

# VR-1

## ***DUAL RACING CHARGER***

INSTRUCTION MANUAL



The TrakPower VR-1 Charger is a fully programmable, high performance, computerized battery charger designed with the electric racer in mind. Dual outputs with built-in balancing provide the ability to charge two batteries simultaneously and eliminate the need for a separate in-line balancer. Capable of charging all chemistry types in the R/C industry, the VR-1 is a top of the line, state-of-the-art battery charger. A large, tilt-able, reversed backlit graphic LCD makes it easy to view at any angle, indoors or out. Able to charge at 20A on channel 1 (up to 6S) and 6A (up to 4S) on channel 2, the TrakPower charger quickly and safely charges batteries so you can get back on the track!



**STOP!!** It is strongly recommended to completely read this manual before use! Damage resulting from misuse or modification will void your warranty.



**WARNING!!** Charging lithium-based rechargeable batteries poses a risk of FIRE! NEVER treat lithium-based batteries in the same manner as other battery types. NEVER leave lithium-based batteries unattended while being charged! ALWAYS charge lithium-based batteries in a fireproof location! Failure to follow all care and handling instructions contained in this manual could result in quick, severe, permanent damage to the batteries and all surroundings!! Follow ALL safety precautions when using such batteries, as listed on page 18 of this manual!

## Index

Specifications .....	2
Special and Standard Features .....	3
Important Precautions .....	4
Glossary of Terms .....	4
Controls and Connections .....	5
DC Input Power .....	5
Navigating the Menus .....	6
Determining Battery Type and Specifications .....	16
NiCd and NiMH Batteries .....	16
Lithium Batteries .....	18
Lead Acid (Pb) Batteries .....	21
Channel 2 .....	22
Cooling Fan .....	22
Error Message and Troubleshooting .....	23
Warranty Information .....	Back Cover

## Specifications

### CHARGER:

<b>Input Voltage:</b>	11-15V external DC power supply
<b>Number of Outputs:</b>	2
<b>Controls:</b>	4 membrane push-buttons, jog dial/switch
<b>Display Type:</b>	128X64 graphic LCD (21x8 character), Negative B&W, backlit
<b>Display Backlight:</b>	White
<b>PC Communications:</b>	USB to UART device type
<b>Case Material:</b>	Aluminum w/ plastic
<b>Cooling System:</b>	built-in, two 40mm and one 25mm DC fan
<b>Case Size:</b>	180mm x 155 x 65mm
<b>Weight:</b>	970g
<b>External Port:</b>	LM35 sensor probe, Mini USB for firmware updates
<b>Delta Peak Detection:</b>	NiCd: 5-25mV/cell NiMH: Zero-15mV/cell
<b>Trickle Charge:</b>	off, 50-500mA, auto
<b>Charge Cutoff Temperature:</b>	50-176°F (10-80°C) adjustable
<b>Charge Voltage:</b>	NiCd/NiMH: Delta peak detection LiPo: 3.7-4.3V/cell Li-Ion: 3.6-4.2V/cell
<b>Balance Current:</b>	300mA
<b>Reading Voltage Range:</b>	0.15-5.5V per cell

### CHANNEL 1:

<b>Battery Types/Cells:</b>	NiCd/NiMH: 1-14 cells LiPo/Li-Ion/LiFe: 1-6 cells Pb: 1-12 (24V)
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<b>Battery Capacity Range:</b>	NiCd/NiMH: 100-9,900mAh LiPo/Li-Ion/LiFe: 100-20,000mAh Pb: 500-65,000mAh
<b>Fast Charge Current:</b>	0.1-20.0A (0.1A increments)
<b>Safety Timer:</b>	Auto, 10-900 minutes, Off
<b>Charge Wattage:</b>	250W Maximum (adjustable)
<b>Discharge Current:</b>	0.1-10.0A (0.1A increments)
<b>Discharge Cut-off Voltage:</b>	NiCd/NiMH: 0.1-1.2V/cell (0.9V fixed in cycle mode) LiPo: 3.0-4.2V/cell Li-Ion: 3.0-4.1V/cell
<b>Discharge Wattage:</b>	80W
<b>Balance Cells:</b>	6 cells
<b>NiMH ONLY Cut-off Voltage:</b>	1.10-1.30V, 1.20V at 100mA
<b>Memory:</b>	40 models
<b>Charge Method:</b>	CC/CV for lithium types Auto, normal, linear, GMVIS, Impulse, reflex and repeak for Ni-XX batteries.

<b>CHANNEL 2:</b>	
<b>Battery Types/Cells:</b>	NiCd/NiMH: 1-10 cells LiPo/Li-Ion/LiFe: 1-4 cells
<b>Battery Capacity Range:</b>	NiCd/NiMH: 100-9,900mAh LiPo/Li-Ion/LiFe: 100-9,900mAh
<b>Fast Charge Current:</b>	0.1-6.0A (0.1A increments)
<b>Charge Wattage:</b>	50W maximum
<b>Balance Cells:</b>	4
<b>Charge Method:</b>	CC/CV for lithium types Normal for Ni-XX types.

## ***Special Features***

- Two outputs, both with built-in balancing
- 40 model memories for storing all essential battery parameters
- Special charge mode for battery storage
- Balancer function
- Large graphic reversed LCD w/tilt viewing
- Mini-USB jack for firmware updates
- Built-in cell checker for quick cell readings
- Graphical data such as temperature, current and voltage
- 12V DC inputs and direct plug system for the TrakPower DPS Power Supply (TKPP5505)

## ***Standard Features***

- Computer controlled universal fast charger
- Ultra simple to operate, with clearly arranged program structure, four buttons and a rotary knob
- Charges LiPo, Li-Ion, LiFe and lead-acid cells (Pb) using constant current/constant voltage (CC/CV) method
- Protected against short circuit, overload and reversed polarity
- Switchable buzzer, selectable melody
- Variable safety timer
- Internal battery resistance display
- Individual cell voltage display for lithium based batteries
- Three cooling fans
- Includes balance boards and banana-to-Deans® adapters for each output



## ***Important Precautions***

- Do not leave the charger unattended while in use.
- Disconnect the battery and remove input power from the charger immediately if the charger or battery becomes hot!
- Do not attempt to charge incompatible types of rechargeable batteries as permanent damage to the battery and charger could result.
- Do not use automotive type battery chargers to power the charger.
- Do not allow water, moisture or foreign objects into the charger.
- Do not block the fans or intake holes, which could cause the charger to overheat.
- Do not attempt to use the batteries with more cells or total voltage than listed in the specifications.
- Do not overcharge batteries as permanent damage could result. Do not use a charge current rate which exceeds the safe level of the battery.
- Do not place the charger or battery on flammable surfaces or near combustible materials while in use, such as carpet, cluttered workbench, paper, plastic, vinyl, leather, and wood, inside an R/C model or full sized automobile!
- Allow the charger and battery to cool down between charges.
- Always disconnect the charger from the power source when not in use.

## ***Glossary of Terms***

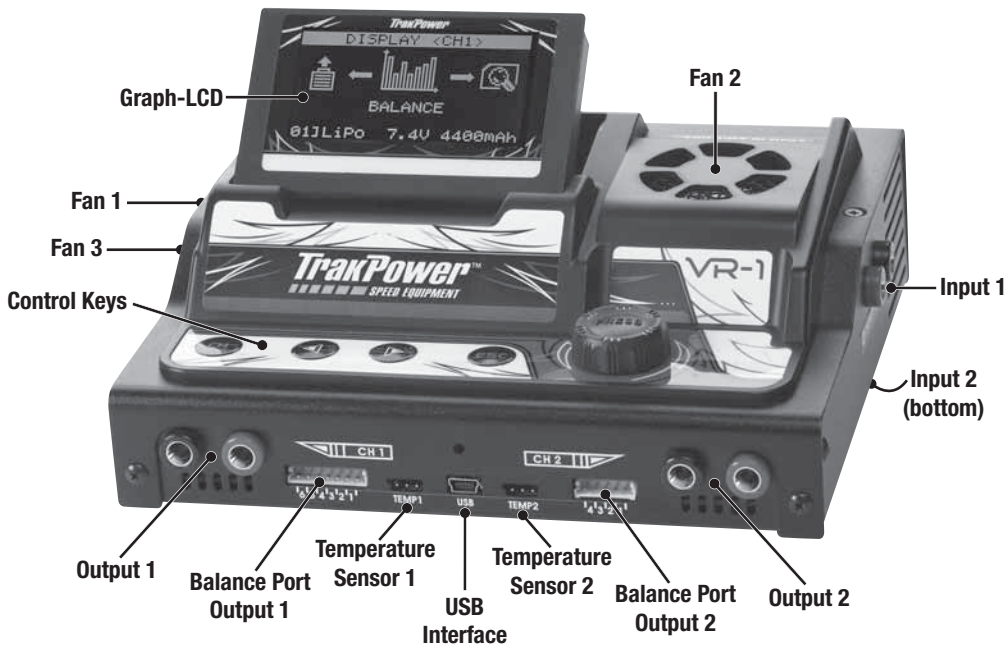
**Amps (A):** The unit of measure for charge current.

**Milli-Amps (mA):** A unit of measure for current, being amps (A) multiplied by 1000 and listed as “mA”. So 2.5A is the same as 2500mA ( $2.5 \times 1000$ ). Or, to convert mA to Amps, simply divide the number by 1000. So 25mA is the same as 0.025A (25 divided by 1000).

**Capacity and milli-amp hours (mAh):** The amount of energy a battery can store is called its **capacity**, which is defined as how much current a battery can supply constantly over one hour of time. Most hobby batteries are rated for capacity in “mAh” or **milli-amp hours**. A 650mAh battery can deliver 650mA of current for one hour ( $650\text{mAh} \times 1 \text{ hr} = 650\text{mAh}$ ). A 3200mAh battery can deliver 3200mA (3.2A) of current for one hour ( $3200\text{mA} \times 1\text{hr} = 3200\text{mAh}$ ), etc.

**“C” Rating:** Capacity is also referred to as the “C” rating. Some battery suppliers recommend charge currents based on the battery’s “C” rating. A battery’s “1C” current is the same number as the battery’s rated capacity number, but noted in mA or amps. A 600mAh battery has a 1C current value of 600mA, and a 3C current value of ( $3 \times 600\text{mA}$ ) 1800mA or 1.8A. The 1C current value for a 3200mAh battery would be 3200mA (3.2A), etc.

# Controls and Connections



Some controls can be used for the same functions.

**CH** Used to switch the LCD between channel 1 and channel 2.

**< (back)** To exit out or return to the previous screen

**> (next)** To enter or move to the next screen

**Jog Dial:** Rotate – Scroll through menus and/or pages

Press once – Enter or confirm

Press & hold – To enter or move to the next screen.

## DC Input Power

This charger is powered by a 12V DC power source. Located on the right hand side of the charger is a jack for the connection of the DC power cord. Also located on the bottom of the charger is a secondary DC jack. This jack is designed for docking into the TrakPower DPS Power Supply – TKPP5505. Always match polarities (red lead to red “+” terminal, black lead to black “-” terminal). To utilize the charger’s absolute maximum power capabilities the DC power source must be capable of delivering at least 20 amps while maintaining 12V DC.



**WARNING!** Never accidentally short together the positive (+) and negative (-) input connections when connected to 12V DC power. Failure to do so could result in permanent damage to the power source and the charger.



This charger is rated for a maximum output power of 250 watts. Depending on certain conditions (if charge current is set to maximum, the maximum number of cells connected to the output, and input voltage is low), the actual current delivered to the battery might be slightly less than the setting. This is normal.

The charger will be on at all times when connected to input power. Disconnect the charger from input power when not in use.

# Navigating the Menus

The TrakPower VR-1 has eight menus assigned to Channel 1. Channel 2 uses a separate menu screen which can be recalled by pressing the “CH” button on the front panel. Channel 2 is covered on page 22 of this manual. The description of the Channel 1 menus is as follows:



## 1. CONFIGURATION MENU

Numerous functions can be configured in the configuration menu. Rotate the dial to find the CONFIG icon (as shown right), then press the > key to enter setup. Rotate the jog dial to move the cursor up or down to the feature you wish to adjust. Press the dial to highlight the adjustable value. Rotate the dial to adjust the value, then re-press the dial to confirm the selection.

- A. Temperature Scale:** The temperature scale can be changed between Fahrenheit (°F) and Celsius (°C).
- B. Button Sound:** VR-1 can be configured so that anytime a button is pressed or the dial is rotated one click an audible tone will beep. This can help to confirm that functions are being adjusted. These beeps can also be turned “off” (but will sound if errors occur).
- C. Finish Sound:** A sound will be emitted to indicate that a function has been completed. This feature adjusts the length of time that the sound will play, ranging from 5 seconds, 15 seconds, 1 minute or continuously until turned off. This feature can be turned off completely.
- D. Finish Melody:** Select from any one of 10 different tunes to be played to indicate that a feature has ended. This feature can also be turned off.
- E. LCD Contrast:** Adjust the contrast of the LCD screen for best viewing. Adjustable range is from darkest (1) to lightest (15).
- F. Internal Power Setup:** Allows the user to configure internal power settings for Channel 1 and Channel 2. Default settings are 200W for Channel 1 and 50W max. for Channel 2. Up to 250W can be assigned to CH1 leaving 2W for Channel 2.
- G. User Name:** Allows user to change the user name which appears on the opening screen when power is initially applied to the charger, and is also located under the “CONFIG” icon in the main menu.

To change the user name, press then rotate the dial to select the character to be changed. Press the dial again to select the character. A highlighter box will appear in the string of characters below. Rotate the dial to the replacement character and press to change character. Once a character has been changed, the next character on the current user name will automatically be highlighted. If you wish you change this character, press to confirm and choose the replacement character. If not, rotate the jog dial to the desired character and repeat as desired. Press ESC to return to the main menu.

To blank out all characters at once press the jog dial to select the first character of the user name. Below in the character list, use the jog dial and scroll to the blank character, press and hold the dial for 2 seconds and all characters will clear.

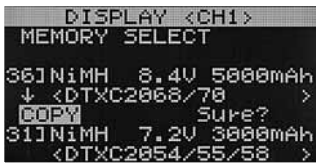
## 2. MAIN MEMORY

A memory bank is available for setting and storing pertinent information for up to 40 different battery types. Batteries currently in the TrakPower, Onyx™ and Hobbico® LiFeSource™ brands are pre-programmed into the main memory for easy recall. Refer to the “Battery Memory – Factory Settings” chart on the fold-out section included with this manual for the default settings in each memory.



**A. Selecting a Battery from Memory:** Rotate the jog dial to the memory icon (shown above right) and press to enter. Use the jog dial to scroll until the desired memory is displayed at the top half of the screen. Press the jog dial once to confirm the change of memory model. Use the ESC key to back out to the main menu.

**B. Copy Models:** If you wish to copy one memory to another, rotate the jog dial to the desired memory to be copied and press the jog dial. Rotate the jog dial to the desired destination location and press and hold the dial. A confirmation will appear asking “Sure?” Press the dial again to confirm the copy process. If the memory has been copied successfully a chime will sound and both displayed memories will be identical. Use the ESC key to exit to the main menu. It is not required to use any of the VR-1 memories. In such case, read further to learn more about manually setting these parameters for each use.



**C. Changing Model Memory Parameters:** To change parameters for a particular model number to match that of your battery needs, rotate and press the jog dial once on the memory icon. In the “Memory Select” screen, use the jog dial to locate the model number you wish to change parameters. Press and confirm with the jog dial. Use the ESC key to back out to the main menu.

With the memory icon selected, press the > key to enter the parameter setup. Use the jog dial to switch between parameters to be adjusted. Pressing the jog dial will highlight the parameter and rotating will change it. Once the parameters match that of your battery needs, pressing the jog dial will confirm these settings. Use the ESC button to back out to the main menu.

To change the model memory name, follow the instructions as posted for changing the user name found in the Configuration section found on page 6.

**D. Reset Model Memory:** To reset all of the battery models back to factory defaults, follow these steps:

- Connect the charger to DC power.
- Press and hold the > button and turn on the DC power source. “LCB Port Test” will appear on the VR-1 charger.
- Press the > button once again and the initialization will begin. Once the initialization is completed, the charger will reset itself.

## 3. CHARGE

Used to set charge currents, charge voltage, cutoff temperature and maximum capacity. To enter charge setup, use the jog dial to locate the charge icon as shown to the right and press the > key.



**A. Charge Current:** To manually adjust charge current, press the dial, then rotate to find the new charge current ranging from 0.1A (100mA) to 20.0 amps. Re-press the dial to confirm setting. **WARNING!! It is NOT RECOMMENDED to charge Li-Ion, LiPo or LiFe cells at a greater rate than their 1C value!! Supplying too much current to a lithium battery can cause very serious damage (including fire!) to the batteries and the surrounding area!**



**B. Charge Voltage (lithium batteries only):** Normally, a LiPo battery is charged to 4.2V per cell but for storage purposes, it can be charged from 3.7V/cell to 4.0V/cell. For charging range per battery type, please refer to your battery’s instruction sheet. Normal maximum charge voltage settings for battery types:

**LiFe:** 3.6V/cell, **Li-Ion:** 4.1V/cell, **LiPo:** 4.2V/cell. For higher cycle life time, use 0.1V less. For storage use 0.4 to 0.5V less. Please refer to page 20 for storage recommendations.

**NEVER set output voltage to anything greater than the batteries’ nominal voltage rating.**

**C. Peak Sensitivity (NiCd and NiMH batteries only):** This value determines the sensitivity/accuracy of the peak detection circuit. Adjustment of this value can help match the characteristics of your battery to the charges for better peak charges. For NiCd batteries the range is 5-25mV. For NiMH batteries the range is 1-15mV. A “ZEROpk” – or “Zero volt Delta Peak” – setting is also available for NiMHs which means it will try to detect the exact voltage peak, but the battery’s condition **must** be good and charge currents and voltages **must** be very clean and stable for

ZEROpk to function properly. A lower number means the charger will try to be more precise in finding peak charge, but in certain situations could cause the charger to errantly stop peak charge too quickly, in which case it may be necessary to increase this number to 8mV or greater (especially if using an external AC power supply on the input). Press the dial, then rotate to find the desired peak sensitivity value. Re-press dial to confirm setting.

**D. Peak Delay (NiCd and NiMH batteries only):** Sometimes during the early stages of peak charge a battery's voltage can be unstable and cause the peak detector to accidentally stop peak charge. This peak delay feature temporarily de-activates the peak detection circuit at the beginning of charge to prevent the charger from accidentally shutting down too early. Usually, a battery's voltage becomes stable in a very short period of time, whereby the peak detection circuit can be re-activated. The adjustable range is 1-20 minutes.

**E. Trickle (NiCd and NiMH batteries only):** This is the amount of trickle charge current which will be applied to the battery only after fast charge has ended. To adjust, press the dial and then rotate to find the new current. Re-press the dial to confirm selection. The range is 0 (off) to 500mA, in 50mA increments. If charging "A" or "AA" size radio batteries (Rx or Tx), it is not recommended to set the trickle current to larger than 50mA. For Sub-C batteries, the recommended trickle current setting is roughly C/20 (battery capacity rating divided by 20). If fast charge is stopped because the battery temperature reached the maximum temperature setting (see below), trickle charge will not begin until battery temperature drops about 4°F (2°C) below the maximum temperature setting.

An auto trickle function is also an option. In the auto trickle mode, the charger will automatically deliver a trickle charge after peak charge ends to help the battery safely reach 100% full charge. Trickle charge is applied *only* after an individual peak charge (not after discharge or cycle), and will remain on until the pack is disconnected. Trickle current is automatically set, based on the fast charge current setting as listed below:

FAST CHARGE CURRENT	TRICKLE CURRENT
0.0-0.9A	0mA
1.0-1.9A	50mA
2.0-2.9A	100mA
3.0-3.9A	150mA
4.0-4.9A	200mA
5.0-5.9A	250mA
6.0-6.9A	300mA

**F. Cut-off temperature:** VR-1 can monitor the temperature of the battery which is being charged. This feature is used in conjunction with TrakPower's optional Temperature Sensor (TKPP5635) which can be found at local hobby retailers. The Duratrax (DTXP4171), Hobbico (HCAPO281) and Triton™ Thermal Probe from Great Planes® (GPMM3151) are also directly compatible. Monitoring a battery's temperature in addition to its voltage can result in most accurate full charges without damaging the battery, and is **highly recommended for use with lithium based batteries**. The adjustable range is from 50 - 176° (10 to 80°C). Each channel has its own designated sensor jack located on the front of the charger. When properly connected to the jack, the sensor's white wire will be on the left and the black wire will be on the right.

- i. If it's NOT desired to measure the temperature of a battery, make sure the temperature sensor is NOT connected to the charger.
- ii. To change the temperature scale from Celsius to Fahrenheit or vice-versa, see the Configuration Setup Menu on page 6.
- iii. To adjust the temperature setting, press the dial and then rotate to find the new temperature. Re-press dial to confirm setting.
- iv. The MAXIMUM temperature for lithium batteries varies by cell manufacturer, but as a general recommendation, the maximum temperature should not exceed 90-95°F (32-35°C). **For lithium batteries, it is better to be safe than sorry!** Start with lower temperatures first and if necessary adjust the temperature setting upward as needed in small increments and closely monitor the charge progress.
- v. During charge, if the battery reaches the selected temperature setting the charge process *will completely stop* and will not re-start. Setting the temperature value too low may cause VR-1 to stop charging the battery before it reaches full charge. In this case, increase the temperature setting by a small amount, making sure not to allow the battery to overheat before full charge has been reached. In this case, decrease the temperature setting.



**G. Maximum Charge Capacity:** This sets the maximum amount of capacity that the charger will deliver to the battery during charge. This feature can be used for two different purposes:

- i. If full charge has not been detected on the battery for some reason, fast charge will stop completely when this maximum capacity value has been reached. This is a safety feature designed to protect the battery pack and user from an overcharge condition.
- ii. Cell manufacturers recommend to apply a partial charge to batteries before being put away for long-term storage (over the winter, for example). For battery storage, please refer to the battery storage section located on page 20 of this manual.

Press and then rotate the dial to find the desired maximum capacity. For NiCd and NiMH batteries the adjustable range is off-150%. This means, if peak voltage is not detected first VR-1 will automatically stop fast charge at the value equal to the battery capacity multiplied by the percent entered in this maximum charge capacity setting. So, if the battery capacity entered was “2400” and if the percentage entered here is “150%”, the charger will automatically stop fast charge when (2400 x 150%) 3600mAh of energy is delivered to the battery.

For Li-Ion and LiPo batteries, the adjustable range is 10-120%. It is recommended not to allow these battery types to charge more than 105% to 110% of their rated capacity. **FOR SAFETY PRECAUTIONS, IT'S RECOMMENDED TO KEEP THIS VALUE CLOSE TO 100%.**

**H. Safety Timer:** If for some reason the charger does not recognize a battery has reached full charge, this backup safety timer can automatically stop charge after a certain period of time. This protects the battery from accidental overcharge. If fast charge IS shut down by this timer, do NOT assume the battery has reached full charge (especially if the battery is not even slightly warm to the touch). **It is strongly recommended to use this function for ALL battery types.**

To use this function, set a safety timer in minutes which ranges from 10 – 900 minutes. See the “Safety Timer Calculations” section below for how to calculate a safety time limit. If the battery repeatedly does not seem to reach full charge, it may be necessary to lengthen the safety timer so the battery can reach full charge properly. **Note:** This function can be disabled for slow charging of NiCd or NiMH batteries by selecting “OFF”.

**Safety Timer Calculations:** For NiCd and NiMH batteries, divide the battery’s rated capacity (mAh) by the fast charge current setting (A). Take that result, and DIVIDE BY 11.1. Set this number of minutes in the safety timer screen. If the charger stops charge at this time limit, approximately 150% of the battery’s rated capacity will have been delivered to the battery. For example:

NICD/NIMH BATTERY RATED CAPACITY	FAST CHARGE CURRENT SETTING	SAFETY TIMER CALCULATED SETTING
1000mAh	0.9A	$((1000 \div 0.9) \div 11.1) = 100$ minutes
1500mAh	2.5A	$((1500 \div 2.5) \div 11.1) = 54$ minutes
3800mAh	2.3A	$((3800 \div 2.3) \div 11.1) = 149$ minutes

For LiPo, Li-Ion, LiFe and Pb batteries, divide the battery’s rated capacity (mAh) by the fast charge current setting (A). Take that result, and DIVIDE BY 15.1. Set this number of minutes in the safety timer screen. If the charger stops charge at this time limit, approximately 110% of the battery’s rated capacity will have been delivered to the battery. For example:

LIPO BATTERY RATED CAPACITY	FAST CHARGE CURRENT SETTING	SAFETY TIMER CALCULATED SETTING
900mAh	0.6A	$((900 \div 0.6) \div 15.1) = 99$ minutes
2100mAh	1.8A	$((2100 \div 1.8) \div 15.1) = 77$ minutes
3200mAh	3.0A	$((3200 \div 3.0) \div 15.1) = 70$ minutes

**I. Flat Check:** If during peak charge the NiCd or NiMH battery’s voltage stops rising, but also does not fall (as most NiCd or NiMH will do), “FLAT CHECK” indicates that the battery’s peak voltage is flat and unchanged and will automatically stop charging the battery as a safety precaution. You may turn on or off this FLAT CHECK function.

**J. Re-peak Charge:** In re-peak charge mode, VR-1 can peak charge the NiCd or NiMH battery up to 5 times in a row automatically. This is good for making certain the battery is fully charged, and for checking how well the battery receives fast chargers. And, VR-1 will track how much capacity was added during each re-peak. A good battery will have low charge capacity values for the 2<sup>nd</sup> and 3<sup>rd</sup> re-peak cycles. Batteries having higher capacity values for the 2<sup>nd</sup> and 3<sup>rd</sup> re-peak charges are not likely receiving peak charge as well. To change the number of re-peak cycles to perform, press and rotate the jog dial to the desired number of cycles and press to confirm.

**K. Re-peak Delay:** This sets a time delay to occur between charge and discharge while cycling in order to allow the battery to cool. The range is from 1-30 minutes. Press, then rotate the dial to find the amount of time for the delay. Re-press dial to confirm setting.



#### 4. DISCHARGE

Used to set discharge current, cutoff voltage, cutoff temperature and maximum discharge capacity. Rotate the jog dial to locate the discharge icon, as shown left and press the > key to enter discharge setup.

**A. Discharge Current:** To manually adjust, press the dial, then rotate to find the desired discharge current which ranges from 0.1A (100mA) to 10.0 amps. You should refer to your battery manufacturer's instruction manual for recommended discharge settings for your particular pack.

**B. Discharge Cutoff:** This is the voltage where discharging of the battery will stop, and is shown as volts PER CELL in the pack (not total pack voltage). Press dial, then rotate to find the correct value. Re-press dial to confirm setting.

i. Some NiCd and NiMH battery manufacturers rate the capacity (mAh) of their batteries based on a discharge cutoff voltage of 0.9V per cell. So, to see if the battery is supplying the amount of capacity as rated by the manufacturer, set the discharge cutoff voltage to 0.8 or 0.9V. This is also a good voltage for stopping discharge of "sub-C" size cells to determine their useful run-time in minutes. However, for any "A", "AA" or "sub-C" size cells that are used to power radio transmitters or receivers, set the discharge cutoff voltage to 1.1V per cell to get an idea of how long the battery will power the transmitter and/or receiver. Most R/C receivers are not capable of maintaining control with a 4-cell NiCd/MH battery that is discharged below 1.1V per cell. The adjustable range for NiCd and NiMH batteries is 0.1 – 1.1V per cell.

ii. For Li-Ion/LiPo batteries, the adjustable range is 2.5 – 4.2V per cell. A setting of 3.2V per cell is recommended.



**WARNING!! Do not attempt to discharge a LiPo battery below its recommended cutoff voltage. Doing so may cause a failure later when attempting to re-charge the battery, and result in FIRE!**

**C. Cutoff Temperature:** Please refer to page 8 in the charge section.

**D. Maximum Discharge Capacity:** This is to set desired discharge percentage. If "OFF" is set, this maximum capacity function is not activated. If battery capacity is 3000mAh and if you set 10% out of the total maximum capacity, the charger should discharge 300mAh. It is recommended that the maximum discharge capacity be turned OFF when discharging lithium type batteries.



#### 5. CYCLE

Battery "cycling" is the process of fully charging then discharging a battery to a pre-determined cutoff point or vice-versa. Cycling is **ONLY** recommended for NiCd and NiMH batteries (never for lithium or lead-acid batteries). The VR-1 can perform anywhere from one to ten cycles consecutively.

**A.** To cycle a Ni-XX battery, be sure the correct battery specifications are entered or correct model memory has been selected.

**B.** Use the jog dial to locate the Cycle menu and press > to enter the setup.

**C.** Decide if you want the battery to be discharged first (preferred if the battery is used often), or charged first (sometimes preferred if the battery is new or has not been used for some time).

**D.** To set the number of times the battery will be cycled consecutively, rotate the dial to "CYCLES" and press to change the number of cycles from 1 to 10 times. Press to confirm.

**E.** A time delay can be set to occur between the charge/discharge functions to allow the battery to cool. This cycle time delay can be adjusted from 1 to 30 minutes. There is a separate delay for the charge process (AF-CHG DELAY, "After-Charge Delay") and discharge process (AF-DCH DELAY) of the cycle.

#### **NOTES FOR CYCLING NICKEL AND NIMH BATTERIES:**

- Periodic cycling of NiCd batteries (once every month or two) can be beneficial in keeping them in good operating condition. Excessive cycling (more than once monthly) will unnecessarily shorten the lifespan of the battery.
- During cycle mode, the discharge cutoff voltage for NiCd and NiMH is FIXED (not adjustable) at 0.9V per cell.
- Cell manufacturers note three main benefits of cycling NiCd and NiMH batteries:
  1. Battery maintenance: NiCd batteries benefit the most from regular cycling to help keep them in good operating condition, and is recommended once-monthly. NiMH batteries do not require as much cycling.
  2. Determining battery condition: NiCd and NiMH batteries are rated by how much charge energy or “capacity” they can store compared to their rated capacity. A battery that can supply only a small fraction of its rated capacity is likely reaching the end of its useful life and may need to be replaced.
  3. Breaking in batteries: new NiCd and NiMH batteries may need to be broken-in before they will perform to their specifications. Older batteries which have been unused for an extended length of time may require to be broken-in again to regain their usefulness. Repeated cycling is the best way to revive such batteries.

## **6. STEP CHARGE**

**CAUTION! The Step Charge method is recommended for use by experienced users only!! If set improperly, the Step Charge method can cause severe, permanent damage to the battery! If you are unsure about how to use this function, do not use it.**



The Step Charge method is designed for very high charge efficiency for NiMH batteries. This feature can be used on NiCd batteries also, but only if the peak sensitivity value is set properly (see page 7). **NEVER USE THE STEP CHARGE MODE WITH LI-ION, LIFE, OR LIPO BATTERIES AS SEVERE, PERMANENT DAMAGE TO THE BATTERY AND ITS SURROUNDINGS WILL RESULT!!**

Parameters which are set in the Step Charge screen do NOT affect those which are set in the Main Memory screen. A temperature sensor **IS REQUIRED**. When using the Step Charge mode, VR-1 will not allow Step Charge to start unless a temperature sensor is connected.

The Step Charge method divides the overall time needed to charge a battery into four separate periods or “steps”. The maximum charge capacity and charge current is set separately for each of the four steps. The purpose of the Step Charge mode is to deliver as much energy to the battery as possible for racing “punch” without damaging the battery, but also to allow for the most accurate peak detection as possible for maximum run-time.

In the beginning, for charge step 1, it’s important that the battery’s voltage becomes stable, so the charge current setting should be rather conservative. Then, when the battery voltage is stable, much higher current can be delivered in Step 2. The higher currents in step 2 will cause the battery to generate heat after a period of time, so it is best to reduce current in step 3. Finally, for step 4, it’s best to reduce current again so the battery’s voltage is more stable which will allow the peak detection circuit to work more accurately to pack as much run-time capacity in the battery as possible. **It is important to note that in Step Charge mode the peak detection circuit functions ONLY in step 4 (not steps 1-3).**

The maximum amount of charge capacity delivered to the battery during each step effectively determines how long the charge current will be delivered to the battery during the step. Be careful not to set the capacity value too high – especially in steps 2 and 3 where the current settings are higher. The higher the capacity setting, the longer that current will be applied to the battery during the step, and the more likely the temperature sensor will trip due to heating and stop the charge process prematurely. It may take some practice and careful attention to dial-in the Step Charge mode for your battery. See the chart that follows for a breakdown of the settings for each step.

STEP CHARGE SETTINGS	MAXIMUM CHARGE CAPACITY SETTING	CHARGE CURRENT SETTING
<b>Step 1:</b> <i>Getting Started</i>	Set to 33-50% of pack's rated capacity	Set a conservative current – not too high! Set to slightly lower than the pack's 1C rating, to help stabilize the early stages of the charge process.
<b>Step 2:</b> <i>Delivering Punch</i>	Set to 50-75% of pack's rated capacity	Battery voltage should now be stable. A higher current can be set (up to the pack's 2C rating), to help deliver "punch" for racing.
<b>Step 3:</b> <i>Beware of Heat</i>	Set to 75-100% of pack's rated capacity	Reduce current to below the value in Step 2 (to approximately 1.2-1.5C) to try and prevent the battery from generating excess heat.
<b>Step 4:</b> <i>Stabilize for Good Peak Detection</i>	Set to 120% of pack's rated capacity	Reduce current to below the value in Step 3 to stabilize battery voltage and allow the peak detection circuit to work more accurately.

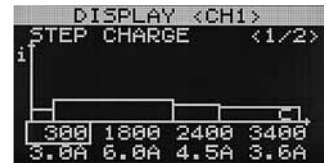
The Step Charge mode will automatically calculate the appropriate charge capacity and currents for each step based on the selected model memory. If you wish to manually change the values for each step, follow these directions.

A. Rotate the dial to move the cursor down to the **capacity** line (just under the graph). This line shows four different capacity values, each being the maximum capacity that will be delivered to the battery during each of the four steps. The range for each step is:

i. Press the dial to highlight the capacity value on the left which is for step #1. Rotate the dial to adjust this capacity value.

ii. Rotate dial to highlight the next capacity value to the right which is for step #2. Rotate dial to adjust this capacity value. Repeat this step 2 more times to adjust the capacity for steps 3 and 4.

iii. Press dial to confirm all capacity settings.



B. Rotate the dial to move the cursor down one line to the **charge current** line. This line shows four different charge current values that will be delivered to the battery during each of the four steps. The range for each of the four steps is 0.1 to 20.0 amps.

i. Press the dial to highlight the charge current value on the left which is for step #1. Rotate the dial to adjust this current value.

ii. Rotate dial to select the next current value to the right, which is for step #2. Rotate dial to adjust this current value. Repeat this step 2 more times to adjust the current for steps 3 and 4.

iii. Press dial to confirm all charge current settings.

iv. Rotate the dial to move cursor down as there are 6 additional lines of features in this menu.



C. **PEAK SENSITIVITY:** Peak sensitivity is the same as in charge mode. Refer to the Charge Menu section on page 7 for a description.

D. **CUT-OFF TEMPERATURE:** Refer to page 8.

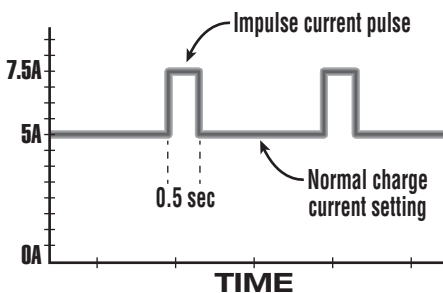
E. **TRICKLE CHARGE:** Rotate the dial to place the cursor in front of this line. This sets the trickle charge current that will be applied to the battery after fast charge ends. Press dial to highlight the value, and rotate to select the value which ranges from 0-500mA.

F. **DISCHARGE:** Rotate the dial to place the cursor in front of this line. This simply instructs VR-1 to automatically discharge the battery before starting the charge process. Press the dial, then rotate to either turn this feature "on" or "off". The discharge current here is automatically set to the maximum battery capacity entered in step G on page 9, multiplied by 4. For simplicity, it is best to set this to "on" to empty the battery before starting the Step Charge process.

**G. IMPULSE CHARGE:** Refer to diagram at right.

This feature functions in Step Charge mode only, and charges the battery at a current equal to the charge current setting x 1.5 for 0.5 seconds, every 3 seconds. The charge current at all other times is as set in the Step Charge screen on page 12. The impulse charge method is much the opposite of the reflex charge method explained below. Instead of applying high level negative charge pulses to the battery for short intervals, VR-1 applies high level positive charge pulses at regular intervals. And as with reflex mode, the impulse method is believed by some to help clear a cell's internal plates from build-up of oxidizing gas bubbles, allowing the batteries to perform better. Decide which steps to have the impulse mode function, which can be any combination of steps 1, 2 or 3. Impulse charge does NOT function in step 4. See the diagram below for how to set this function.

**IMPULSE CHARGE**



- i. Rotate dial to Impulse and place the cursor on step 1. Press and rotate dial until the “⏏” symbol appears next to the 1.

```

DISPLAY <CH1>
STEP CHARGE <2/2>
PEAK SENS 3mV/C
CUT-TEMP. 132°F
TRICKLE CHG OFF
DISCHARGE ON
IMPULSE CHG 1 2 3
REFLEX CHG 1 2 3
    
```

- ii. Rotate dial to move cursor to step 2. Press and rotate dial until the “⏏” symbol appears next to the 2. Press to confirm. Repeat for step 3 if desired.

```

DISPLAY <CH1>
STEP CHARGE <2/2>
PEAK SENS 3mV/C
CUT-TEMP. 132°F
TRICKLE CHG OFF
DISCHARGE ON
IMPULSE CHG 1 2 3
REFLEX CHG 1 2 3
    
```

**H. REFLEX CHARGE:** As with the impulse charge mode, reflex charge can be used in the Step Mode charge mode. Decide which steps to have the reflex charge mode function, which can be any combinations of steps 1, 2 or 3. Reflex charge does NOT function during step 4. Setting this feature is the same as Impulse charge mode. See the above diagram for how to set this feature.

*Note that impulse charge and reflex charge can be applied to the battery at the same time!*

**To start step charge mode:**

- i. Press the jog dial once on the Step Charge icon. A delay screen will appear showing all of the settings at the bottom of the screen. If these settings are correct, either allow the timer to expire or press and hold the dial to begin. If these settings are incorrect, press ESC to back out and make the necessary changes.
- ii. Before the VR-1 begins the Step Charge process the battery will perform a pre-discharge process. This pre-discharge process discharges the battery to a safe discharge level. Once the discharge cut-off voltage has been reached there will be a 1 minute delay prior to initializing the Step Charge.
- iii. During the Step Charge process, the current step will be displayed on the screen. See picture at right. There will also be a one minute delay between each step.

```

DISPLAY <CH1>
STEP-CHG START 3
PROCESS [STEP-CHG ]
321NiMH 8.4V 3000mAh
800 1800 2400 3400
    
```

```

DISPLAY <CH1>
[PRE-DCHG ]DISCHARGE
TIME 0:00:29
CAPACITY 0074mAh
VOLTAGE 8.441V
CURRENT - 9.48A
BATT TEMP. 73.0°F
    
```

```

DISPLAY <CH1>
[ 4STEP ] CHARGE
STEP =1 [⏏] [V]
TIME 0:03:03
CAPACITY 0165mAh
VOLTAGE 9.194V
CURRENT + 3.08A
BATT TEMP. 97.3°F
    
```



## 7. BALANCE

Displays lithium battery information such as number of cells connected, overall pack voltage, average cell voltage, individual cell voltages, gap voltage, minimum and maximum cell number and voltage and internal resistance for each cell. Cell voltages are also displayed in a bar graph. The charger will detect the number of cells connected to the charger via the balance adapter.

To enter the balance function, locate the Balance icon as shown above left, connect battery and press the dial. A balance start delay screen and confirmation screen will appear prior to balancing. You will need to verify that the correct number of cells is connected to the balance port of the charger prior to balancing.

While or after balancing has been completed, you can rotate the jog dial to view the various data that is displayed as listed below.

Use the jog dial to scroll through the screens to view other information such as all individual cell voltages and the internal resistance of the cells. The last data screen displays the cell voltages in a graph form.

A. Displays information such as cell number, pack voltage, average cell voltage, gap voltage, highest and lowest cell voltage.

```

DISPLAY <CH1>
BALANCE <1/4>
BATT CELLS 2CELL
PACK VOLTS 8.361V
AVG VOLTS 4.188V
GAP VOLTS 0.005V
MAX NO. 1 4.183V
MIN NO. 2 4.178V

```

B. Displays individual cell voltages

```

DISPLAY <CH1>
BALANCE <2/4>
1N 4.183V 5N 0.000V
2N 4.178V 6N 0.000V
3N 0.000V
4N 0.000V

```

C. Displays resistance of individual cells.

```

DISPLAY <CH1>
RESISTANCE <3/4>
1N 0.0mΩ 5N 0.0mΩ
2N 0.0mΩ 6N 0.0mΩ
3N 0.0mΩ
4N 0.0mΩ

```

D. Displays cell voltages in bar graph form.



## 8. DATA VIEW MENU

This menu option shows various types of data pertaining to the input or output of the charger. This menu consists of four different screens and can be seen only before a function has started, or after a function has ended (not while a function is being performed).

### DATA VIEW 1/4:

A. **INPUT VOLTAGE:** Shows the DC voltage at input lead.

B. **OUTPUT VOLTAGE:** Shows the DC voltage at banana jacks. It is important to understand that the condition of the connector lead on the battery and the charger's output can affect the accuracy of the voltage reading.

C. **BATTERY TEMPERATURE:** Shows the temperature of the battery as measured with the optional temperature sensor. If no sensor is connected the display will show "0.0°F".

D. **HIGH TEMPERATURE:** In conjunction with the Battery Temperature feature above, VR-1 will constantly record the highest measured temperature of the battery which is connected to the output.

E. **BATTERY RESISTANCE:** Will measure the battery's internal resistance starting 2 minutes AFTER discharge has stopped, and is shown in milli-ohms ( $\Omega$ ). Battery resistance will not be measured if cell voltage is lower than 1.0V for NiCD/NiMH batteries for 3.0V for Li-Ion/LiPo batteries. This is because the most important time to judge a battery's internal resistance is when it is closer to full charge. A lower resistance value is better, indicating the charger can likely condition the battery more efficiently and accurately. **IMPORTANT:** This value can be greatly affected by the quality of the connection between the battery and VR-1's output. A solid physical connection is important to having a good electrical connection. High quality components in the battery's own lead and the adapter lead between the battery and charger is also very important. Silicon

insulated wire has lower resistance, as do gold plated terminals and copper conductors. Larger gauge wire (with a smaller numerical value) also provides lower resistance. A battery whose internal resistance gradually worsens over time will be showing signs of aging, and could also result in poor charge and/or discharge capabilities and may need replacement soon.

#### **CYCLE DATA 2/4:**

This stores charge and discharge data. Cycle data has a total of 11 memories. The memory is ROM and even if powered off, the data will remain. Memory 0 is the latest data and memory 10 is the oldest data. Data which has happened after 10 cycles will be removed in order.

**F. CHARGE DATA:** Records the amount of time needed to complete a charge function, not counting the time a battery is in trickle charge (NiCd and NiMH) or top-off charge (NiMH only). Shown in seconds.

**G. DISCHARGE DATA:** Records the amount of time needed to complete a discharge function. Shown in seconds.

#### **TRACE DATA 3/4:**

This is to check battery condition. Information displayed is last charged capacity, last discharged capacity, highest charged capacity up to now, highest discharged capacity up to now, minimum internal battery resistance up to now, charged number and date of using battery for first time.

#### **DATA VIEW 4/4:**

**H. GRAPHIC DATA VIEW:** VR-1's graphic display can also show voltage curve, current and temperature waveforms after a charge or discharge function has ended (not for cycles). In the upper right corner, graph type is displayed by "GR". Following GR is which graph is currently displayed: V is for voltage, T is for temperature and I is for current. To change the graph from voltage, current and temperature press and rotate the jog dial until "graph type" is displayed on the screen. The cursor will be in the upper right hand position. Rotate until the desired graph type is displayed and re-press the dial to confirm the change.

**I. ZOOM:** The zoom factor is located in the lower-right. This enables you to zoom the graph for finer measurement readings. "x1" is the closest view. "x43 is the widest view". AT is auto-zoom. This is time of X axis and 1-43 zoom can be set. The wider the zoom, the less accurate the graph becomes.

**J. AUTO/MANUAL:** If Auto mode is selected, there are no other adjustable features for the graphing view. If "manual" mode was selected, features such as y-axis value, center value, point value and position may be adjusted as needed.

The total length of time that battery voltages will be graphed in this screen will be from the start to finish of either charge or discharge. For NiCd/ NiMH batteries, the overall graph should be shown in single display. For lithium batteries, the overall graph period is designed for a maximum of 3 hours based on a 1C rate (data past 3 hours won't be displayed). Information is NOT shown in graph form for re-peak charge mode, time delays, top-off charge, cycles, or discharge-before-charge steps.

# Determining Battery Type and Specifications

**IMPORTANT:** What is your battery's CHEMISTRY TYPE, RATED CAPACITY, AND RATED VOLTAGE?

To avoid causing permanent damage to your battery, carefully read your battery's label and/or instruction sheet or consult your battery supplier and determine:

1. **TYPE:** Is the battery a nickel-metal hydride (NiMH), nickel-cadmium (NiCd), lithium-polymer (LiPo), lithium-ion (Li-Ion), or lithium-ferrite phosphate (LiFe, such as LiFeSource brand)?
2. **RATED CAPACITY:** The amount of charge energy the battery can store should be listed on the battery's label in "mAh" ("milli-amp hours").
3. **RATED VOLTAGE:** If not printed on the battery's label, consult your battery supplier or determine the proper pack voltage as follows (refer to the charts at right):
  - A. NiMH and NiCd: number of cells x 1.20.
  - B. LiPo batteries: number of cells x 3.70.
  - C. Li-Ion batteries: number of cells x 3.60.
  - D. LiFe batteries: number of cells x 3.30.

NICD AND NIMH BATTERY PACK VOLTAGES	
NUMBER OF CELLS	NOMINAL VOLTAGE
4 cells	4.8V
5 cells	6.0V
6 cells	7.2V
7 cells	8.4V
8 cells	9.6V
9 cells	10.8V
10 cells	12.0V
11 cells	13.2V
12 cells	14.4V
13 cells	15.6V
14 cells	16.8V

NUMBER OF CELLS	LIPO, LI-ION AND LIFE PACK VOLTAGES		
	LiPo	Li-Ion	LiFe
1 cell	3.7V	3.6V	3.3V
2 cells	7.4V	7.2V	6.6V
3 cells	11.1V	10.8V	9.9V
4 cells	14.8V	14.4V	13.2V
5 cells	18.5V	18.0V	16.5V
6 cells	22.2V	21.6V	19.8V

## NiCd and NiMH Batteries

### CARE AND HANDLING OF NICD AND NIMH BATTERIES

- Do not allow NiMH batteries to overheat! Disconnect overheated batteries from the charger immediately and allow to cool.
- Do not attempt to use the charger's lithium functions with NiMH batteries.
- Store NiMH packs with some voltage remaining on the cells (refer to battery supplier).
- It is important to recharge NiMH batteries immediately prior to use, as they have a high self-discharge rate.
- "AAA", "AA" and "A" size radio batteries can safely be peak charged at currents up to 1.5C to 2C (battery capacity x 1.5 or 2.0). High charge currents can overheat batteries and thus reduce service life, especially for smaller size cells.

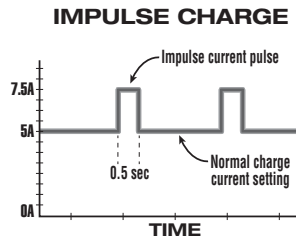
### CHARGING NICD OR NIMH BATTERIES

1. Plug the adapter into the charger FIRST. Then connect the battery to the adapter ONLY after it has been connected to the charger.
2. Be sure that the correct model number that matches your battery specifications is selected or the appropriate settings have been made in the CHARGE SETUP screen as noted on page 7. Charge current, cutoff voltage, cutoff temperature and maximum capacity can be adjusted within the Charge setup screen.
3. To begin charge, press the jog dial. A CHARGE START screen will appear displaying all of the settings at the bottom of the screen. If these settings do not match that of your battery, press the ESC button to back out and make the necessary adjustments. There are 6 different charge methods that can be selected from the delay screen. Below is a description of each. In most cases, the NORMAL charge mode will be used. The charge will initiate once the timer expires.

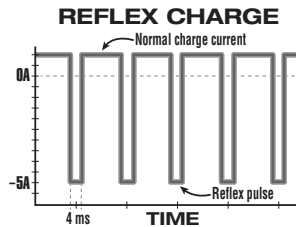
**A. NORMAL CHARGE MODE:** Linear current is delivered to the battery in normal mode. The charge process will shut off every one minute to measure the charge voltage to check the condition of the battery. The charge will finish by delta peak. This charge mode is good to charge old batteries.



**B. IMPULSE CHARGE MODE:** Refer to diagram at right. This feature charges the battery at a current equal to the charge current setting  $\times 1.5$  for 0.5 seconds, every 3 seconds. The charge current at all other times is as set in the Charge Setup screen. The impulse charge method is much the opposite of the reflex charge method. Instead of applying high level negative charge pulses to the battery for short intervals, VR-1 applies high level positive charge pulses at regular intervals. And as with reflex mode, the impulse method is thought by some to help clear a cell's internal plates from build-up of oxidizing gas bubbles, allowing the batteries to perform better. The impulse charge method can be used in the Step Charge process (see page 11).



**C. REFLEX CHARGE MODE:** As shown in the chart at right, in reflex charge normal current is delivered to the battery for 99.6% of every second, but for the remaining 4 milli-seconds a very deep discharge current is delivered to the battery. The quick discharge current is equal to the charge current setting multiplied by 4. Reflex charge is believed by some to help remove oxidizing gas bubbles from the battery's cell plates, allowing the battery to charge more efficiently, and is thought to be especially helpful on older NiCd batteries. Reflex charge mode may not be recommended by some NiMH battery manufacturers (check with your supplier). The reflex charge mode can also be used in the Step Charge process (see page 11).



**D. RE-PEAK CHARGE MODE:** In re-peak charge mode, VR-1 can peak charge the battery once, twice or three times in a row automatically. This is good for making certain the battery is fully charged, and for checking how well the battery receives fast charges. And, VR-1 will track how much capacity was added during each re-peak. A good battery will have low charge capacity values for the 2<sup>nd</sup> and 3<sup>rd</sup> re-peak charges. Batteries having higher capacity values for the 2<sup>nd</sup> and 3<sup>rd</sup> re-peak charges are not likely receiving peak charge as well. A five minute cool-off delay occurs after each re-peak charge.

**E. LINEAR CHARGE MODE:** This charge mode is very sensitive to the charge adapter connection, so if the adapter is touched, the charger could stop prematurely. Since delta peak is detected every second, delta peak is checked very accurately. It is possible to finish charging without increasing battery temperature as ZERO peak can be detected in this charge mode. After charging is completed, a 10 minute period will be needed to measure battery internal resistance.

**F. GMVIS™ CHARGE MODE:** During the GMVIS charge mode, the VR-1 will charge at the selected charge current for 6 seconds and pause every 2 seconds, in 8 second intervals. The purpose of this charge mode is to condition the cells and prevent the battery from being overheated or venting.

4. When charging has finished, you can recall information relating to the charge by rotating the dial or simply disconnect the battery and use.

## DISCHARGING NICD AND NIMH BATTERIES

1. Plug the adapter into the charger FIRST. Then connect the battery to the adapter ONLY after it has been connected to the charger.
2. Be sure that the correct model number that matches your battery specifications is selected or the appropriate settings have been made in the DISCHARGE SETUP screen as noted on page 10. Discharge current, cutoff voltage, cutoff temperature and maximum capacity can be adjusted within the discharge setup screen.
3. To begin discharge, with the DISCHARGE icon selected, press and hold the dial for 2 seconds. A "DISCHARGE START" delay screen will appear verifying all settings at the bottom of the screen. If these settings do not match that of your battery, press the ESC button to back out and make the necessary adjustments. There are 2 different discharge methods that can be selected from the delay screen. Below is a description for each. In most cases, the NORMAL discharge mode will be used. The discharge will initiate once the timer expires:

**A. NORMAL:** Linear current is pulled from the battery in normal mode. The discharge process will shut off every one minute to measure the discharge voltage to check the condition of the battery.

**B. LINEAR:** Linear current is pulled from the battery and discharges without stopping. The internal resistance is measured only one time after starting discharge. This is measured 3 minutes after starting discharge.

4. When discharge has finished, a chime will sound. Press the ESC button and disconnect the battery for use. You can recall information relating to the discharge by pressing the < or > keys.

### ***CYCLING NICD AND NIMH BATTERIES***

1. To cycle NiCd or NiMH batteries: With the correct memory model loaded or necessary programming completed, scroll to the "CYCLE" icon. Press the > key to enter Cycle Setup to change parameters or pressing the dial for 2 seconds will begin the cycle process.
2. After pressing the dial for two seconds, a CYCLE START screen will appear. On this screen, the charge and discharge process type may be changed. See charge and discharge sections located on page 16 and above for an in depth description for each type.
3. Once the 5 second timer expires, the cycle process will begin. To speed things up, press and hold the dial until the chime sounds. A connection check will take place and the cycle process will begin.

## ***Lithium Batteries***

### ***CARE AND HANDLING OF LIPO, LI-ION AND LIFE BATTERIES***



- **WARNING!! DO NOT** try to charge lithium-polymer (LiPo) or lithium-ion (Li-Ion) or LiFe cells in the same way as other battery types! Always read the instructions that are included with your lithium batteries carefully before use. Failure to follow these care and handling instructions can quickly result in severe, permanent damage to the batteries and their surroundings and even start a FIRE!
- **ALWAYS** charge lithium batteries in a fireproof location, which could be a LiPo bag such as GPMP0751 or a container made of metal or ceramic tile. Monitor the area with a smoke or fire alarm, and have a lithium approved fire extinguisher available at all times.
- **NEVER** attempt to extinguish a lithium fire with water or non-lithium approved fire extinguisher! Always have a lithium approved "Class D" fire extinguisher ready.
- **ALWAYS** provide adequate ventilation around LiPo/Li-Ion/LiFe batteries during charge, while in use, and during storage.
- **NEVER** allow LiPo, Li-Ion or LiFe cells to overheat at any time, as they can and usually will become physically damaged could possibly **EXPLODE** or catch **FIRE!!** If a battery becomes overheated (over 140°F, 60°C), disconnect it from the charger **IMMEDIATELY!**
- **NEVER** continue to charge LiPo, Li-Ion or LiFe batteries if the charger fails to recognize full charge. LiPo and LiFe cells which swell or emit smoke may be in an overcharge condition and should be disconnected from the charger immediately.
- **NEVER** set the charger's LiPo/Li-Ion/LiFe battery voltage settings to a voltage that is **HIGHER** than the nominal rating of the battery itself, as such cells cannot handle overcharging in any way.
- **NEVER** charge LiPo, Li-Ion or LiFe batteries at currents greater than "1C" rating of the battery, or the maximum rated current as specified by the battery's manufacturer.
- **NEVER** allow LiPo cells to come in contact with moisture or water at any time.
- **NEVER** allow the internal electrolyte from LiPo, Li-Ion or LiFe batteries to get in the eyes or on the skin – wash affected areas immediately if they come in contact with the electrolyte and contact your physician!
- **NEVER** attempt to use the charger's NiCd and NiMH functions for LiPo or Li-Ion batteries.
- **ALWAYS** keep LiPo batteries away from children.

## BALANCED VS. NON-BALANCED LITHIUM PACKS

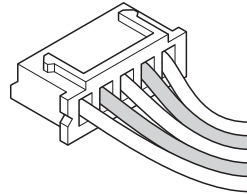
Lithium batteries for R/C are commonly available in two different assembly/wiring configurations: wired for balancing, and non-balanced. It is important to know which configuration you have before proceeding. Consult your battery supplier if you are unsure if your battery is wired for balancing, if it's not wired for balancing but has a built-in safety circuit, or neither.

**WARNING!** It is NOT recommended to charge a LiPo battery which is not wired for balancing, or which does not have a built-in protection circuit! Such types of LiPo batteries have NO means to protect the equipment or the user from damage that could result from an overcharge condition of any single cell in the pack.



Packs wired for **BALANCING** have a unique connector which has more than two wires going to the pack itself. Such packs **SHOULD** be charged with a LiPo charger that is capable of balancing, or with a LiPo charger that is connected to a separate LiPo cell balancer. The VR-1 has built-in balancing circuits.

Balancing Connector



For LiPo batteries with bullet connectors, a different type of balance adapter other than what is included will need to be used to accommodate the bullet type connectors. This adapter consists of two 4mm male bullet connectors (one positive and one negative) and a 2mm male bullet connector for balancing. This type of adapter is available separately (DTXC2225).



**NON-BALANCED** packs are wired so the charger can only detect the voltage of the entire pack (not individual cells), and only have one charge lead. It's highly recommended to **ONLY** use such types of LiPo packs if they have a built-in charge safety circuit which prevents any single cell in the pack from being overcharged. Simply connect the battery's main power lead to the charger's banana jacks (note proper polarity).

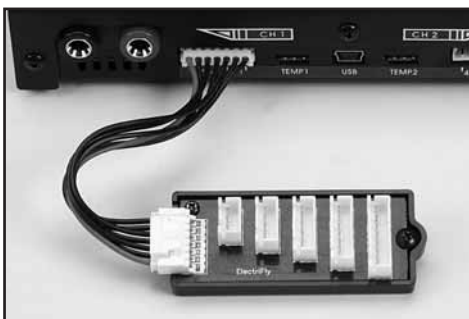
## CHARGING LITHIUM BATTERIES

**WARNING!** Always follow the instructions below when charging LiPo/Li-Ion or LiFe batteries! LiPo, Li-Ion and LiFe batteries should **NEVER** get warm or change shape anytime during charge! Disconnect batteries **IMMEDIATELY**, **ONLY** if safe to do so, if they become excessively warm or hot or change shape at any time, and refer to the Troubleshooting Guide in the rear of this manual for details. LiPo, Li-Ion and LiFe cells are much more dangerous than NiCd or NiMH batteries, and pose a significant **FIRE HAZARD** which can result in causing bodily harm and/or permanent damage to the cells and the surrounding environment. It is recommended to use this charger's temperature cutoff function when charging lithium batteries, to provide an additional layer of safety. See page 8 for details.



## BATTERY CONNECTION

After the correct model memory has been selected and/or all necessary programming is completed, the correct adapter(s) will need to be installed.



To balance a LiPo battery during charge, connect the balance board adapter that matches your battery's balance connector to the charger's balancing jack (above left). The red wire will always be on the left. Then connect the battery's balance lead to the balancing board. Lastly, connect the battery's main power lead to the adapter connected to the charger's banana jacks and note proper polarity (shown above right). Make sure to connect to the proper output.

## CELL CHECKER

When a lithium battery is first connected to the charger, the Cell Checker function will automatically open. This cell checker measures and displays information such as the overall pack voltage, gap voltage between highest and lowest cell and the individual cell voltages. Pressing any of the buttons located on the front panel will exit the Cell Checker screen. Using the built-in Cell Checker function is a quick way to be sure the pack is in good condition and the voltages on each cell are acceptable.

```
CELL CHECKER <CH1>
PACK VOLTS      8.361V
GAP VOLTS      0.005V
1N 4.163V    2N 4.178V
3N 0.000V    4N 0.000V
5N 0.000V    6N 0.000V
```

## STARTING CHARGE - LITHIUM

- After all necessary programming has been completed (as listed on page 7, step 3) and the battery is properly connected to the charger, charging may begin.
- To start the charge process, rotate dial to locate the “CHARGE” icon and press to begin the charge process. Three options are available for charging lithium batteries located on the Charge Start screen. In most cases, the CC/CV method will be used. Below is a description of each:

**A. CC/CV:** Lithium based batteries are charged using the “Constant Current/Constant Voltage” method (cc/cv). Constant current is delivered during the first part of fast charge. When the battery reaches a pre-set voltage, constant current is no longer delivered and a constant voltage is applied to the battery. As the battery’s voltage becomes equalized to the voltage on the charger’s output, charge current will steadily begin to drop. This is normal. When current reaches an approximate value of 1/10C, the charge process will end completely.

**B. FAST CHARGE:** Fast charge is conducted in the same manner that the standard CC/CV is processed with the exception that when the current reaches an approximate value of 1/5C, the charge process will end completely. The Fast Charge process is the faster of the two charge methods.

**C. STORAGE** – The TrakPower VR-1 has a storage mode for partially charging lithium batteries. This feature can be found in the charge menu. Rotate the jog dial to locate the Charge Menu icon. Press the jog dial as you would begin charging a battery. In the charge start screen, rotate the jog dial until “STORE” is displayed. Press the jog dial to select store. Once this is selected, “STORE-VOLT” will appear under the Process option. Use the dial to select the desired storage voltage. Press to confirm.

```
DISPLAY <CH1>
CHARGE START      4
PROCESS [ STORE ]
STORE-VOLT 4.00V/C
081LiPo 7.4V 6800mAh
C: 6.8A D:10.0A
```

LITHIUM BATTERY STORAGE VOLTAGE	
Lithium-Polymer (LiPo)	3.7V (88%) to 4.0V (95%)
Lithium-Ferrite Phosphate (LiFe)	3.3V (91%) to 3.5V (97%)
Lithium-Ion (Li-Ion)	3.6V (88%) to 3.9V (95%)

- Before charging begins, a confirmation screen will appear verifying the number of cells connected. If the number of cells connected is other than what is asked for confirmation, re-check all programming for accuracy. If programming is correct and the number of cells connected is correct, it is recommended to ensure that the battery is in good condition. If the number of cells connected matches that displayed on the screen, press the dial to confirm or simply allow the timer to expire.

Pressing the < or > keys while the battery is charging or has finished charging allows different information to be viewed about the charge process.

**A.** Displayed information includes time to complete charge, total capacity, voltage, current and battery temperature.

```
DISPLAY <CH1>
CC/CV 251 CHARGE
TIME      0:00:03
CAPACITY  0000mAh
VOLTAGE   8.357V
CURRENT   + 0.19A
BATT TEMP. 0.0°F
```

**B.** Displays charging information in graphical form. Graphs may be changed to view by time, current, voltage or temperature.



### C. Displays individual cell voltages by bar graph form



4. When the battery has finished charging, a chime will sound. Press the ESC button or unplug the battery.

### **STARTING DISCHARGE – LITHIUM**

1. To discharge a lithium type battery, ensure the correct model memory is selected that matches that of your battery specifications or all programming has been completed (as listed on page 10, step 4).
2. Locate the DISCHARGE icon on the main menu and press the dial to select.
3. As with the charge process, a battery check confirmation screen will appear asking you to confirm the amount of cells connected. If correct, press the dial to confirm.

4. There are two options for discharging lithium type batteries:

**A. Normal:** The most common method for discharging lithium batteries. While discharging, VR-1 stops the discharge process every one minute to measure the resistance of the battery. This is to ensure the overall condition of the battery is good and the discharge process is being performed accurately.

**B. Linear:** Discharges without stopping. Internal resistance is measured only one time every three minutes after starting the discharge process. This is the quickest discharge method.

Pressing the < or > keys while discharge is taking place or after discharge has completed displays various information about the discharge process. This information is the same as the charge process.

## **Lead-Acid (Pb) Batteries**

### **CARE AND HANDLING FOR LEAD-ACID (PB) BATTERIES**

Never attempt to care for lead-acid (Pb) batteries in the same way as other battery types! Lead-acid batteries commonly used in the R/C hobby field boxes require unique care and handling methods as they contain different characteristics than other battery types.

- Do not attempt to use the NiCd, NiMH, or lithium functions on Pb batteries.
- Do not exceed 14.7V maximum charge voltage for batteries rated at 12V.
- Pb batteries have a self-discharge rate of 5-10%, meaning they hold charge well. There is no need to trickle charge Pb batteries. No cycling of Pb batteries is needed.
- Do not leave Pb batteries in the full discharge condition, which could cause the battery to lose its ability to regain full charge.

### **CHARGING LEAD-ACID (PB) BATTERIES**

1. Check to see if any of the preloaded memories match your battery specifications. If one does match, skip to number 3. If none of the preloaded memories match that of your battery's needs, refer to page 7 to change the parameters.
2. Once the parameters have been made to match your battery, connect your battery to the charger.
3. Locate the CHARGE icon on the main menu and press the dial to begin charge.
4. When charging has finished, the charger will show completed on the screen and tones will sound.

#### **NOTES ABOUT CHARGING Pb BATTERIES:**

- Lead-acid (Pb) batteries are charged using the “constant current/constant voltage” process (CC/CV) as explain in the section for lithium batteries. However, the charger will determine the battery is full when output current drops to approximately 90mA and will automatically stop charging at that time. The cutoff voltage for Pb batteries is also different from lithium batteries.
- Lead-acid batteries do not need trickle charge, and therefore no such feature exists.
- Lead-acid batteries have a nominal voltage of 2.0V per cell. For most field batteries, even though you cannot see any individual “cells”, there are 6 cells internally. At 2.0V per cell, this makes a total field battery voltage of 12.0V.
- For lead-acid batteries rated at 12V or greater, the actual amount of current delivered to the battery might be limited due to the charger's max. power rating. This is normal.

## DISCHARGING LEAD-ACID (Pb) BATTERIES

1. To discharge lead-acid batteries, ensure the correct battery memory or parameters have been in the charger.
2. Connect the battery to the charger.
3. Use the jog dial to locate the DISCHARGE icon and press to begin discharge.
4. When the battery has finished discharging, the screen will show “Completed” and tones will sound.

### NOTES ABOUT DISCHARGING Pb BATTERIES:

- For more accurate discharge readings, it's better to use a current which can discharge the battery in 2 or 4 hours.
- The maximum discharge current is 3 amps. The actual amount of current drained from the battery might be limited for higher voltage Pb batteries due to the chargers max. power rating. This is normal.
- The proper discharge cutoff voltage for batteries with a nominal rated voltage of 6V is 5.4V, and 24V batteries should be discharged to 21.6V.

## Channel 2

Channel 2 is a charge ONLY output and may be used independently or while Channel 1 is being used. This allows two packs, of different chemistries, to be charged at the same time. Channel 2 is completely separate from the Main Menu associated with Channel 1. There is no model memory selection. Therefore, prior to charging a battery, the parameters must be changed to match the battery.

1. To access Channel 2, press the “CH” button located on the front panel.

```
DISPLAY <CH2>
OUTPUT2 CHARGE <1/2>
BATT TYPE      [LiPo]
BATT CAPA     2280MAH
BATT CELL     11.1V
CHG CURRENT   2.5A
```

2. Use the jog dial to change the settings to match that of your battery specifications. Press the dial and rotate to change to the desired setting. Press to confirm.

```
DISPLAY <CH2>
OUTPUT2 CHARGE <2/2>
CHG VOLTAGE   [4.28V/C]
CUT-TEMP.    176°F
SAFETY TIMER  385min
```

3. After battery connections have been made and programming is completed, press the dial to begin the charge process. A confirmation screen will appear as it does for Channel 1. Press the dial to confirm the correct number of cells is connected to the charger.

```
DISPLAY <CH2>
*CONNECTED CHECK* 3
[02] cells are now
connected at the
balancing port
.....Right?
OUTPUT [ 8.363V ]
```

4. During the charge process or after the charge has finished, various information can be accessed by pressing the < or > keys. This is the same information that is displayed on channel 1.
5. When charging has finished, press the ESC button to exit or simply unplug the battery.

## Cooling Fans

This charger has three built-in cooling fans (as shown on page 5) that aid in keeping the charger cool during operation. This will help extend the service life of the charger and allow it to function more accurately and efficiently. **CAUTION: Do not block any of the fans or vent holes for the cooling fans on the charger. Failure to do so could cause the charger to overheat and possibly cause permanent damage.**

# Error Messages and Troubleshooting Guide

Several safety features are included in this charger to protect itself and the battery against certain unwanted conditions, as follows:

LCD MESSAGE	PROBLEM AND SOLUTION
<b>No Battery</b>	A battery is not connected to the output. Please connect the battery to the output then restart.
<b>Reverse Polarity</b>	A battery is connected to the output in reverse! Please correctly connect the battery to the output.
<b>Input Voltage</b>	The present input voltage is __. __V. Please check the input voltage. The input voltage must be 11-15V.
<b>Short-circuited</b>	Output short circuited. Please check the output.
<b>Low Output Voltage</b>	Output voltage is lower than the selected cells or voltages.
<b>Open Circuit</b>	A battery is disconnected during an operation. Please reconnect the battery and restart.
<b>Temperature Sensor</b>	A temperature sensor is connected in reverse or is defective.
<b>Bat. Temp Too Low</b>	Battery temperature is too low to be operated (the temperature and output voltage will be displayed on the screen).
<b>High Output Voltage</b>	Output voltage is higher than the selected cells or voltages.
<b>Internal Temp</b>	Internal temperature is too hot! Contact Hobby Services if this message appears often.
<b>Data Communication</b>	Something is wrong with the internal circuit. Contact Hobby Services.
<b>Bat. Temp too High</b>	Battery temperature is too high to be operated (The temperature and output voltage will be displayed on the screen).
<b>Bal. Voltage Low</b>	Balancer cells voltage is too low!! The low cell number and voltage will be displayed on the screen during this error.
<b>Calibration Data</b>	Either calibration data or internal circuit might have been damaged.
<b>Bal. Voltage High</b>	Balancer cells voltage is too high!! The high cell number and voltage will be displayed on the screen during this error.
<b>No Temp. Sensor</b>	A temp-sensor is not connected to the port. Please connect the temp-sensor to the port and restart.
<b>Connection</b>	Selected cells and cells connected to the balancing port are different. Please re-check and re-start.

## **WARRANTY INFORMATION**

TrakPower warrants this product to be free from defects in materials and workmanship for a period of five (5) years from the date of purchase. During that period, TrakPower will, at its option, repair or replace without service charge any product deemed defective due to those causes. You will be required to provide proof of purchase (invoice or receipt). This warranty does not cover damage caused by abuse, misuse, alteration or accident. If there is damage stemming from these causes within the stated warranty period, TrakPower will, at its option, repair or replace it for a service charge not greater than 50% of its then current retail list price. Be sure to include your daytime telephone number in case we need to contact you about your repair. This warranty gives you specific rights. You may also have other rights, which vary from state to state.

For service on your TrakPower product, warranty or non-warranty, send it post-paid and insured to:

**HOBBY SERVICES**  
3002 N. Apollo Drive Suite 1  
Champaign, IL 61822  
(217) 398-0007  
hobbyservices@hobbico.com

\*For warranty and service information if purchased outside the USA or Canada, see the additional warranty information insert (if applicable) or ask your retailer for more information.



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