SPECTRA 4

4 Outputs

1-10 cell NiCad / NiMh

1-4 cell LiPo / Li-Ion / A123

1 - 6 cell Lead Acid

Charger / Cycler */ Loaded Volt Meter
**cycling for 2 or more cells*

50 mA – 1000 mA
Input 11-15 VDC

Reverse Polarity Protection on Input and Output

Memorizes up to 20 battery pack charge settings for “AUTOCHARGE”
Remembers packs by NAME not NUMBER
Charges Multiple Batteries with Common Grounds

Owners Manual

Spectra 4

For battery charging and maintenance

Spectra 4 will charge NiCad and NiMh battery packs of 1 to 10 cells, lithium battery packs of 1 to 4 cells, and lead-acid batteries of 1 to 6 cells.

It will also cycle, (discharge to measure capacity – then recharge), NiCad, NiMh, and lithium packs. It can be programmed to perform up to 3 cycles on a battery pack automatically.

Spectra 4 will fast charge NiCad and NiMh batteries, terminating the charge by peak detection, or charge at a specified rate continuously, or for a specified period of time using the safety timer.

Lithium and lead-acid batteries require a float charging method which is applied automatically, and no options are selectable except cell count, charge rate, and the safety timer as a safety precaution.

Spectra 4 will make loaded voltmeter measurements while applying a selectable load of 100 to 1000 milliamperes.

Spectra 4 can process functions on up to 4 batteries simultaneously with individually selectable charge and discharge currents of up to 1 amp, (1000 milliamperes), for each battery.

The Spectra 4 was designed with the R/C airplane modeler in mind for the purpose of maintaining battery packs for the control equipment of the aircraft. However, it is powerful enough to charge batteries for the smaller electric airplane motor power.

There is a 5 amp ATC blade fuse located in the power cord by the banana plugs. If your unit should fail to power up check this fuse and replace if necessary.

Important safety information
Read carefully.

Please read the entire manual before using the SPECTRA 4. When charging or discharging any battery, it is important to monitor the process. Batteries should not be left unattended.

Batteries should be disconnected from the charger within a reasonable period of time after all functions have been completed in the program. When all functions have been completed, and the word "END" is displayed on the monitor screen, there will be a small discharge to the battery. The load amounts to less than 5 mA in most cases, however, over a long period of time, your battery could discharge a substantial amount. Do the math.

Lithium batteries should be charged or cycled in a fireproof container, and should be inspected for damage before charging, discharging, or using them. Improperly handled or damaged Lithium batteries can explode or cause a fire. Read and follow all directions supplied by the battery manufacturer. New or experimental lithium chemistry batteries, (other than lithium-ion and lithium-polymer, A123), should not be charged with the Spectra 4. Upgrade software may be available for new chemistries if they become popular.

The Spectra 4 was designed to charge lithium batteries using leads of 22 gauge wire 30 to 36 inches long. (such as, the leads sold with the unit). Contact technical support before making or using other leads for charging lithium batteries.

<u>Do not</u> try to charge your 12 volt battery with your Spectra 4 charger, while using that same 12 volt battery as the power source for the charger. Perpetual energy has not yet been invented. Doing this may release the magic smoke in your charger, which cannot be replaced.

Know your battery, size (mAh, and number of cells) and chemistry, (i.e. NiCad, NiMh, Lithium, or Lead-acid including, gel types) before charging or cycling.

By accepting delivery and using the SPECTRA 4, the user acknowledges, understands and agrees to accept all liability for consequential damages that may occur as a result of using this product regardless of the cause.

Keep vent openings in the bottom and on the side clear of obstruction.

The heatsink can become hot, please use caution. Do not use near flammables, or combustibles. Keep children away during operation. Not intended for use by children.

The LCD display on Spectra 4, (as with all LCD's) will fade if exposed to direct sunlight for a prolonged period. Keep your charger in the shade as much as possible. Clean the LCD with mild soapy water.

SYMBOLS & ABBREVIATIONS

PCH	=	PEAK CHARGE	P1	=	PORT 1
CHG	=	CHARGE	P2	=	PORT 2
CCH	=	CONSTANT CHARGE	P3	=	PORT 3
CYC	=	CYCLE	P4	=	PORT 4
NC	=	NiCad	TOP	=	TOPPING
NM	=	NiMh	TRK	=	TRICKLE
LITH	=	LITHIUM	DCH	=	DISCHARGE
LEAD	=	LEAD ACID	COOL	=	COOLING TIMER
mA	=	MILLIAMPS	A1	=	A123 or LiFe

USING YOUR Spectra 4

Spectra 4 is a powerful and complex unit, yet simple to operate. The 4 line LCD and 4 simple buttons enable you to program all the functions of Spectra 4 by simply answering a few questions it will ask you during programming.
The 4 buttons are “UP”, “DOWN”, “NEXT”, and “BACK”. Anytime you find yourself somewhere you don’t want to be, just press “BACK”. This will take you sequentially back to where you came from, or to the Main Menu.
Spectra 4 will lead you to where you need to be, just read the screen and answer the questions.

GETTING STARTED

On power up your Spectra 4 will emit a single beep and identify itself as Spectra 4. This will change in a few seconds, and identify the owner. Both of these screens can be skipped over by pressing the “NEXT” button. This will take you to the Main Menu.

The Main Menu is very simple. Select what you want to do by moving the flashing cursor up or down until it is adjacent to the function you want to use. Then press the “NEXT” button and the Spectra 4 will ask you to make selections to complete your task.

You can:
Move the flashing cursor to the menu selection you want and press the “NEXT” button.

SELECT PORT - This takes you to the “SELECT PORT MENU” where you choose the battery port you want to use.

MONITOR PORTS - This screen will show you what each battery port is doing, one at a time. Press the “NEXT” button to scroll from battery port to battery port. Press the “UP” button and the Spectra 4 will automatically scroll from port to port approx. every 5 seconds. Press the “DOWN” button to disable automatic scrolling.

The voltage reading displayed on the screen when charging batteries is the charging voltage. The higher the charging rate, the higher the voltage, when charging nickel batteries. Actual battery voltage will be displayed after the charge is complete.

VOLTMETER – This will take you to the LOADED VOLT METER FUNCTION. You will be asked to select a load, ranging from 100 to 1000 mA (milliamperes). After selecting the load, press “NEXT”. Allow 10 seconds for the voltage to stabilize for an accurate reading.

POWER MONITOR – This displays the voltage of your input power, (power supply or battery), this is very helpful if you are using a 12-volt battery to power the Spectra 4.

Spectra 4 will shut off or hibernate (if battery backup is in use), if the power source voltage drops below 10.5 volts.

SELECT PORT MENU

The port selection menu enables you to choose a battery port corresponding to the banana jack ports to the left of the buttons. Ports 1, 2, 3, and 4. Insert a charge lead in the port you want to use, (red plug in the red jack, black plug in the black jack, (directly below the red jack). Connect a battery.

Now move the flashing cursor up or down using the “UP” and “DOWN” buttons to the port you want to use and press the “NEXT” button. The “NEXT” button is always used to confirm your menu selections and take you to the next logical screen.

AFTER YOU HAVE SELECTED A PORT

The screen that appears after you select a port is the “MANUAL” or “MEMORY” charge settings screen. Choose “MANUAL” if you don’t have settings stored for the battery pack you are managing, or to cycle the battery pack. Cycle functions cannot be stored.

If you have charge settings stored for the battery to be charged, choose “MEMORY”, and scroll through your list of stored settings for the battery pack you intend to charge, then press <NEXT>.

Spectra 4 will ask you for the information it needs to perform the task chosen.

CHARGING AND CYCLING

You will be ask the chemistry of your battery, the number of cells, and whether you want to peak charge, constant charge, or cycle your battery pack.

Peak charging automatically terminates the charge when your battery pack is fully charged. Constant Charge continues to charge until the battery pack is disconnected, or until it is stopped after a specific charge time, (if you enable the safety timer option). You WILL be asked before charging starts.

The “cycle function” discharges your battery pack, and then recharges automatically. You can elect to cycle the battery 1 – 3 times, sequentially. The screen, when charging, will show the following: Line 1- Port number, type of charge, battery voltage while charging. Line 2 – Charge rate selected in mA, the time in hrs, mins, and sec. Line 3 - # of mA put back into the battery (this number will increase each time an mA is put back into the battery.

When cycling the screen will show: Line 1 – Port number, function (cycle), number of cycles to be done, battery voltage while discharging. Line 2 – mA discharge rate, time (hrs,mins,sec.) Line 3 - # of mA discharged so far. Line 4 – shows the final number of mA discharged after each cycle is completed. If you only do 1 cycle, you see will the number of mA for that cycle followed by 2 zero’s. If you do 2 cycles the second zero will change to the number of mA discharged for the 2nd cycle when it is finished, and so forth.

In addition to chemistry, cell count, and function, Spectra 4 will ask you for charge rates, discharge rates, and charge times, plus a few more things just to be safe.

MEMORIZING CHARGE SETTINGS

The last question you will be asked before a charge function is started, is “SAVE SETTINGS”. If you choose “NO” the charge will start without saving your settings.

If you choose “YES”, you will be taken to a screen to name your battery pack.
Use the <UP> and <DOWN> buttons to locate the first character you need to spell out the name. Scroll the character to the position between the arrows and then press <NEXT>.

Example: Choose an “A”. Locate the character “A” between the arrows. >A<
Press <NEXT> and that character will appear on the top line. If you make an error, press <BACK>.

Repeat for subsequent letters until finished. You can use up to 16 characters for a battery pack name. If the name is shorter than 16 characters , enter spaces until your charge starts. “SPACE” is the first character in the list, for your convenience.

You can name a pack anything you want. Here are some examples.

CAP232 RECVR, CAP232 IGN, FUTABA TX FAST, FUTUBA TX SLOW12V STARTER BATT, TRAINER RECVR

You will notice the transmitter listed twice. You can program a fast charge at perhaps a charge rate equal to battery pack capacity, (1C). And a second charge setting for 10% capacity, (C/10) using the safety timer to end the charge after a time specified, (15 – 16 hrs).

The Spectra 4 can hold up to 20 different charge settings.

The Spectra 4 assumes you know something about your batteries. If you don't, read the section on BASIC BATTERY KNOWLEDGE before you start.

LITHIUM BATTERY PACKS

As stated previously in this manual, lithium battery packs can be very volatile. Flaming and explosion are a risk, especially during charging and discharging. Charging should always take place in a fireproof container. Examine your battery packs before charging and discharging for damage. Watch lithium-polymer cells for denting, perforation, and swelling. If you smell a "sickly sweet" odor, the lifespan of one or more cells has expired, but it can still be dangerous. Dispose of it properly.

If your lithium pack has a substantial charge, and you try to charge it more, you may find the Spectra 4 stops the charge as fast as you start it. If your pack still is not up to full voltage, lower the charge rate and try again.

If you want to cycle a lithium pack to check for capacity, we suggest that you discharge at half the capacity of the battery, or less. High rates of discharge can pull your packs lower than 3 volts per cell. Cycling is not helpful for lithium packs, and should be considered useful only for determining the battery capacity.

OTHER FEATURES

When peak charging NiCad and NiMh packs you will be given an option to apply a "topping charge" after the battery has peaked. The topping charge will last 5 hours and then terminate all charging. Topping your batteries occasionally helps to keep the cells balanced and consequently enhances their performance. NiMh batteries love the "topping charge".

When you charge Nicad packs you will be offered a "Trickle Charge" after charging or topping.

If you don't choose a topping or trickle rate, (leaving them set to 0), they will not be implemented.

When cycling battery packs more than one cycle, a “COOL” time out will be implemented after re-charging. The cool timer will let your battery rest for 15 minutes after recharging. This keeps your pack from overheating during the repeated charge and discharge of the cycle regimen.

BATTERY BACKUP

Your charger was shipped with a battery backup lead. You may connect this lead to any reasonably charged 6 to 10 cell battery pack, and then plug it into the jack on the left end of the Spectra 4 near the power wire.

In the event of a power failure, the backup battery will continue to power the microprocessor and LCD while terminating all other functions. When power is restored, all functions will pick up where they left off. Battery backup can save you a lot of headaches, especially if you are powering your unit from an AC driven power supply, subject to the power companies reliability. Your backup battery pack does not need to be large. A 500 mAh pack should keep you going for more than 10 hours of power failure.

When you are doing multiple cycles, battery backup can keep you from having to start over.

WHAT’S THAT BEEPING NOISE

Yes, everything electronic has to beep. You’ll learn to read the beeps. Spectra 4 beeps one time, when it powers up. It beeps three times when a charge is completed, twice when a discharge is completed, five times when battery backup kicks in, one beep when anything changes, and has been known to go nuts if you try something really stupid.

BASIC BATTERY KNOWLEDGE

Here are some battery basics to help you manage your battery packs

1. **New Nicad & NiMh** batteries should be form charged, this is done by charging at a C/10 rate for approx.15 hrs. You can do this by selecting “Constant Charge” in the function menu, and setting the charge rate to 10% (C/10) of the battery pack capacity (i.e. a 1000 mAh pack should be set to 100 as the discharge rate). You should discharge a pack at 20% of the packs rated capacity to determine actual capacity. You can “CYCLE” your battery pack 3 times, or until the pack shows a discharge amount of it’s approx. rated capacity. Some packs may never reach their full capacity, depending on the quality of the cells. Batteries that have already been formed, or broken in, should be cycle tested occasionally to be sure they are still reaching adequate

capacity. Older packs should be tested more often and discarded when they no longer reach at least 80% of the rated capacity. NOTE.. Some battery packs will show more or less than their rated capacity even when brand new. This is normal, as there are some differences in battery manufacturers and brands.

2. **PEAK,** or fast charging, NiCad or NiMh batteries should be done at 1C to 2C or less (this means 1 to 2 times the packs capacity or less) a 500 mAh pack should be charged between 500 and 1000 mAh or less. 250 mAh packs should be charged at 500 mAh or less. We recommend 1C charging, or less, unless you are in a real hurry. The minimum rate for peak charging is 250 mAh.

3. **TOPPING charge**: A topping charge is used to balance cells in the pack, and will add to the life of your battery, and enhance performance. Topping should be done about once every 10 charges. A topping charge of C/10 to C/15 is recommended. The topping charge will last five hours and then terminate to a trickle (if you selected a trickle rate) or shut the charge off completely. (NiCad & NiMh only).

4. **TRICKLE** charging is a small amount of current applied to the battery to replace the batteries natural self – discharge when not in use. A trickle charge should be done at C/40 to C/50 (a 1000 mAh pack would be set to a trickle rate of 25 mA C/40) or 20 mA, (C/50). (NiCad & NiMh only).

5. **LITHIUM** batteries should be charged at a maximum of 1C (1 times the rated capacity), trickle and topping options are not available when you select a lithium battery to charge or cycle. Lithium batteries must be monitored through out the charging or cycling process. Lithium packs need to be balanced every 10 charges or so to achieve their best performance, and to keep cell imbalance from destroying a weak cell. We recommend using a balancer or balancing charger to keep your packs balanced. Most balancers can be used as a stand- alone item, or can be connected to a charger that is lithium compatible. Balancing your lithium packs will add to their life and maximize their performance. If you cycle a lithium battery pack to test capacity, we recommend a discharge rate of 20% of the rated battery pack capacity. Using a 20% discharge rate will yield the most accurate result. There is no value in cycling lithium packs, except to determine capacity.

6. **LEAD ACID** batteries are 2 Volts per cell, a 12 Volt battery has 6 cells, a 6 Volt battery has 3 cells etc… Be sure to input the number of cells and not the voltage when programming a lead acid battery for charging, (i.e. don't put a 6 volt battery in as 6 cells or you will over charge and damage or destroy the battery). Typically the charge rate should be 10% of mAh capacity rating.

NOTE: Many transmitters have a diode that prevents discharging a pack while inside the transmitter. You must either jumper the diode or remove the pack from the transmitter before cycling.

BATTERY FORMULA'S

Figuring the C rate for a battery is very simple. You have probably heard of C/10 charging, this simply means dividing the mA capacity of the battery by 10, C/20 means dividing the mA capacity of the battery by 20, and so on. The C stands for the rated "Capacity" of the battery (mAh).

Anytime you see the letter C precedes a number, you divide. A 1000 mAh battery pack that is charged or discharged at a C/10 rate is being charged or discharged at 100 mA..

When the number precedes the C, then you multiply. For example if you are charging at 1C, then you are charging at 1 times the rated "Capacity" of the battery. If you are charging at 2C then you are charging at 2 times the "Capacity" of the battery. The same 1000 mAh pack as used in the example above, if charged at 1C would be charging at a rate of 1000 mA, the 2C rate would be 2000 mA.

A quick word about cell count

NiCad or NiMh battery packs are made up of individual cells with a nominal Voltage of 1.2 Volts Per Cell (VPC). So a 4.8 Volt receiver battery pack is 4 cells at 1.2 VPC. A 9.6 volt transmitter battery has 8 cells with a nominal voltage of 1.2 VPC. A fully charged 4 cell pack will read approx. 5.6v or 1.4 VPC. A fully charged 8 cell transmitter pack will read approx. 11.2v.

Lithium battery packs are made up of individual cells as well, but they have a nominal voltage of 3.6 to 3.7 VPC (depending on manufacturer). So a 7.4 volt Lithium pack would have 2 cells of 3.7 volts each.

Lead Acid batteries are 2 volts per cell, so a 12 volt lead acid battery, like the one in your car, flight box or garden tractor, have 6 cells at 2 Volts each. A 6 volt lead acid battery has 3 cells at 2 volts each, etc..

Warranty

The SPECTRA 4 is warranted for a period of 1 year from the date of purchase, to the original owner. We will repair or replace, at our option, any unit found to have manufacturing defects during the warranty period. Physical damage to the unit is not covered under this warranty. Misuse, intentional or otherwise, is not covered under this warranty. Charging leads purchased or provided by Hughes RC are not warranted.

If you should experience a problem with your unit, please call our tech support dept., before shipping the unit back. Shipping charges to our facility for warranty or other repair or service shall be the responsibility of the owner.

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