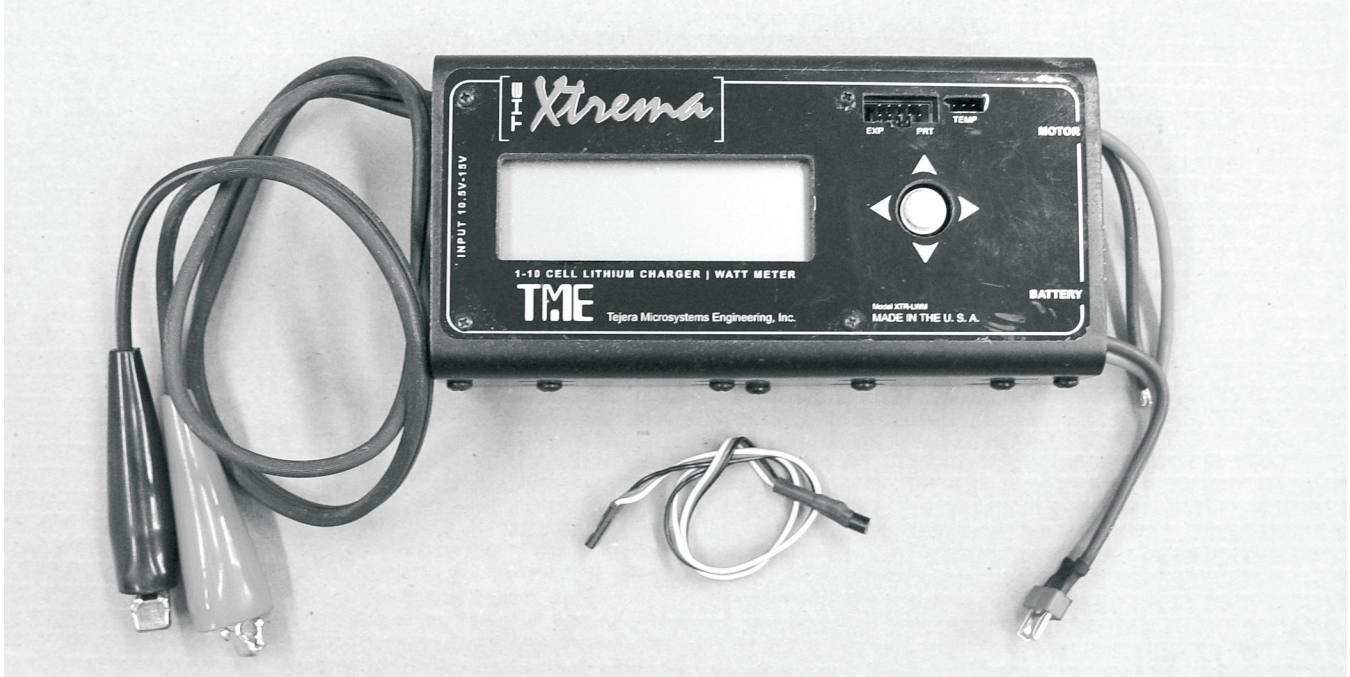


R/C REPORT

PRODUCT TEST REPORT



Item Tested	TME Xtrema Lithium Battery Charger and Wattmeter	Charge Rates	50-8000 ma in 50 ma steps (4000 ma max @ 10-cells)
Purpose .	Charging and analysis of lithium batteries	Volts/Cell Shutoff	3.6-4.2 volts, adjustable in .05 volt increments
Type	Microprocessor-based "smart" lithium battery charger	Safety Shutoff Timer	Adjustable from 10-990 min. in 10 min. increments (120 min. default)
Manufacturer .	Tejera Microsystems Engineering, Inc. 11705 Boyette Rd. #418 Riverview, FL 33659 www.TMEnet.com or www.theXtrema.com	Electric Cooling Fan	Software controlled
Distributor	Direct or through participating distributors	Safety Temperature Cutoff	External thermal probe, 60-130°F adjustable (104°F default)
Suggested Retail Price	\$189.95	Alphanumeric Display . .	4 line, 20 character LCD
Warranty	NEW! 3 Year Warranty	Audible Alarms	Piezo speaker
Dimensions	6.25x3.25x2.25"	<hr/> WATTMETER	
Weight	22 oz.	Input Supply Voltage	6.5-15 VDC
Number of Cells	1-10	Voltage Measurement	0-60 VDC, resolution .01V
Input Voltage	10.5-15 volts DC @ up to 20 Amps	Current Measurement	1-100 Amps peak, 50 Amps continuous, resolution .01 Amp
Input Connectors	Heavy-duty alligator clips on a 3' cord	Power Measurement	0-6000 Watts, with a resolution of 0.1 Watts
Output Connections	14 gauge silicone wire (no connectors)	Horsepower Measurement	0-8.0 HP with a resolution of .01 HP
		Temperature Measurement .	302°F max (150°C)

CHEERS - New three year warranty; easy to use with intuitive controls; free lifetime software upgrades (requires optional data cable. see text); adjustable thermal cutoff; charge settings adjustable for different lithium battery chemistries; four battery charger settings can be stored in memory; built-in Wattmeter with storage for maximum and minimum data values; free PC software (downloadable from website) coming in 2007.

JEERS - No integrated cell balancer (but that too is coming).

The Xtrema is a high-tech “intelligent” lithium battery charger developed by Tejera Microsystems, with a substantial number of technical features designed to improve the safety and reliability of lithium battery charging. As most modelers are aware by now, lithium-based batteries (of which LiPo’s are the most popular) offer extremely high energy density compared to NiCd and NiMH cells. This high energy density (high power but small size and low weight) comes with some significant technical and safety issues, however.

The operating voltage range of a multi-cell lithium battery pack has to be tightly maintained between a low-end discharged limit and a high-end charged limit. For LiPo’s these limits are generally 3.0 volts and 4.2 volts respectively, but some new lithium-based batteries with different chemistries have different limits. Even as little as 0.1 volts outside these limits can result in immediate and severe battery damage! Gross overcharging can result in a battery fire!

Only chargers designed especially for lithium batteries should be used because lithium batteries don’t have the same “peak voltage rollover” as NiCd and NiMH batteries. If the wrong kind of charger

is used, a lithium battery will continue to absorb voltage until irreversible damage (and maybe a fire!) results.

Lithium batteries should *never* be left unattended while charging! Due to a variety of reasons, such as unseen crash damage, undetected shorting of connective wires, an erroneous charger setting, or using an improper charger for example, lithium batteries (LiPo’s in particular) can catch fire. Once its internal chemicals are heated to kindling temperature, the battery will burn vigorously until all the lithium is consumed. One tipoff that precedes a fire will be rising temperatures in the battery, which is why LiPo cells should be charged in a flame-proof container such as a metal, porcelain, or glass enclosure. Using a temperature probe is also highly recommended.

With these comments in mind as background, let’s take a look at the TME Xtrema to see how it handles the issues described above.

The Xtrema is packaged in a compact plastic case with wiring provided for input power (12-13.8 VDC power supply or a 12 volt lead acid battery), wiring for charging outputs to the lithium battery being charged, and wiring for the Xtrema to be used in a Wattmeter mode to test an electric motor while it’s connected to its motor battery. Unlike other chargers that may have a sometimes perplexing multitude of control buttons, the Xtrema is controlled by a single “joystick button” that can be toggled left, right, up, or down to select desired functions from the LCD display. The single control makes learning the procedures easy and intuitive, following the LCD display’s menu choices step by step.

An expansion port located on the Xtrema’s front face allows the software to be updated from

TME’s website if desired. First there was an RS232 serial port interface cable (\$34.95), and now there’s a new USB cable (\$49.95), with a USB adaptor (\$19.95) for the earlier RS232 cable. More on this feature later. (*Editor’s Note: We’ve just learned that there will also be some free software coming in 2007 that can be downloaded from the TME website to allow interfacing with PC computers; graphing, charts, data recording, and more.*)

The Xtrema’s documentation is supplied on a CD, and I found the directions and safety guidelines to be unusually complete! The explanations for the various settings are very clear, and all “need to know” safety guidelines are clearly spelled out. In addition to a fully detailed set of technical instructions, TME also provides a “Quick Start” instruction sheet to streamline the charging setup process. All this documentation is also available at the TME website, which allows the information to be continuously updated as changes and corrections are incorporated. For computer savvy users, this is a very “user friendly” feature that bypasses the tyranny of outdated paper documentation. For those not so computer savvy users, an occasional call to TME can lead to the same information and updates.

Now let’s step through a typical charging sequence and see how it goes. Upon activation and initialization, the Xtrema opens with a Setup Menu that lets you customize the charger’s settings for Volts per Cell, Safety Timer, Temperature Cutoff, and several other default settings. The Volts per Cell setting lets you set the maximum volts per cell limit in 0.1 volt increments to match different lithium battery chemistries (4.2 volts per cell for LiPo’s, and 3.6 volts per cell for the new A123 Lithium-Ion

batteries). The Xtrema's default setting is 4.2 volts per cell, which is suitable for most LiPo's, and the capability to set this safety-critical parameter is very useful for the new and different lithium based batteries that may still be coming in the near future. I've seen advertisements and references to lithium-manganese and lithium-molybdenum cells, but I don't have any first-hand information on their charge and discharge characteristics. With the Xtrema, though, we can reconfigure the charger settings so we shouldn't have any problems charging these batteries even if their minimum and maximum settings are different from what we now use for LiPo's and Li-Ion's.

To handle these emerging lithium-based batteries (if they turn out to be attractive for our use) the Xtrema can be upgraded at no charge to update any internal settings, using the supplied RS232 serial port connector and optional wire harness. This pre-planned built-in expansion of capabilities is unique in the industry, and indicates that TME has developed and implemented a forward-looking strategy to accommodate future changes. I've already been able to download updates into my Xtrema charger to handle the unique charge requirements for the new A123 Systems M1 LiIon cells that I've been using since early summer. If you'd prefer not to upgrade the settings yourself, you can send the charger back to TME and they will install the upgrades for you.

The Safety Timer is used to shut down the charge process when a pre-set timer value is reached. The default setting is 120 minutes, but it can be set anywhere from 10 to 900 minutes in the Setup Menu.

The Temperature Cutoff provides another safeguard with a temperature-sensitive thermal probe that can be attached to the

battery being charged. This will shut down the charger if the battery temperature starts to rise abnormally. The default setting is 104°F, but is adjustable from 60-130°F. A conservatively safe practice is to set the temperature cutoff 5-10° above the battery's ambient temperature, which is carefully noted in the documentation. A sharp temperature rise indicates that the battery has been damaged or that the charge current is too high. The thermal probe is designed to minimize the risk of further battery damage (or fire), but it cannot save the battery from the existing problem(s) just mentioned. Frankly, I think having a thermal shutoff should be a mandatory item for *all* LiPo battery chargers!

Now let's get back to the charging sequence of operations. Once past the Setup Menu we then select the cell count and milliamp capacity of our lithium battery. Given a menu of four different cell and capacity choices, we can update any of the menu choices to suit our particular setup. Updated settings will be stored in memory, so future setups with the same or similar batteries can be done quickly and easily.

Please note that what I've just described, the Xtrema's entry and verification of a battery's cell count and milliamp capacity, is a deliberate operational procedure that provides an important layer of protection. Some lithium chargers have a feature where the charger computes a cell count based on the voltage being read. The problem with that (and it's a biggin) is that even *normal* variations in battery voltage can result in an erroneous cell count calculation, and this is especially true for batteries with many cells. The normal variation of a LiPo cell is between 3.0 and 4.2 volts per cell. A perfectly good 10-cell battery can therefore read

anywhere from 30-42 volts. A major safety issue can thus arise if a lightly drained 8-cell battery, for example, was charged from a starting point of 4.0 volts per cell, or 32 volts for the whole battery. Obviously, this voltage reading could be interpreted by some chargers as the voltage of a well-drained 10-cell battery, resulting in unsafe settings for charging an 8-cell battery! This could have dangerous consequences! The TME Xtrema neatly avoids this guessing game by requiring the user to enter the cell count and milliamp capacity.

On this note, please remember that the maximum safe charge rate for a LiPo battery is 1C (in Amps or milliamps) where C is the battery capacity. Usually expressed in milliamps, the 1C rating for a 3-cell 2100 mah pack is 2100 milliamps (or 2.1 Amps). With the Xtrema's menu flexibility, you can charge at a lower setting simply by decreasing the battery's milliamp value. The charge time will go up since the charge rate is lower, so you may need to modify the Safety Timer setting to allow more charging time. For LiPo batteries in particular, be careful to *never* charge at a higher current than 1C, or you may at least damage the pack, or at worst cause a disastrous fire! And *please* put the battery being charged inside a flameproof container!

Now let's start the charging process. Once past the setup phase we tab to the screen that gets us started in the actual charging process. A four-line display comes up that lists the following important information: the present Battery Voltage, the selected Charge Rate, the Cell Count entered, the maximum Volts per Cell setting, the Temperature Cutoff setting, and the Safety Timer setting in minutes. When the Xtrema then asks "Are you sure?", we should carefully check the information dis

played before proceeding. If any of the information needs changing, or we don't want to start the charge for any reason whatsoever, we can choose "No" and return to the prior menus. The charge process starts when you choose "Yes" to that "Are you sure?" question, so *be sure!* That last chance "Are you sure?" check is a very good way to double-check the settings before the charge begins. (Another "layer of protection"!)

During charging the Xtrema displays cell count, charge status (Constant Current or Constant Voltage), input voltage, battery voltage, battery temperature, charge current in milliamps, time in minutes and seconds, and the charge inserted so far in mah (milliamp hours). When the charge is done the Xtrema will start beeping (unless you've silenced the beeper in the Setup Menu). The ending values of the charge parameters will remain readable until you exit the charge screen. The battery can then be safely disconnected.

Now let's look at the Xtrema's Wattmeter function. In this mode the Xtrema is powered up as usual with an external power supply (10.5 to 14 VDC). The motor to be tested, along with its ESC, is then connected to the Xtrema, and finally the motor's battery is connected. Controlling the motor is done by normal means, either through your radio system or by a servo controller. In Wattmeter mode, the Xtrema "in real time" displays Watts, horsepower, motor current (in Amps), battery voltage, and temperature (the thermal probe can be attached to the battery, the controller, or the motor). When the testing is done, the Xtrema has an additional stored display of maximum motor current, minimum battery voltage, maximum temperature, and the calculated Watts and horsepower.

I tested a fairly large Axi brushless outrunner motor using the Xtrema in its Wattmeter mode, and found that the displayed information, as well as the stored maximum and minimum data values, were extremely useful for evaluating different propeller and battery combinations. While I have measured partial throttle settings on some occasions, more often than not I'm more interested in maximum power settings. The Xtrema's "data hold" feature makes record keeping much easier than trying to remember multiple data values in your head while testing. This information, along with measurements of motor RPM and installed thrust, is very handy to figure out efficient combinations of propeller diameter and pitch to operate our aircraft efficiently and with minimum danger of burning out a motor, speed controller, or battery, by improper use or equipment selection.

So what's ahead for the Xtrema? Using their downloadable features, TME is working on several advancements that won't require hardware upgrades. A cell-balancing feature is in the works, as well as a data logger and plotter interface for both the charging and Wattmeter functions. Farther out there are plans for an integrated tachometer and expanded memory. In response to feedback from beta testers and other Xtrema users, minor upgrades to the screen displays have already been incorporated with software upgrades available on the Xtrema's home page. This is terrific after-sale product support!

So what's the bottom line on the TME Xtrema from my perspective? The Xtrema isn't the least expensive charger available, but it includes features for which we'd ordinarily expect to pay extra, such as the built-in Wattmeter and temperature shutoff probe. Without

question, the Xtrema is the most user friendly lithium charger I've ever used, and its user interface has been carefully designed to give the modeler several "layers of protection" in a clear and logical manner. Its no-cost lifetime downloadable upgrades are a tremendous extra value, and will ensure that the Xtrema will never become obsolete, unlike many chargers. I'm looking forward to the planned upgrades, and I expect to use my Xtrema often, and for a very long time! Of all the LiPo chargers I've used so far, the Xtrema is my favorite, partly because it's the easiest to use and has all the key parameters "right on top" where you can see and check them.

-Peter Young
pwyoung@ix.netcom.com