

# TurboCharger 4000 – Expanded User Manual

This charger has been one of our most popular for more than five years and has some advanced safety features that require a more detailed user manual than the one that is supplied by the manufacturer in order to be fully understood and appreciated.

These safety features are very useful because nowadays there are so many battery manufacturers and the quality and capacity vary greatly among their products. The manufacturer of this charger asserts, and we agree, that to give more safety control mechanisms will be very helpful to greatly reduce the possibility of a disaster from over-charging and over-heating.

The TurboCharger 4000 will charge two or four AA and AAA NiMH batteries and NiCD batteries of any brand or capacity. It charges quickly and safely, without allowing the batteries to overheat.

This expanded user guide clarifies the how and why behind the features and operation of the Turbo4000 in four sections:

## **General features and use.**

### **Smart charger (microprocessor) features.**

### **How to use “charge only” mode.**

### **How to use “discharge, then charge” mode.**

## **General features and use.**

- Universal power adapter built in – works with voltage ranges from 100-240 VAC and it does not matter which way you plug it into the wall.
- Insert two or four AA or AAA NiMH or NiCD cells into the charger. If only two cells are to be charged, insert them into either the two right or two left slots. Each pair of slots are separate charge channels. Each charge channel should have the same chemistry and capacity of battery inserted at the same time but you can have different chemistries and/or capacities in each of the two channels. i.e.- you can have two NiCD 800mAh AAA's in one channel and two NiMH 2500mAh AA's in the other.
- Each charge channel has a charge rate of 800mA max and a discharge rate of 300mA so that you can determine the required charge and/or discharge time for your specific batteries.
- There are two settings on the back of the charger. The little, flush-mounted switch may be moved with a fingernail or a ballpoint pen. Position one is for discharging and then charging the batteries. Position two is for charging only.
- Trickle charge cycle and safety feature interaction – This charger has a feature that, when a battery is fully charged, it will automatically go into trickle charge mode unless one of the three built-in safety features is activated during the charge cycle: Vmax Detection, Safety Timer or the Thermal Sensor. If one or more of these safety features are initiated by the charger during the charging process, the charger will stop charging without going into trickle charge mode and the LED will turn off.
- To open the cover press lightly on the finger grooves and slide it open ¼ inch; then pivot the cover open wide. Hint - The cover comes off easily. Removing it might help keep the charging batteries cooler, as some batteries heat more than others and may activate the thermal sensor.

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## Smart charger (microprocessor) features.

**Auto detect feature** – Each time that the charger is plugged in, the charger will begin the auto detect, evaluate and rescue feature that tests the batteries in each charge channel.

It begins by sending a small current into each of the two charge channels. When you plug this charger into the wall - even with no batteries in it - both LEDs will light up initially. During this detection phase, the charger will test;

The batteries' chemistry - are they NiCD or NiMH batteries?

The batteries' capacity - are they 1600 mAh AA's, 2300 mAh AA's or 800 mAh AAA's?

The batteries' condition - i.e. are they over discharged or otherwise defective?

**Rescue (detail)** - This charger will attempt to “rescue” any batteries that are over discharged automatically if it determines that this is needed during the auto detect feature. The LED will turn green while rescuing and turn off while detecting. It may repeat this process if needed. If the battery can be rescued the LED will glow green steadily indicating that charging has begun. In the rare case that the charger determines that you have a defective battery and the rescue feature cannot bring the battery back to a useable condition in one rescue cycle, unplug the charger and plug it back in one or two more times, this will repeat the detect and rescue feature. If this fails - then the battery cannot be charged. If this ever happens, remember that the charger has two batteries in each charge channel and when it has found a “defective battery”, it means that one of the two (almost never both) batteries in that charge channel are bad and need to be replaced. To find out which battery is bad, use a battery tester, or replace one of the batteries in the charge channel with a known good battery and repeat till you find the defective battery.

**Discharge mode/battery conditioning** - first discharges each pair of batteries down to one volt, and then charges them.

**Vmax Detection:** This commonly found feature among chargers is a way for the charger to detect when the battery is at full charge capacity and then go into trickle charge mode or turn off. It is a complicated set of algorithms that are unique for different battery chemistries. When a normal charge is in process, neither the Safety timer nor the thermal sensor will activate but will remain in an idle state. This means that, for example, the safety timer will not activate unless the thermal safety feature is also activated during the charge cycle and/or VMax detection is experiencing an abnormal input reading. However, the you cannot tell if/when any of these safety sensors are activated, this is all being done internally and the charger will just turn off rather than enter trickle charge mode.

**Safety Timer:** Safety Timer is not a timer for charging time control, it will keep itself in an idle state and will activate only when the charging process is irregular and has to be stopped for safety purposes i.e.- the thermal or Vmax sensors are also activated. If the charging time is over ~ 3 hours, the safety timer may activate and stop the charging process. If this happens, no trickle charging will be initiated and the LED turns off.

**Thermal Sensor:** Activated if the battery cell body temperature is higher than 52+/-5 C degrees, and the charging process is then stopped. No trickle charging will be initiated and the LED turns off. Special operation for thermal control: If the thermal sensor senses the temperature shown above within 1 and half hours of the initiation of the charge process, the charging process will be terminated, the LED turns off, and no trickling charging at all will be begun. If the thermal sensor senses the temperature shown above beyond 1 and half hours after the charge cycle has been initiated, then the charging process will be continued like a normal charge cycle and then trickle charging will be initiated after the charge cycle is completed.

**Automatic Shutdown** - The Turbo4000 will automatically shut down if any of the internal safety sensors have been initiated.

**Trickle Charging** - After charging completes, unless one of the safety sensors have been triggered, the Turbo4000 enters a trickle charge cycle, charging two seconds every minute as evidenced by a slowly blinking green LED.

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## **How to use “charge only” mode.**

1. Set the toggle switch on the back of the charger to the “2” setting.
2. Plug the charger into a standard AC socket.
3. Charger completes the auto detect, evaluate and rescue feature.
4. The batteries begin charging, and both LED's glow solid green. If only one pair of batteries are charging, the right or left LED will go dark, as the remaining solid green LED indicates the charging status of the active channel.
5. Each solid green LED indicates that its channel (left or right pair) is charging. When charging of a channel is complete, the charger either turns off or it's LED blinks slowly and indicates trickle charge mode.
6. Remove the charger from the AC outlet.
7. Slide the battery cover open, and remove the cells from their slots.
8. Press down on the plastic catch next to the AC plug to fold it back into the storage position.

## **How to use “discharge, then charge” mode.**

1. Slide the toggle switch on the back of the charger to the “1” setting.
2. Plug charger into a standard AC outlet.
3. Charger completes the auto detect, evaluate and rescue feature.
4. Each channel's LED flashes rapidly, indicating discharging.
5. Automatically, LED will glow solid green when discharging completes and the charge cycle begins.
6. Go to step four of charge only mode.