, and null (or no value) will be displayed in each battery slot (if no battery is installed). The charger is now ready for use.

Only use the AC adapter shipped with this unit.

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### 3.3 Quick Start Guide

Although the manual is comprehensive, much of the information contained may be intuitive or not required for simple use. The following are simple steps for recharging batteries.

1. Plug in the BC-3000 to AC power.
2. Insert 1 to 4 batteries into the battery slots.
3. Charge until the display shows “Full”.

## 4 Basic Features

- The product is intended to charge and discharge NiCd, NiMH or 3.7v Li-ion rechargeable batteries, including the following sizes:  
AAA, AA, C, 16340, 10440, 14500, 16340 (LIR123A), 18500, 18650, 26650, 26500
- It provides four independent charging slots for rechargeable batteries. The charger can also optimize and test the maximum capacity of the rechargeable batteries.
- The charger can charge batteries of different sizes, types, and capacities at the same time.
- The charger integrates the voltage change over time, referred to as the “minus delta voltage ( $-\Delta V$ )”, and automatically terminates charging.
- For NiCd and NiMH batteries, when the battery is fully charged, the charger will automatically continue to provide a trickle charge. Trickle charging prevents the rechargeable batteries from being overcharged, and compensates for self-discharging of the batteries.
- For LiIon batteries, the charger will not provide a trickle charge current when charging is completed for safety reasons. However when the LiIon battery voltage drops below 4.12V, the charger will start charging batteries to automatically to 4.2V.
- The charger includes a fan for heat dissipation. When any of the six temperature sensors detect the circuit board or battery voltage is over 104 degF (40 degC), the ventilation fan will turn on automatically. Only when all six temperature measure less than 104 degF (40 degC), then the fan will be switched off.
- The charger also includes over-temperature protection, and will shut off the current flow to protect the rechargeable batteries and charger itself from overheating.

### 4.1 General Display Information

Each charging slot has an informative display, showing various operational modes and display modes.

The operational modes are as follows:

1. Charge Mode
2. Discharge Mode
3. Refresh Mode
4. Test Mode
5. Quick Test Mode

The display modes are as follows:

1. Charge/discharge Voltage
2. Charge/discharge Current
3. Charge/discharge Time Elapsed
4. Charge/discharge Accumulated Capacity

The charger backlight will turn on after any key is pressed. The backlight will automatically turn off after 10 seconds if no more buttons are pressed.

## 4.2 Function Keys

<b>MODE</b>	Reference Section 5.2
<b>DISPLAY</b>	Reference Section 5.5
<b>CURRENT</b>	Reference Section 5.4
<b>SLOT</b>	Reference Section 5.3

# 5 Detailed Operation

## 5.1 Initialization Mode

Once a rechargeable battery is inserted, the present voltage (for example, **1.12V**) will be displayed for 3 seconds, then the default charging current (**500mA**) **Charge** will be displayed for another 3 seconds. If the battery is fully charged, **FULL** will be displayed.

If the **MODE** or **CURRENT** button is not pressed during the next 6 seconds, the charging process will begin (normal working mode).

If any button is pressed, the unit will wait for another 10 seconds before entering the normal working mode.

## 5.2 Changing Modes (MODE button)

Press and hold the **MODE** button for 2 seconds to change the working mode selection for all four battery slots. All four battery slots will flash.

If you wish to change the mode for a particular slot, press the **SLOT** button until the desired slot is flashing.

Press the **MODE** button to toggle between **Charge**, **Discharge**, **Refresh**, **Test**, and **Quick Test** mode.



## 5.3 Slot Selection (SLOT button)

The **SLOT** button is used to select the desired slot for the different working modes, charge current or display mode. When a slot is selected, the LCD display will flash.

The sequence is as follows:

1 -> 2 -> 3 -> 4 -> all four slots -> exit

## 5.4 Adjusting the Charging Current (CURRENT button)

Once the normal working mode begins, the charging current can no longer be changed.

The only way to change the charging current is by re-inserting the rechargeable batteries or re-powering the charger by disconnecting and reconnecting the AC adapter, and pressing the **CURRENT** button to program a different charge current.

If you want to adjust the charge current for each battery, press the **CURRENT** button after inserting

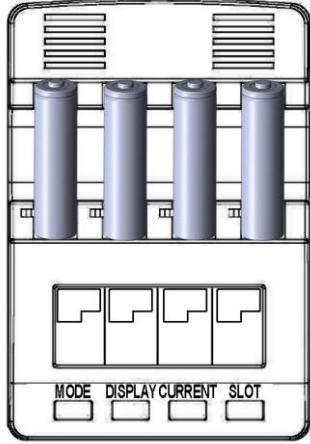
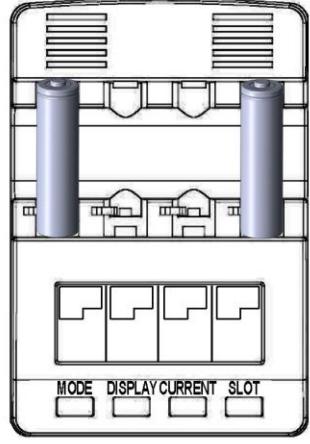
the battery.

If you want to select the same charge current for multiple batteries at the same time, it is best to insert all four batteries into the charger, re-power the charger again, then press **CURRENT**, and all batteries will charge at the same current.

If a different working mode or display mode is desired for a particular slot, press the **SLOT** button to select the desired slot and then press **MODE** or **DISPLAY** to change the mode.

The charging current can be adjusted between 200mA, 300mA, 500mA, 700mA, and 1000mA. If only slots 1 and/or 4 are used for charging, the charging current can be further adjusted to 1500mA and 2000mA.

The following table provides the ideal configuration for two battery charging as well as the charging current for two and four battery operation.

Battery configuration		
Maximum charging current per slot	1000 mA	2000mA

The following table provides the maximum charging current for several battery configurations.

Slot 1	Slot 2	Slot 3	Slot 4
2000 mA	--	--	--
2000 mA	--	--	2000 mA
--	1000 mA	1000 mA	--
1000 mA	1000 mA	1000 mA	1000 mA

**NOTE:** When a high impedance battery (over 2500 milliohm) is loaded onto the charger, due to its high internal impedance, the displayed charging current may be much less than your pre-selected charging current. When this occurs, it does not indicate the charger is defective. It does require longer charging times.

## 5.5 Display Modes (DISPLAY button)

Press the **DISPLAY** button to change the display mode selection for all four battery slots.

If you wish to change the mode for a particular slot, press the **SLOT** button until the desired slot is

flashing.

Press the **DISPLAY** button to toggle between **Voltage**, **Accumulated Capacity**, **Time Elapsed**, and **Current** display modes.

CHARGE	CHARGE	CHARGE	CHARGE
V	mAh	h	mA
Voltage	Accumulated Capacity	Time Elapsed	Current

1. **Charge/Discharge Voltage.** The instantaneous battery voltage (in Volts) is displayed. If the battery is full, **FULL** will be displayed.
2. **Charge/discharge Accumulated Capacity.** The accumulated battery capacity (in mAh) of the current cycle is displayed.
3. **Charge/discharge Time Elapsed.** The charging/discharging time (in hours:minutes) of the current cycle is displayed.
4. **Charge/discharge Current.** The instantaneous current (in mA) is displayed.

## 5.6 Operational Modes

1. **Charge Mode.** The rechargeable battery is charged up to its maximum capacity.

For LiIon batteries, the maximum charging voltage is 4.2V (using the CC/CV standard LiIon charging algorithm).

2. **Discharge Mode.** The discharge mode is used to reduce the “memory effect”. The rechargeable battery is discharged to a preset battery voltage (0.9v for NiMH and NiCd batteries, 2.8v for LiIon batteries). Discharge current is always half of the selected charge current. Once discharged, you can manually recharge the battery.

Once the discharge is finished, the total accumulated discharging capacity is displayed in the mAh display mode, showing how much energy was discharged from the battery, which is referred to as the accumulated discharging capacity.

For NiMH and NiCd batteries, the trickle charge current will be applied after the discharge cycle is finished, preventing the batteries from discharging any further.

For NiMH and NiCd batteries, the maximum discharging current is 700mA (when 1000mA charging current is selected in the **TEST** or **REFRESH** mode, the discharging current is still 700mA).

The discharging current can be selected between 200mA, 300mA, 500mA, 700mA and 1000mA for LiIon batteries.

The default discharge current is 500mA.

3. **Refresh Mode.** A rechargeable battery is charged and discharged repeatedly to optimize to its maximum capacity. Old rechargeable batteries or rechargeable batteries that have not been used for a long period of time can be restored to their rated capacity. Depending on the selected charging current, it can take days before completed. The refresh mode will complete three discharge and charge cycles before completed. Discharge current is always half of the

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selected charge current.

After a charge cycle is complete, the total charged capacity will be displayed in the mAh display mode even if it is in the discharging stage of the cycle.

4. **Test mode:** The test mode checks the present capacity of the rechargeable battery. The maximum capacity is determined by discharging the rechargeable battery after fully charged. If the maximum capacity is much lower than the rated capacity then it may be near its end of life. After the test mode is complete, the battery is returned to full capacity.
5. **Quick Test mode:** The charger will analyze the dynamic internal battery resistance by applying a load current, and measuring the current.

This current reading is referred to the “voltage drop” detected on the battery. In about 10 seconds, the tested battery resistance will be displayed in milliohms.

A good quality battery, internal resistance is low: in the range of 20 to 80 milliohms. If the battery internal resistance is over 500 milliohms, then it may be near its end of life. Always use batteries with similar load resistance when used in serial to achieve maximum battery life.

Alkaline and any other 1.5v batteries can be tested on this charger. If a completely empty or “dead” battery is tested, it is impossible to measure the load resistance.

Please note that since the internal battery resistance can be very small, and contact resistance can be a major factor, the same battery tested in different slots or even at the same slot with different contact conditions can result in a reading variation as much as 10% to 20%. This is normal.

If a completely drained battery is tested, it is not possible to obtain a correct reading.

Test multiple times to assure a correct measurement result.

Due to the manufacturing tolerances, there is an approximate 30 milliohm contact resistance from the charger itself, and this resistance is calculated together with battery internal resistance. This 30 milliohm should be deducted from the reading to get a more accurate battery resistance reading.

## 5.7 Backlight Operation

The backlight temporarily turns on if any button is pressed. After 30 seconds, the backlight will automatically turn off.

To permanently turn on the backlight, press and hold the **DISPLAY** button for 5 seconds. To turn off this feature, press and hold the **DISPLAY** button again for 5 seconds.

## 6 Overheating Protection

The BC-3000 includes comprehensive overheating protection. There are four independent over-temperature battery sensors and two independent over-temperature control board sensors.

1. If any battery temperature exceeds 140 degF (60 degC), the charging or discharging function will be halted. The charging or discharging functions will resume when the battery temperature drops below 104 degF (40 degC).



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2. If the control board temperature exceeds 171 degF (77 degC), the charging or discharging function will be halted for the two associated batteries. The charging or discharging functions will resume when the board temperature drops below 122 degF (50 degC).

## 7 Maintenance

The device is maintenance-free, but should be cleaned occasionally. When cleaning, the device must be removed from any power source. Only use a dry and soft cloth to clear the housing of the charger. Do not use liquid, abrasives or solvents.

## 8 Specifications

Operating Voltage	12 Vdc	
Power Adapter	Input:	100~240V ~ , 50/60Hz
	Output:	12V DC
Charging Current range	200, 300, 500, 700, 1000, 1500, 2000 mA	
Discharging Current range	200, 300, 500, 700mA 1000mA (LiIon only)	
Max. Charging Capacity	20000mAh	
Operating Temperature	0 to 40 degC / 32 to 104 degF	
Voltage Deviation	< 0.03v @4.2v	
Current Deviation	< 5%	

## 9 Glossary of Terms

Term	Definition
Battery load resistance	The internal resistance of a battery is dependent on the specific battery's size, chemical properties, age, temperature and the discharge current. The units of measure is ohms.
LiIon	A lithium-ion battery (sometimes LiIon battery or LIB) is a member of a family of rechargeable battery types in which lithium ions move from the negative electrode to the positive electrode during discharge and back when charging. LiIon batteries use an intercalated lithium compound as one electrode material, compared to the metallic lithium used in a non-rechargeable lithium battery. The electrolyte, which allows for ionic movement, and the two electrodes are the constituent components of a lithium-ion cell.
mA	Milli-amps, or battery current units of measure
mAh	Milli-amp-hours, or battery capacity units of measure

Memory effect	Memory effect is an effect observed in nickel cadmium and nickel–metal hydride rechargeable batteries that causes them to hold less charge. It describes the specific situation in which certain NiCd and NiMH batteries gradually lose their maximum energy capacity if they are repeatedly recharged after being only partially discharged. The battery appears to "remember" the smaller capacity. The source of the effect is changes in the characteristics of the underused active materials of the cell.
NiCd	The nickel–cadmium battery (NiCd battery or NiCad battery) is a type of rechargeable battery using nickel oxide hydroxide and metallic cadmium as electrodes. The abbreviation Ni–Cd is derived from the chemical symbols of nickel (Ni) and cadmium (Cd).
NiMH	A nickel–metal hydride battery, abbreviated NiMH or Ni–MH, is a type of rechargeable battery. Its chemical reactions are somewhat similar to the largely obsolete nickel–cadmium cell (NiCd). NiMH use positive electrodes of nickel oxyhydroxide (NiOOH), like the NiCd, but the negative electrodes use a hydrogen-absorbing alloy instead of cadmium, being in essence a practical application of nickel–hydrogen battery chemistry. A NiMH battery can have two to three times the capacity of an equivalent size NiCd, and their energy density approaches that of a lithium-ion cell.
null	No logical value. Can also mean zero or open circuit (infinity)

## 10 Troubleshooting Guide

If your question is not answered here, you can contact us as follows:

1. Email Support: [support@ambientweather.com](mailto:support@ambientweather.com)
2. Technical Support: 480-346-3380 (M-F 8am to 3pm Arizona Time)

Problem	Solution
Battery voltage always reads “null”	The battery is defective or installed incorrectly. Immediately remove and inspect the battery polarity. Discard the battery if defective.
Battery is excessively hot to the touch.	The battery is defective or installed incorrectly. Immediately remove and inspect the battery polarity. Discard the battery if defective.
Fan no longer operates during high charging /discharging.	The fan has failed. Do not use the battery charger.

## 11 Liability Disclaimer

Reading the “User manual” is highly recommended. The manufacturer and supplier cannot accept any responsibility for any incorrect readings and any consequences that occur should an inaccurate reading take place.

This product is not to be used for medical purposes or public information.



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The specifications of this product may change without prior notice.

This product is not a toy. Keep out of the reach of children.

No part of this manual may be reproduced without written authorization of the manufacturer.

Ambient, LLC WILL NOT ASSUME LIABILITY FOR INCIDENTAL, CONSEQUENTIAL, PUNITIVE, OR OTHER SIMILAR DAMAGES ASSOCIATED WITH THE OPERATION OR MALFUNCTION OF THIS PRODUCT.

## 12 FCC Statement

### **Statement according to FCC part 15.19:**

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.
2. This device must accept any interference received, including interference that may cause undesired operation.

### **Statement according to FCC part 15.21:**

Modifications not expressly approved by this company could void the user's authority to operate the equipment.

### **Statement according to FCC part 15.105:**

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

## 13 Warranty Information

Ambient, LLC provides a 3-year limited warranty on this product against manufacturing defects in materials and workmanship.

This limited warranty begins on the original purchase date, and is valid only on products purchased and used in the United States, only to the original purchaser of this product, and only from an authorized dealer. To receive warranty service, the purchaser must contact Ambient, LLC for troubleshooting and service.

Warranty service can only be performed by an Ambient, LLC authorized service representative. The original receipt must be provided upon request as proof of purchase to Ambient, LLC.

Ambient, LLC will replace this product with new or reconditioned parts or products, if found to be



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defective during the limited warranty period specified above.

Replacement parts and products assume the remaining original warranty, or ninety (90) days, whichever is longer.

The owner must pay any shipping charges incurred in getting your Ambient, LLC product to a Ambient, LLC for replacement or repair. Ambient, LLC will pay reasonable return shipping charges to the owner of the product.

Your Ambient, LLC warranty covers all defects in material and workmanship with the following specified exceptions: (1) damage caused by accident, unreasonable use or neglect (including the lack of reasonable and necessary maintenance); (2) damage resulting from failure to follow instructions contained in your owner's manual; (3) damage resulting from the performance of repairs or alterations by someone other than an authorized Ambient, LLC authorized service center; (4) units used for other than in the manner described in this manual.

## 14 Disposal

Please help in the preservation of the environment and return used batteries to an authorized depot. The electrical and electronic wastes contain hazardous substances. Disposal of electronic waste in wild country and/or in unauthorized grounds strongly damages the environment.

The user is legally required to return used batteries and rechargeable batteries to any collecting point of your local authority. Disposing used batteries in the household waste is prohibited. Batteries/rechargeable batteries containing hazardous substances are marked with the crossed-out wheeled bin. The symbol indicates that the product is forbidden to be disposed via the domestic refuse. The chemical symbols for the respective hazardous substances are Cd= Cadmium, Hg = Mercury, Pb = Lead.

