

Programmable Charger, Discharger and Analyzer for R/C Cars, Trucks & Boats

## **INSTRUCTION MANUAL**

IntelliPeak™ Ice™ is a high performance computerized battery charger, discharger, and cycler. IntelliPeak Ice is flexible enough to handle NiCd, NiMH, Li-Po and Li-Ion batteries, and offers a large variety of adjustable functions, yet is very easy to program and understand its numerous display screens. Quick reference flowcharts are included to help understand the overall programming structure of IntelliPeak Ice. **It is strongly recommended to read this manual in its entirety, and to fully understand exactly what types of batteries you have and how to care for them. Damage resulting from misuse or modification of this charger will void your warranty.**

## **INDEX**

Specifications .....	2
Special Features.....	2
Important Precautions .....	3
Charger Controls & Connections .....	4
Determining Battery Type & Specifications.....	5
Care & Handling of NiMH Batteries .....	6
Care & Handling of Li-Po & Li-Ion Batteries .....	6
DC Input Power.....	7
Navigating Menus.....	8
Setting a Battery into Memory – Selecting a Memory .....	9
Selecting & Naming Battery Memories .....	10
Adjusting Settings in the Main Memory Screen .....	10
Selecting & Starting Charge, Discharge or Cycle.....	16
Charge & Discharge Status Screens & Graphs .....	22
Motor Break-In Menu .....	24
User Set-Up Menu .....	25
Data View.....	26
Cycle Displays .....	29
Four-Step Charge Setup .....	30
Error Messages & Troubleshooting Guide.....	36

## **SPECIFICATIONS**

<b>Input Voltage:</b>	11-15V DC
<b>Battery Types, # of cells:</b>	1-10 Nickel-Cadmium cells (1.2 - 12.0V NiCd) 1-10 Nickel-Metal Hydride cells (1.2 - 12.0V NiMH) 1-4 Lithium-Ion or Lithium-Polymer cells (3.6 - 14.8V Li-Ion/Li-Po)
<b>Battery Capacity Range:</b>	100-9900mAh
<b>Fast charge current:</b>	0.1 - 8.0A (1C max for Li-Ion/Li-Po)
<b>Fast charge methods:</b>	linear, reflex, impulse and 4-step
<b>Fast charge termination:</b>	peak detection for NiCd and NiMH constant current/constant voltage for Li-Ion/Li-Po (cc/cv) optional thermal cutoff for all battery types
<b>Peak Sensitivity:</b>	0 - 25mV adjustable
<b>Trickle Charge Current:</b>	0 - 500mA (n/a for Li-Ion/Li-Po)
<b>Top-off Charge:</b>	0 - 1000mA (NiMH only)
<b>Discharge Current:</b>	0.1 - 10.0A adjustable (2C max for Li-Ion/Li-Po)
<b>Discharge Cutoff Voltage:</b>	0.1 - 1.1V per cell NiCd & NiMH 2.5 - 3.7V per cell Li-Ion/Li-Po
<b>Temperature Cutoff Range:</b>	50 - 132° F
<b>Cycle Count:</b>	1-10 cycles (n/a for Li-Ion/Li-Po)
<b>Cycle Cool-off Delay:</b>	1-30 minutes adjustable
<b>Battery Memories:</b>	10 battery memories
<b>Display Type:</b>	8 x 21 LCD (168 characters max)
<b>Graphical Displays:</b>	graphs charge and discharge voltage curves
<b>Output Connectors:</b>	banana jacks (two adapter leads included)
<b>Motor Break-in:</b>	1.0 - 8.0V selectable, 1 - 180 minutes, 10A constant, 30A surge
<b>Case Size:</b>	5.5 x 1.8 x 5.9" [140 x 45 x 150mm]
<b>Weight:</b>	21 oz. [605g]

## **SPECIAL FEATURES**

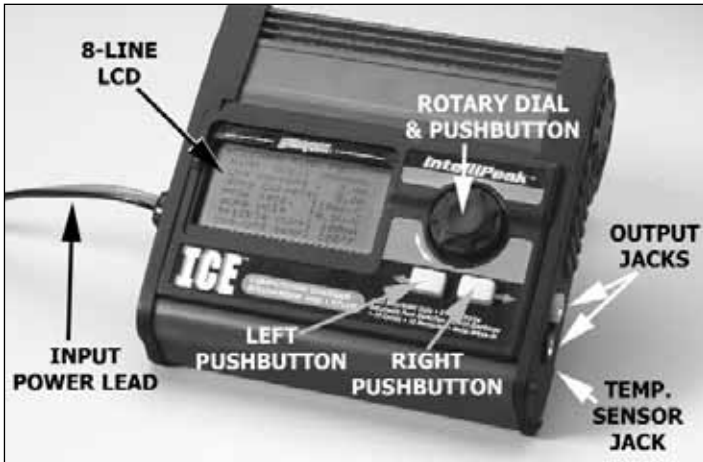
- Expanded LCD with extremely simple menus and controls!
- Great for electric R/C car, truck and boat batteries
- Peak detection with adjustable sensitivity for NiCd and NiMH batts
- Four charge methods: linear, reflex, impulse and 4-step
- Top-off charge feature fully charges NiMHs without overheating
- Optional fast charge thermal cutoff (requires optional temperature sensor – DTXP4171)
- Adjustable cool-off delay for cycling (1-30 minutes)
- Recall data for 10 full cycles on an expanded 8-line, 21 character LCD
- Configure up to 10 batteries in memory for instant, easy re-call and charger setup. Set custom names for all packs in memory.
- Displays input and output voltage, battery resistance, max. battery temperature, charge and discharge currents, voltages, time, and capacity and much more

- Custom display graphs charge and discharge voltage curves – great for evaluating pack performance!
- Motor break-in feature, adjustable from 1.0-8.0V, 1-180 minutes, and 10A constant (30A surge) for break-in of motors or operating commutation lathes
- Adjustable sound cues, LCD contrast, fan operation, temperature scale and more
- Loaded with safety features and warning screens (cool-off time delay, maximum charge voltage, maximum battery capacity cutoff, improper input voltage, reverse polarity, open or shorted output, poor battery voltages and temperatures, poor motor connections, excessive charger heating, and more)
- Rugged aluminum case, two pushbuttons, and rotating dial that acts as pushbutton also for easy navigation of all menus
- Built-in cooling fan, for better charge efficiency and extends life of charger
- Banana jacks on output with two charge adapters included (banana plugs to large alligator clips, and banana plugs to standard connector)
- Banana plugs pre-installed on input lead. Large alligator clips included which directly mate to bananas on input.

## **IMPORTANT PRECAUTIONS**

- 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 air intake holes, which could cause the charger to overheat.
- Do not attempt to use batteries with more cells or total voltage than listed in the specifications
- Do not leave the charger unattended while in use.
- **Disconnect the battery and remove input power from charger immediately if the charger becomes hot!!** Allow the charger or battery to cool down before reconnecting.
- Do not place the charger or any battery on a flammable surface or near a combustible material while in use. Do not charge or discharge on a carpet, cluttered workbench, paper, plastic, vinyl, leather, wood, inside an R/C model or full sized automobile!
- Always turn off the power switch or disconnect from power source when not in use.
- Do not overcharge batteries as permanent damage could result. Do not use a charge or discharge current rate which exceeds the safe level of the battery.
- Keep out of reach of children.

## CHARGER CONTROLS & CONNECTIONS



**INPUT POWER LEAD:** The input power lead is located on the left side.

**OUTPUT JACKS:** The output banana jacks are located on the right side.

**TEMPERATURE SENSOR JACK:** The temperature sensor jack is located directly underneath the output banana jacks on the right side of the charger.

**DIAL AND PUSHBUTTONS:** Next to the LCD is a rotating dial plus two pushbuttons which control all of Ice's programming. The button ← marked is generally used to move to the left through the menus. The button marked → is generally used to move to the right in the menus. The dial has two functions: rotating the dial in both directions will scroll through menus and adjust parameters quickly and easily, and pressing down on the dial acts as another pushbutton which is often used to select different parameters on-screen.

**BATTERY CONNECTIONS:** It is strongly recommended to connect batteries using pre-assembled charge leads which are widely available from any hobby retailer. Two adapter leads are included, one having alligator clips for connecting racing cells to Ice, and another having a standard battery connector for connecting pre-assembled packs. For transmitters, find a charge lead that best matches the type of radio that you are charging (see below). These may be purchased through your local hobby shop.

Part #	Radio Charge Leads Description
HCAP0101	Futaba® J Tx and Rx charge leads, except 9VAP
HCAP0102	Futaba J Tx and Rx charge leads, 9VAP only
HCAP0104	Airtronics/Sanwa Tx and Rx charge leads

HCAP0105	JR Tx and Rx charge leads
HCAP0106	Hitec Tx and Rx charge leads
HCAP0108	Charge leads, banana plugs to alligator clips
HCAP0110	9V-style Tx connector, Futaba-J Rx charge lead
HCAP0310	Banana Plugs (3 pair)
HCAP0320	Heavy Duty Banana Plugs (2 pair)

Always connect the charge lead to the charger first, then the battery to the charge lead. The battery's red, positive (+) lead must always be connected to the charger's red, positive (+) jack, and the battery's black, negative (-) lead to the charger's black, negative (-) jack. **WARNING! Never allow a battery's positive and negative leads to accidentally touch each other. This will result in a short circuit and cause permanent damage to your battery and/or charger.**

### ***DETERMINING BATTERY TYPE & SPECIFICATIONS***

**It is always very important to know your battery's exact type, rated voltage and capacity!!** Failure to know these points is one of the biggest reasons why batteries are improperly cared for and fail. A few short minutes learning the basics of battery care can easily prevent unnecessary crashes (and lost money!). Carefully read your battery's label and/or instruction sheet or consult your battery supplier and determine:

1. Is the battery *type* Nickel-Cadmium (NiCd), Nickel-Metal Hydride (NiMH), Lithium-Ion (Li-Ion), or Lithium-Polymer (Li-Po)?
2. What is the battery's *total rated capacity*? This number indicates how much charge energy or "capacity" the battery can store, and should always be listed on the battery's label as "mAh" ("milli-amp hours"). Capacity is also referred to as the "C" rating. Charge and discharge currents are also expressed as a function of this "C" rating. For example, a 3300mAh battery would have a "1C" charge or discharge current rate of 3300mA or 3.3 amps. This battery's 2C rating would be (3.3 x 2) 6.6 amps, etc.
3. What is the battery's *nominal rated voltage*? If not printed on the battery's outer label, consult your battery supplier or determine pack voltage as follows:
  - a. **NiCd and NiMH Batteries:** Multiply the total number of cells in the pack by 1.20. A 7-cell pack will have a nominal voltage of 8.40 volts (7 x 1.20). A 4-cell pack will have a nominal voltage of 4.80 volts (4 x 1.20), etc.
  - b. **Li-Po Batteries:** Multiply the total number of cells in the pack by 3.70. A 3-cell pack wired in series will have a nominal voltage of 11.1 volts (3 x 3.70), etc.

- c. **Li-Ion Batteries:** Multiply the total number of cells in the pack by 3.60. A 2-cell pack wired in series will have a nominal voltage of 7.20 volts (2 x 3.60), etc.

### **CARE & HANDLING OF NiMH BATTERIES**

- Do not to allow NiMH batteries to overheat! If overheated, disconnect the battery from the charger immediately and allow to cool.
- Do not attempt to use Ice's Li-Po/Li-Ion functions with NiMH batteries.
- NiMH cells do not exhibit the "memory effect" like NiCd cells, so little cycling is needed.
- Store NiMH packs with some voltage remaining on the cells (refer to battery supplier).
- NiMH cells have a self-discharge rate of approximately 20-25% (compared to 15% for NiCd batteries). It is important to recharge NiMH batteries immediately prior to use.
- "N", "AAA", "AA" and "A" size radio batteries can safely be peak charged at currents up to 1.5C (battery capacity x 1.5). High charge currents can overheat batteries and thus reduce service life, and is especially more true for smaller size cells.

### **CARE & HANDLING OF LI-PO & LI-ION BATTERIES**

**Never attempt to care for lithium-polymer (Li-Po) or lithium-ion (Li-Ion) cells in the same way as other battery types!** Li-Po and Li-Ion characteristics greatly differ from NiCd and NiMH batteries and therefore require different care and handling. 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 its surroundings and even start a **FIRE!**

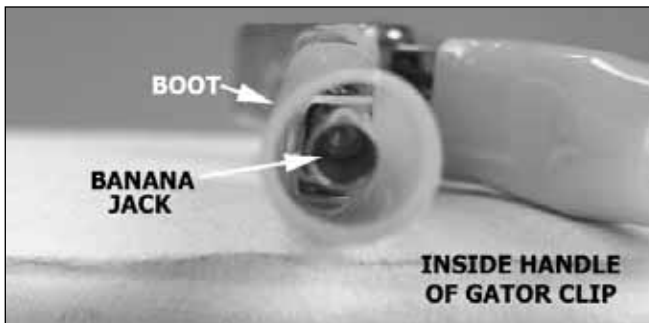
- **ALWAYS** charge lithium batteries in a fireproof location, which could be a container made of metal or ceramic tile. Monitor the area with a smoke or fire alarm, and have a lithium approved "ABC type" fire extinguisher available at all times.
- **ALWAYS** provide adequate ventilation around Li-Po/Li-Ion batteries during charge, discharge, while in use, and during storage.
- **DO NOT** allow Li-Po or Li-Ion cells to overheat at any time, as they can and usually will become physically damaged and could possibly **EXPLODE** or catch **FIRE!!** If a battery becomes overheated, disconnect it from the charger **IMMEDIATELY!**
- **DO NOT** continue to charge Li-Po or Li-Ion batteries if the charger fails to recognize full charge. Swelling of Li-Po cells is an indication that they are in an overcharge condition and they should be disconnected from the charger immediately.

- **DO NOT** set Ice's Li-Ion/Li-Po battery voltage to greater than the nominal rating of the Li-Po or Li-Ion battery, as such cells cannot handle overcharging in any way.
- **DO NOT** charge Li-Po or Li-Ion batteries at currents greater than the "1C" rating of the battery ("C" equals the rated capacity of the battery).
- **DO NOT** discharge Li-Po or Li-Ion batteries at currents which exceed the discharge current rating of the battery, as this can often cause a cell to overheat.
- **DO NOT** allow Li-Po cells to come in contact with moisture or water at any time.
- **DO NOT** allow the internal electrolyte from Li-Po or Li-Ion batteries to get in the eyes or on skin – wash affected areas immediately if they come in contact with the electrolyte and contact your physician!
- **DO NOT** attempt to use Ice's NiCd and NiMH functions for Li-Po or Li-Ion batteries.
- **ALWAYS** store Li-Po cells/packs in a secure location away from children.

### **DC INPUT POWER**

To achieve Ice's **absolute maximum** output power capabilities the DC power source must be capable of delivering at least 15 amps of current while maintaining 12 volts DC (although 12.5A will be enough for most functions). Once connected to input power, the charger will be turned on as there is no ON/OFF power switch. Disconnect the charger from input power when not in use. There are two ways to connect the charger to 12V DC input power:

1. Connect the banana plugs on Ice's input cord directly to banana jacks on a separate DC power supply. Always connect the charger's red lead to the power source's red, positive (+) terminal and the charger's black lead to the black, negative (-) terminal.
2. A unique set of alligator clip adapters are included which have a female banana jack built inside the handle of each clip. Securely slide the input lead's banana plugs into the female jacks on the alligator clips. Attach each alligator clip onto the terminals of a 12V battery or power supply noting proper polarities.



**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. It's recommended to disconnect the charger from input power when not in use.**

## **NAVIGATING THE MENUS**

IntelliPeak Ice has 6 programming screens. Refer to the Main Programming Menu flowchart included with this manual for an overall view of Ice's programming. The most commonly used screen is the "Main Memory" screen shown at the far left on the flowchart. To move to any menu to the right of the Main Memory screen (such as the Motor Break-in or Cycle Data menu, etc.) press →. Press ← to move left, back towards the Main Memory screen.

As shown in the Main Memory screen at right, and within any screen, rotate the dial to move the cursor arrow up or down the screen. The LCD screen shows 8 lines, but there may be more than 8 lines of features to be viewed depending on the menu. If so, continue to move the cursor downwards and the extra lines will automatically scroll up for viewing.

TURN DIAL TO  
MOVE CURSOR  
UP & DOWN

[0] Memory Name...

→ NiCd 6Cell 2400mAh

Chg current : 2.4A

dChg current : 2.4A

Peak sens. : 8mV/C

dChg volt : 0.9V/C

trickle curr : 100mA

cut-off temp : 120°F

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no. of cycles : 1time

cycle delay : 20min

cycle mode : D>C

max chg capa : 150%

peak delay : 3min



As shown below, press the dial to highlight the first adjustable feature on any line. If there is more than one adjustable feature on any line, press ← or → as necessary to highlight the proper value. Rotate the dial to adjust the highlighted value. Re-press the dial to confirm the selection.

PRESS  
DIAL TO  
HIGHLIGHT  
VALUE

[0] Memory Name...

→ NiCd 6Cell 2400mAh

Chg current : 2.4A

dChg current : 2.4A

Peak sens. : 8mV/C

dChg volt : 0.9V/C

trickle curr : 100mA

cut-off temp : 120°F

PRESS

→

[0] Memory Name...

→ NiCd [6Cell] 2400mAh

Chg current : 2.4A

dChg current : 2.4A

Peak sens. : 8mV/C

dChg volt : 0.9V/C

trickle curr : 100mA

cut-off temp : 120°F

PRESS

→

[0] Memory Name...

→ NiCd 6Cell [2400mAh]

Chg current : 2.4A

dChg current : 2.4A

Peak sens. : 8mV/C

dChg volt : 0.9V/C

trickle curr : 100mA

cut-off temp : 120°F

The purpose of all the menus is as follows:

- 1. MAIN MEMORY:** To store battery information, set battery type, set charge and discharge currents and voltages, set discharge and cycle parameters, set maximum battery temperature, and to start charge, discharge or cycle functions.



2. **MOTOR BREAK-IN:** To break-in brushed motors and adjust all related settings.
3. **USER SETUP:** To set various miscellaneous functions, such as fan control, temperature scale, audible tones, LCD contrast, etc.
4. **DATA VIEW:** To see specific data about the operating condition of Ice or the battery being conditioned, such as input and output voltages, battery temperature, battery resistance, charge or discharge time, and enter the charge and discharge voltage graphs.
5. **CYCLE DATA:** To view all charge or discharge capacity information for individual cycles, or all 10 cycles.
6. **STEP CHARGE SETUP:** To set Ice's "four-step charge" settings.

### **SETTING A BATTERY INTO MEMORY – SELECTING A MEMORY**

There are two main ways in which to configure Ice for conditioning of batteries. A memory bank is available for setting and storing pertinent information for up to 10 different batteries. After entering battery data into the memories, simply recalling the battery's appropriate memory number makes Ice instantly ready to go – no need to re-configure settings when changing batteries! Once a battery's information is stored into a memory it will be saved until changed again manually.

Ice's 10 memories are factory pre-programmed for different battery types, charge and discharge currents, etc. Refer to the "Battery Memory – Factory Settings" chart on the fold-out section included with this manual for the default settings in each memory. Also on this sheet find a large printout of a blank memory chart. Use the blank chart to record your own personal memory settings.

It is not **required** to use any of Ice's memories. In such case, the Main Memory screen #0 acts as the main setup screen for manually changing the battery, charge, discharge, or cycle settings. There is no other menu for manually setting parameters or starting a function. Read further to learn more about manually setting these parameters.

To **RESET** all settings to the factory defaults, disconnect the input connectors from 12V DC power. Press and hold both the **➔** and **➜** buttons while re-connecting the input leads to 12V DC power. A brief initialization screen will appear, then the display will automatically change to the Main Memory screen. At this time, all previous settings will be **CLEARED** and reverted back to the factory defaults. **Do NOT perform this reset if you do not wish to clear all settings in the memory!**

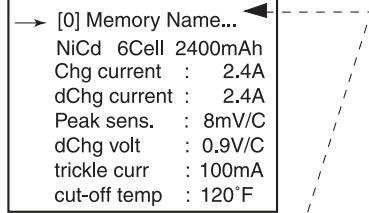
## **SELECTING & NAMING BATTERY MEMORIES**

**NAVIGATING THROUGH ALL OF ICE'S SCREENS WILL START AT THE MAIN MEMORY SCREEN.** If your battery parameters match any of those already listed in the included memory chart, simply select that memory number to quickly get Ice ready to handle your battery.

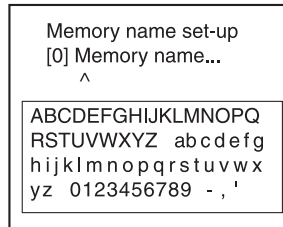
Each memory screen shows a memory number and name. With the cursor pointing to the top line:

1. **Memory Number:** To change the memory number, press the dial once to highlight the memory number shown in brackets. Rotate the dial to find the appropriate memory number.
2. **Memory Name:** To change the memory name, press  $\rightarrow$  to automatically show the Memory Name Setup screen as shown at right. Rotate the dial to move the  $\wedge$  symbol underneath the characters in the string of letters. Press dial to highlight letter, then rotate to change the letter. Press  $\rightarrow$  to move to the next letter and repeat this step as desired. Press dial to confirm all selections and highlight will disappear. When done press  $\leftarrow$  to return to Main Memory Screen.

MAIN MEMORY SCREEN



MEMORY NAME SETUP SCREEN



3. When memory name and numbers are selected, press the dial to confirm selections and the highlight will disappear.

If your battery type does not match any of the settings pre-programmed into a memory, or if you just do not wish to use the battery memories, simply adjust the settings in memory location #0, then start the charge, discharge and cycle functions while in this screen (see next page).

## **ADJUSTING SETTINGS IN THE MAIN MEMORY SCREEN**

Within the Main Memory screen (as shown above), rotate the dial to move the cursor up or down. Press the dial to highlight the adjustable value. Rotate the dial to adjust the highlighted value. Re-press the dial to confirm the selection. Ice will automatically store parameters into memory one second after being entered. There is no need to manually confirm settings into memory separately.

1. **Battery Info:** Move the cursor next to the first line under the memory name.
  - a. Press the dial to highlight the battery type. Rotate the dial to find the desired battery **type** that exactly matches your battery (NiCd, NiMH, Li-Ion or Li-Po).
  - b. With the battery type still highlighted, press **→** to highlight the **number of cells** (for NiCd/MH) or **total voltage** (for Li-Ion/Li-Po). Rotate the dial to find the number of cells or voltage which **exactly** matches the number of cells in your battery. For NiCd and NiMH, choose from 1-10 cells. For Li-Ion choose from 3.6, 7.2, 10.8 or 14.4V. For Li-Po, choose from 3.7, 7.4, 11.1 or 14.8V. **WARNING!! NEVER set this voltage to a level that is higher than the battery's rated voltage. Li-Ion/Li-Po cells cannot handle overcharging in any way!!** If a NiCd or NiMH battery does not achieve a true peak, the charge process will shut down automatically if the battery reaches 2.0V per cell. The maximum voltage for lithium-ion cells is 4.10V, and 4.20V for lithium-polymer cells. This feature is designed to protect the battery. For this reason, it is very important to set the proper voltage for your battery.
  - c. With the #cells/voltage still highlighted, press **→** to highlight **pack capacity**. Rotate the dial to find the battery capacity value which matches the rating of your battery. If the battery's exact rated capacity cannot be found, select the capacity which *most closely* matches the capacity of the battery. Choose from 100-9900mAh. **IMPORTANT!! For Li-Po and Li-Ion batteries, make sure the capacity setting matches the rating of the battery as closely as possible. Be very careful with batteries that are assembled in series or series/parallel configurations. Check with your battery's instructions or supplier if unsure of the pack's RATED capacity.**
  - d. Press the dial to confirm all of the above settings.
2. **Charge Current:** Rotate the dial to move the cursor down one line. To manually adjust charge current, press the dial, then rotate to find the new charge current which ranges from 0.1A (100mA) to 8.0 amps. For safety precautions, the maximum charge current value for Li-Ion and Li-Po batteries will be limited to their 1C value. Re-press dial to confirm setting. **WARNING!! It is NOT RECOMMENDED to charge Li-Ion or Li-Po cells at a rate greater than their 1C value!! Supplying too much current to a Li-Ion or Li-Po battery can cause very serious damage (including fire!) to the batteries and the surrounding area!**
3. **Discharge Current:** To manually adjust, press the dial, then rotate to find the new discharge current which ranges from 0.1A (100mA) to 10.0 amps. For safety precautions, the maximum discharge current value for Li-Ion and Li-Po

batteries will be limited to their 2C value. Do NOT discharge Li-Ion or Li-Po batteries at currents which exceed the discharge current rating of the battery as this can often cause a cell to overheat. Re-press dial to confirm setting.

4. **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 charger for better peak charges. For NiCd batteries the range is 5-25mV. For NiMH batteries the range is 3-15mV. A “ZEROpk” – or “Zero Volt Delta Peak” setting is also available for NiMHs which means Ice 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.
5. **Discharge Cutoff Voltage:** This is the voltage level that Ice will stop discharging the battery, 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.
  - a. 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 Tx and/or Rx. 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.
  - b. For Li-Ion/Li-Po batteries, the adjustable range is 2.5 - 3.7V per cell. A setting of 2.8 - 3.0V is recommended.
6. **Trickle Charge Current (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 then rotate to find the new current. Re-press dial to confirm selection. The range is 0 - 500mA. 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 max. temperature setting (see below), trickle charge will not begin until battery temperature drops about 4°F (2°C) below the max. temperature setting.

7. **Cutoff Temperature:** Ice can monitor the temperature of the battery which is connected to the banana jack outputs. This feature is used in conjunction with Ice’s optional Temperature Sensor (DTXP4171) which can be found at local retailers. The Hobbico® Accu-Cycle™ Elite Temperature Sensor (HCAP0281) and the Triton™ Thermal Probe from Great Planes® (GPMM3151) are also directly compatible. Monitoring a battery’s temperature in addition to its voltage can result in the most accurate full charges without damaging the battery, and is highly recommended for use with Li-Ion/Li-Po batteries. The adjustable range is from 50 - 132°F (10 - 55°C). The sensor jack is located on the right side of the charger underneath the banana jacks. 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.
  - a. If it’s NOT desired to measure the temperature of a battery, make sure the temperature sensor is NOT connected to the charger.
  - b. To change the temperature scale from Celsius to Fahrenheit or vice-versa, see the User Setup Menu on page 25.
  - c. To adjust the temperature setting, press the dial then rotate to find the new temperature. Re-press dial to confirm setting.
  - d. The recommended maximum temperature for NiCd batteries is 113-130°F (45-55°C). The recommended maximum temperature for NiMH batteries is 110-125°F (43-52°C). NiCd and NiMH cells which are “AAA” size or smaller should use lower values. Start with lower temperatures first and if necessary adjust the temperature setting upward as needed in small increments and closely monitor the charge progress.
  - e. The maximum temperature for Li-Ion/Li-Po batteries varies by cell manufacturer, but as a general recommendation the maximum temperature should not exceed 90-95°F (32-35°C). ***For Li-Ion/Li-Po 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. Note: It’s a good idea to set the temperature cutoff approx. 5°F lower than suggested because battery temperature will continue to increase for a short time after charge or discharge has ended.

- f. 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 Ice 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. Setting the temperature value too high may cause the battery to overheat before full charge has been reached. In this case, decrease the temperature setting.
  - g. During discharge, if the battery reaches the temperature that is set in this screen the discharge process will *temporarily pause* to allow the battery to cool down to a safe temperature. The discharge process will automatically resume when the battery's temperature drops about 4°F (2°C) below the maximum temperature setting.
8. **Number of Cycles (NiCd and NiMH batteries only):** This is the number of times Ice will consecutively perform a charge-to-discharge or discharge-to-charge cycle (see "10. Cycle Mode" below for how to set which function to perform first). The range is from 1-10 cycles. Press the dial, then rotate to set the number of times to perform a cycle. Re-press dial to confirm setting.
9. **Cycle Delay (NiCd and NiMH batteries only):** 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.
10. **Cycle Mode (NiCd and NiMH batteries only):** This sets the *pattern* in which cycles are performed. There are two options: charge followed by discharge (C>D), or discharge followed by charge (D>C).
11. **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:
- a. If full charge has not been detected on the battery for some reason, fast charge will stop completely when this max. capacity value has been reached. This is a safety feature designed to protect the battery pack and user from an overcharge condition.
  - b. Cell manufacturers recommend to apply a partial charge to batteries before being put away for long-term storage (over the winter, for example). In this application, it is recommended to set this maximum charge capacity to 30% for NiCd/MH batteries, and 10% for Li-Ion/Li-Po batteries.

Press, then rotate the dial to find the desired max. capacity. For NiCd and NiMH batteries the adjustable range is 10-150%. This means, if peak voltage is not detected first Ice will automatically stop fast charge at the value equal to the battery capacity setting in point #1c on page 11 ("Pack Capacity") multiplied by the percent entered in this maximum charge capacity setting. So, if the battery capacity entered was "2400" and if the maximum charge capacity 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 Li-Po 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%.

12. **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 1-10 minutes.
  
13. **Top-off Charge (NiMH batteries only):** Nickel-metal hydride batteries can benefit from having a short "top-off charge" applied to the battery after peak charge has ended. This top-off charge current is typically larger than a "trickle" current and is designed to help fill the pack to maximum capacity more quickly. If set, top-off charge will automatically begin 5 minutes after fast charge has ended in normal and reflex charge modes only (not automatic, impulse or four-step mode). It's recommended that the top-off charge current setting be no greater than 1/5<sup>th</sup> of the "pack capacity" value that was entered in #1c on page 11. If the battery capacity value entered was 3000mA, the top-off charge current should be no greater than (3000mAh / 5) 600mA. The adjustable range is off-1000mA (1.0A). Top-off charge will be applied for 20 minutes. If the battery's voltage peaks or its temperature reaches the maximum setting before the timer expires, top-off charge will end automatically.

## SELECTING & STARTING CHARGE, DISCHARGE OR CYCLE

To start a charge, discharge or cycle function or to change the charge or discharge mode:

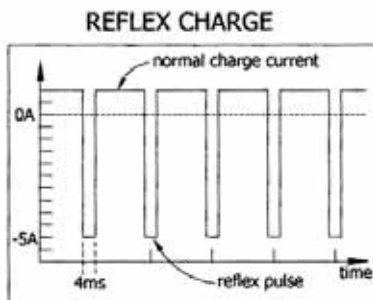
	MAIN MEMORY SCREEN		CHARGE/ DISCHARGE/ CYCLE SCREEN
	<pre>[0] Memory Name... → NiCd 6Cell 2400mAh Chg current : 2.4A dChg current : 2.4A Peak sens. : 8mV/C dChg volt : 0.9V/C trickle curr : 100mA cut-off temp : 120°F</pre>	→	<pre>[0] Memory Name... NiCd 6Cell 2400mAh → CHARGE &lt; NORMAL &gt; ↑ D-CHARGE&lt; NORMAL &gt; ↓ CYCLE</pre>
<p>1. While in the Main Memory screen, press and HOLD the dial for 2 seconds. The "Charge / Discharge / Cycle" screen will show (see right).</p>	<p>Press and hold dial to enter the charge/discharge/cycle screen.</p>		<p>Press dial to highlight charge mode inside arrows. Rotate dial to select the desired charge mode: NORMAL, REFLEX, RE-PEAK or AUTOMATIC.</p>

2. **Charge Mode:** Rotate the dial to place the cursor next to "CHARGE." Press the dial to highlight the charge mode, then rotate the dial to select the desired charge mode. Select one of the four charge modes, as designated within the arrows next to "CHARGE". Re-press the dial to confirm the selection.

a. **Normal Charge Mode (NiCd and NiMH batteries only):** Linear current is delivered to the battery in normal mode. While "NORMAL" is highlighted, a note about "reserve" time will show at the bottom of the screen. See the "Reserve Time Function" section on page 17 for full details about the reserve time function. If it is not desired to use the reserve time function, leave it set to "off." To START CHARGE, place the arrow cursor next to "charge" and press and hold the dial for 2 seconds.

b. **Reflex Charge Mode (NiCd and NiMH batteries only):** As shown in the chart at right, in reflex charge (sometimes referred to as "burp" or "reverse pulse 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

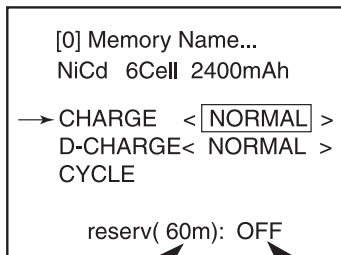




your supplier). While “REFLEX” is highlighted a note will be shown at the bottom of the screen for “reserve” time. See the “Reserve Time Function” section below for how to use the reserve time function if desired, otherwise leave it set to “off.” To START CHARGE, place the arrow cursor next to “charge” and press and hold the dial for 2 seconds.

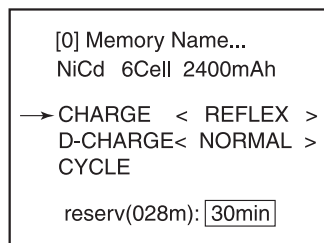
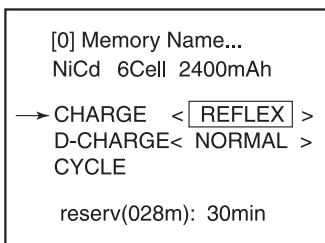
### Reserve Time Function

When NORMAL or REFLEX charge mode is selected, “reserv(00): off” will show at the bottom of the screen. This “reserve time” feature can be thought of like a charge scheduler, by setting a timer which will cause Ice to finish putting a full charge on the battery **immediately before** the start of a race so the pack is at optimum race-readiness.



Referring to the diagram at right, the number inside the parenthesis is the “expect” time – the number of minutes that Ice calculates to be needed to fully charge the battery (based on charge current and battery capacity values entered). The number on the right is the “reserve” time – the number of minutes from now that you want the battery charge process to be finished.

For example:  
Say the next race starts 90 minutes from now, and that Ice calculated an “expect time” of 50 minutes needed to fully charge



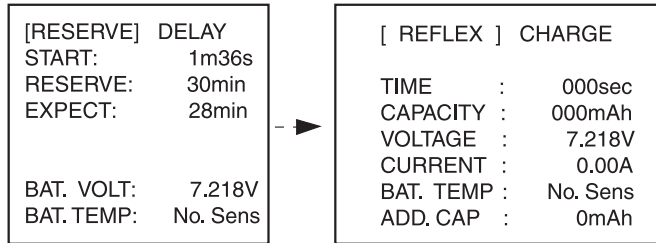
When “REFLEX” or “NORMAL” are highlighted, press → to highlight the reserve time at the bottom. Rotate dial to select a reserve time. Press → to confirm setting. Press and hold dial to start reserve time charge process.

the battery. Setting the “reserve” time to “80min” means Ice will wait 30 minutes (80 min. reserve time – 50 min. expect time) and THEN start the charge process. In the end, if the total time needed to charge the battery was indeed 50 minutes, this will leave 10 minutes (90 min. until race time – 80 min. reserve time) for the battery to cool and to get to the start line for the race.

**It may take some practice and careful attention to get the reserve time function to work as desired.** To maximize the effectiveness of the reserve time function, the “capacity” setting in the main menu may need to be set to the most realistic possible maximum capacity

## Reserve Time Function (continued)

for your battery – as opposed to the pack's actual rated capacity. For example, if your 3300mAh battery pack can regularly accept a charge of up to, say, 3562mAh, you should set the capacity value in Ice's Main Memory Screen to 3600mAh.



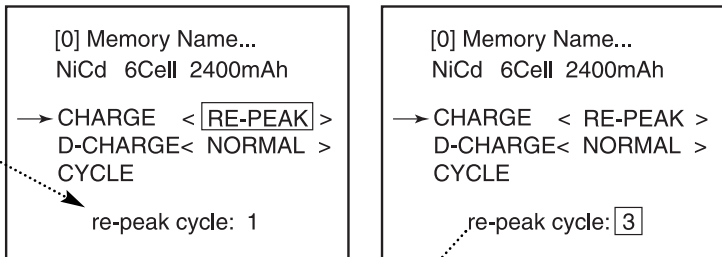
When started, the reserve time delay screen above will show, and the "START" timer will begin counting down. When the reserve time delay expires, the charge process will start automatically.

The minimum reserve time will be no less than the calculated "expect" time. Max. reserve time is 600 minutes.

- c. **Re-peak Charge Mode (NiCd and NiMH batteries only):** In re-peak charge mode, Ice 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, Ice 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. See the diagram below for using re-peak charge mode. To START CHARGE, place the arrow cursor next to "charge" and press and hold the dial for 3 seconds.

### RE-PEAK CHARGE

When "RE-PEAK" charge mode is highlighted, "re-peak cycle: 1" will show at the bottom. Press → to select the re-peak cycle number.



Rotate the dial to find the desired number of times to re-peak charge the battery. Press → to confirm selection. Press and hold dial to start the re-peak charge process.

## RE-PEAK CHARGE (continued)

In the re-peak charge status screen, "1" is the re-peak charge being performed at this time, and "3" is the total number of re-peaks that will be performed. This screen will change to "END: DELTA-PEAK" when finished.

Shows the charge capacity that was delivered to the battery BEFORE ANY re-peak charges were applied.

Shows the total amount of ADDITIONAL charge capacity that was delivered to the battery during all re-peak charges combined.

[ RE-PEAK ] CHARGE	
→ CYCLE :	1/3
TIME :	195sec
→ CAPACITY :	0mAh
VOLTAGE :	6.932V
→ CURRENT :	1.34A
BAT. TEMP :	No. Sens
→ ADD. CAP :	57mAh

When ALL re-peak charges are done, the charge capacity data for all re-peaks can be seen in the Cycle Data View screen as shown below (see flowchart to find the cycle date screen).

If a battery was charged or discharged PRIOR to starting re-peak charge, those capacity values will be shown for cycle #1.

Charge capacity added during re-peak #1 will be shown under cycle #2.

Charge capacity added during re-peaks #1, and #2 will be shown under cycle #3.

Charge capacity added during re-peaks #1, #2 and #3 will be shown under cycle #4.

[ CYCLE DATA ]		
NO CAPACITY VOLTAGE		
→ 1 C:	650mAh	7.878V
D:	0mAh	0.000V
→ 2 C:	26mAh	7.957V
D:	0mAh	0.000V
→ 3 C:	45mAh	7.943V
D:	0mAh	0.000V
-----		
→ 4 C:	57mAh	7.936V
D:	0mAh	0.000V

- d. **Automatic Charge Mode (NiCd and NiMH batteries only):** Ice can detect the condition of the battery which is connected to the output and automatically charge the battery. **IMPORTANT!! Make sure the proper battery type and temperature settings are entered before starting auto charge!** Ice will likely charge batteries *better* if the normal charge mode is used (assuming all user settings are properly tailored to the battery), but the Automatic mode can be used. Peak sensitivities are pre-set at 5mV for NiCd, and 4mV for NiMH. Fast charge will end if maximum battery temperature is reached (if set) or if peak charge is achieved. To START CHARGE, place the arrow cursor next to "charge" and press and hold the dial for 3 seconds.

- e. For Li-Ion and Li-Po batteries, the “cc/cv” or “constant current/ constant voltage” is the only charge mode available. If the battery’s temperature reaches the maximum setting (if set) before full charge is detected the charge process will end automatically. To START CHARGE, place the arrow cursor next to “charge,” and press and hold the dial for 3 seconds.

```

[8] Memory Name...
    LiPo 7.4V 700mAh

→ CHARGE < CC-CV >
↑ D-CHARGE< NORMAL >
↓
  
```

**Note:** The cc/cv charge method is COMPLETELY DIFFERENT than the peak detection method that is used to charge NiCd or NiMH batteries. In the beginning, Ice forces constant current into the battery at the rate which is set in the Main Memory screen. When Li-

```

[ CC-CV ] CHARGE
END: CC-CV FULL
→ TIME      : 912sec
CAPACITY   : 1137mAh
VOLTAGE    : 7.981V
CURRENT    : Trk.
BAT. TEMP  : No. Sens
ADD. CAP   : 0mAh
  
```

Po batteries reach 4.20V per cell, or Li-Ion’s reach 4.10V per cell, Ice automatically *stops delivering constant current and starts applying constant voltage* to the battery. Here, the charger is no longer forcing current to the battery. Instead, the battery is only draining the amount of current from the charger that it can take naturally. As Li-Ion/Li-Po batteries become more fully charged they will take less and less current from the charger. Here, the actual current coming from the charger will gradually drop below the value that was set in the Main Menu. **THIS IS NORMAL!!** When charge current drops to approx. 100mA, Ice will beep to indicate that regular quick charge has finished. At this time, Ice will automatically start a unique “LiPo trickle charge” current (based on application of a constant-voltage) as indicated by “Trk” which will flash on the current line on the screen shown above right. When this lithium trickle current drops to 30mA Ice will completely stop all charge current and “Trk” will change to “0.00A”.

3. **Discharge Mode:** While in the Main Memory Screen, press and hold the dial for 2 seconds. The designated discharge mode (automatic or normal) will be shown within the arrows next to “D-CHARGE.” To change the discharge mode, move the arrow cursor next to “D-CHARGE.” Press the dial to highlight the text inside the arrows, then rotate the dial to select the discharge mode. Re-press

```

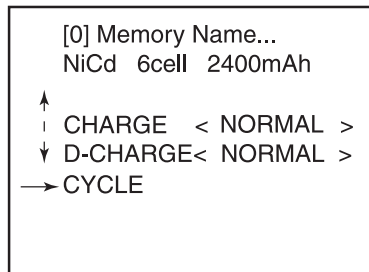
[0] Memory Name...
    NiCd 6cell 2400mAh

    CHARGE < NORMAL >
→ D-CHARGE< NORMAL >
↑ CYCLE
↓
  
```

dial to confirm selection. TO START DISCHARGE, press and hold the dial for 2 seconds. If a temperature sensor is used, discharge will temporarily pause if maximum battery temperature is reached, and will automatically resume when the battery temperature drops approx. 4°F (2°C) below the maximum setting.

- a. **Normal Mode (all battery types):** Discharge is guided by all user settings in the Main Memory screen. Discharge current is linear, and cutoff voltages are those which are set in the main memory screen.
- b. **Automatic Mode (NiCd and NiMH batteries only):** Most user settings are ignored. Ice automatically sets the current based on the condition of the battery. Discharge cutoff voltage is pre-set in this mode to 0.8V per cell. Ice will likely discharge batteries *better* if the normal discharge mode is used (assuming all user settings are properly tailored to the battery), but the automatic mode can be used.

4. **Cycle Mode (NiCd and NiMH batteries only):** While in the Main Memory Screen, press and hold the dial for 2 seconds. Place the cursor in front of "CYCLE," then press and hold the dial TO START CYCLING (see Main Memory screen and page 14 for setting # of cycles, cycle delay, etc.). **Note:** The "normal" charge mode and "normal" discharge mode is used during cycles.



5. To manually abort any function, press the ◀ button at any time to return to the Main Memory screen.

### **CHARGE & DISCHARGE STATUS SCREENS & GRAPHS**

While a function is being performed a "Status Screen" will automatically show on-screen (see next page). All information will be updated automatically every second while the function is being performed. Information shown in the Status Screen is as follows:

## STATUS SCREEN

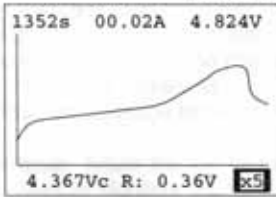
[ CYCLE ]	CHARGE	
DCH->CHG :	1/1	← number of times discharge or charge have been performed
TIME :	776sec	← elapsed time, counted in seconds
CAPACITY :	216 mAh	← capacity delivered to battery during charge, or from battery during discharge
VOLTAGE :	5.671V	← voltage measured at the output banana jacks
CURRENT :	0.00A	← current being delivered to/from battery
BAT. TEMP :	No. Sens	← shows the temperature of battery when sensor is used
ADD. CAP :	0mAh	← "additional capacity" provided during "top-off" charge or re-peak charge
peak temp :	0.0°F	← the maximum temp. battery reached during a function
peak volt :	13.174V	← the maximum voltage reached by battery during charge
avg. volt :	0.000V	← the average voltage of battery during discharge
in volt :	12.372V	← voltage measured at Ice's input connection
batt. res :	0m ohms	← the internal resistance of battery measured during discharge, in milli-ohms
→ volt rng :	auto	← select the "voltage range" setting that Ice will use in voltage graphs, select "auto" or "manual"

Note that the voltage reading in the Status Screen above will show the voltage of the battery while it's under a load. Loading will skew the voltage reading, which is normal. A higher load will skew the reading more than a smaller load.

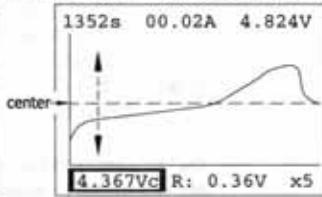
Ice's custom display can show graphical images of the battery's voltage curve while charge or discharge is in progress. Various types of data can be viewed and adjusted in the voltage curve graphs.

1. While in the Status Screen shown above, move the cursor to the "volt rng" or "voltage range" line at the bottom. Press the dial, then rotate to select either "auto" mode, where most graph settings will be selected automatically by Ice, or select "manual" mode in which you can manually adjust more parameters shown on the graph. Re-press the dial to confirm the selection.
2. Press → anytime while the Status Screen is shown to see the graph. The graph will show as long as the charge or discharge function has been operating for at least 5 seconds. Press → again to return to the Status Screen shown above. Pressing ← at any time will STOP the function completely.
3. **Manual View:** Set the "volt rng" line in the Status Screen to "manual" view, then press → to see the graph. The first adjustable parameter will automatically be highlighted (graph zoom). Refer to the diagram below for this and the other adjustments:

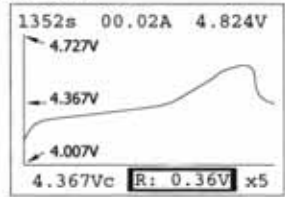
## MANUAL GRAPH VIEW – ADJUSTABLE PARAMETERS



The zoom factor in the lower-right will be highlighted first. Rotate dial to select zoom factor. “x1” is the closest view. “x5” is the widest view.



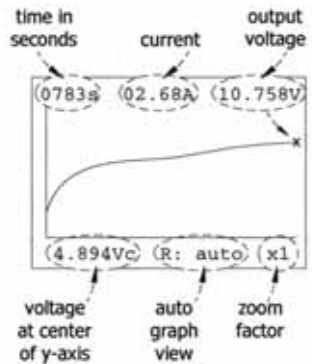
Press dial to highlight “Vc” which is the voltage at the center point of the y-axis (vertical). Rotate dial to change the voltage at the center point of the graph



Press dial to highlight “R” then rotate to set the voltage range of the y-axis. As shown above, with R: being 0.36V, the highest point on the y-axis is  $(4.367 + 0.36) 4.727V$ , and the lowest point is  $(4.367 - 0.36) 4.007V$ .

After adjusting the voltage range “R:”, press the dial to again highlight the zoom factor. Press  $\rightarrow$  anytime while in a graph screen to return to the Status Screen.

4. **Auto View:** When the “auto” mode is selected on the “volt rng” line of the Status Screen, Ice will automatically set nearly every graph parameter. Select “auto”, then press  $\rightarrow$  to view the graph. Note that “auto” will flash next to the “R:” mark along the bottom of the screen. The only adjustable parameter is the “zoom” factor in the lower-right corner, which will already be highlighted. Rotate the dial to adjust the zoom factor. The voltage curve can be zoomed-in for detailed viewing (“x1”), or a wider view of the curve can be seen when zoomed-out (“x5”). At “x1,” the screen width equals 2 minutes of time and data is updated every second. At “x5,” the width of the screen equals 10 minutes of time and data will be updated every 5 seconds. Note that when adjusting the zoom value here the “Vc” and “R:” values will automatically change as well.



On-screen, the graphs always advance from right to left. Along the top of the auto or manual graph screens the elapsed time will be shown in seconds (top-left), the charge/discharge current level will be shown in amps (top-center), and the voltage at Ice’s output at that instant will be shown (top-right).

When a function ends while a graph is being shown, the audible tones will sound (if set) and the graph will stop moving the voltage curve to the left. Press  $\rightarrow$  to

return to the Status Screen. The Status Screen will be flashing a message indicating the final result of the operation which was just completed, such as “END: DELTA-PEAK” when peak charge has ended, “END: CUT-VOLTAGE” when a discharge has ended, etc. One unique message is “FLAT-LIMITED” – if during peak charge the NiCd or NiMH battery’s voltage stops rising, but it also does not fall (as most NiCd or NiMH batteries will do), this message shows to indicate that the battery’s peak voltage is flat and unchanging and Ice will automatically stop charging the battery as a safety precaution.

Press ◀ to stop the function and leave the Status Screen. Then, go to the “Data View” screen to see the finalized data (see the flowchart and Data View section).

## **MOTOR BREAK-IN MENU**

While in the Main Memory screen, press ▶ to find the Motor Break-In screen (see below). The Motor Break-In feature is designed to break-in new brushes on brushed electric motors by delivering up to 10 amps of current at a selected voltage for a selected time. Ice will try to maintain 10A on the output, but only if the motor will allow it. It is important that the power source for Ice can maintain 12 volts and 15 amps to fully utilize this feature. Power to the motors is pulsed and not linear.

1. Rotate the dial to move the cursor up or down to the feature you wish to adjust.
2. **Set Voltage:** With the cursor pointing to “set volt,” press the dial once to highlight the voltage value. Rotate the dial to set the appropriate voltage of 1.0 - 8.0 volts. Re-press the dial to confirm the voltage setting. Set the voltage to match the nominal operating voltage specification of your motor as closely as possible. Do not set the voltage too high, as permanent damage to the motor could result. **Note:** Motors with high internal impedance may have difficulty working properly with the motor break-in function. It may be necessary to set the voltage slightly higher here in order to turn such motors.
3. **Set Time:** Rotate the dial so the cursor points to “set time.” Press the dial once to highlight the “0m” value. Rotate the dial to adjust number of minutes in the operational time, ranging from 0-180 minutes. Press ▶ to move the cursor to the “10s” value. Rotate the dial to adjust the number of seconds in the operational time. Press the dial to confirm the total break-in time setting.

[ MOTOR Break-in ]	
set volt	: 3.0V
→ set time	: 0m 10s
TIME	: 0m 9s
VOLTAGE	: 3.00V
CURRENT	: 2.09A



4. **Make sure the motor is firmly mounted to a motor stand prior to operation, and that the motor's output shaft is NOT connected to – or touching anything prior to starting this function!**
5. Connect the motor's white positive lead to Ice's red, positive (+) banana jack, and connect the motor's blue negative lead to Ice's black, negative (-) banana jack.

6. To start the motor break-in function, make sure no values on-screen are highlighted, then press and hold the dial.

```

[ MOTOR Break-in ]
set volt      : 3.0V
→set time    : 0m 10s
[ RUNNING.. ]
TIME         : 0m 9s
VOLTAGE      : 3.00V
CURRENT      : 2.09A

```

```

[ MOTOR Break-in ]
set volt      : 3.0V
→set time    : 0m 10s
[ END ]
TIME         : 0m 9s
VOLTAGE      : 3.00V
CURRENT      : 2.09A

```

The "RUNNING..." screen will show during operation, followed by the "END" screen when the motor break-in function has ended. The operating conditions of the break-in function will show along the bottom of the screen.

## **USER SET-UP MENU**

While in the Main Memory screen, press → twice to find the User Setup screen. Numerous miscellaneous functions can be configured in the User Setup screen. Rotate the dial to move the cursor up or down to the feature you wish to adjust (see next page). Press the dial to highlight the adjustable value. Rotate the dial to adjust the value, then re-press the dial to confirm the selection.

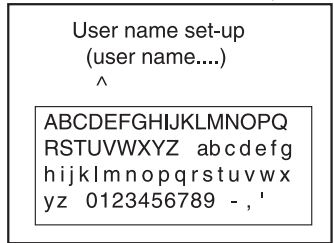
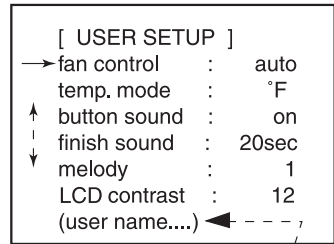
1. **Fan Control:** Ice's built-in fan has two modes, "auto" and "on." In the "auto" mode, the fan will automatically turn on when the *internal* temperature of the charger reaches 122°F (50°C). This is designed to protect the charger's circuitry from damage caused by overheating. In the "on" mode, the fan will run continually until turned off manually.
2. **Temperature Mode:** The temperature scale can be changed between Fahrenheit (°F) and Celsius (°C).
3. **Button Sound:** Ice 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 still sound if errors occur).

4. **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 to 3 minutes, or this feature can be turned “off.”

5. **Melody:** Select from any one of 5 different tunes to be played to indicate that a feature has ended. This feature can also be turned off.

6. **LCD Contrast:** Adjust the contrast of the LCD screen for best viewing. Adjustable range is from lightest (1) to darkest (12).

7. **User Name:** At the bottom of the screen, enter anything you wish to identify your charger. This name will appear on the opening screen when power is initially applied to Ice. Press the dial to enter the User Name Set-up screen to find the User Name Set-up Screen (see above). Rotate the dial to move the ^ symbol underneath the characters in the string of letters. Press dial to highlight letter, then rotate to change letter. Press → to move to the next letter and repeat this step as desired. Press dial to confirm all selections and highlight will disappear. Repeat this step for all other characters as desired. Press ← to return to the User Setup screen.



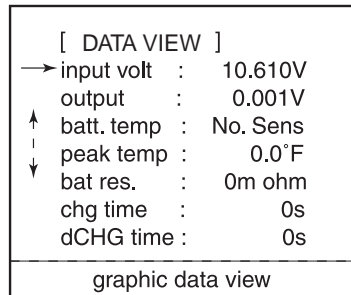
When finished adjusting the User Setup screen, press ← twice to return to the Main Memory screen.

**DATA VIEW**

While in the Main Memory screen, press → three times to find the Data View screen. This screen shows various types of data pertaining to the input or output of the charger. This screen can be seen only before a function has started, or after a function has ended (not while a function is being performed).

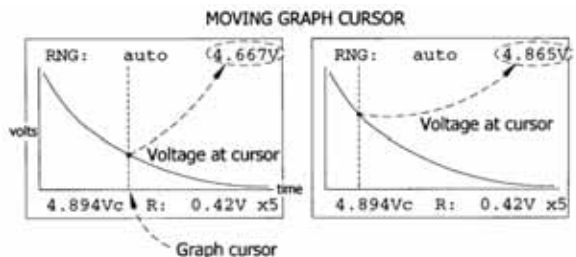
1. **Input Voltage:** Shows the DC voltage at Ice’s input lead.

2. **Output Voltage:** Shows the DC voltage at Ice’s 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.



3. **Battery Temperature:** Shows the temperature of the battery as measured with the optional temperature sensor. If no sensor is connected the display will show “No. Sens.”
4. **Peak Temperature:** In conjunction with the Battery Temperature feature above, Ice will constantly record the highest measured temperature of the battery which is connected to the output.
5. **Battery Resistance:** Ice will measure the battery’s internal resistance starting 2 minutes AFTER discharge has stopped, and is shown in milliohms ( $\Omega$ ). Battery resistance will not be measured if cell voltage is lower than 1.0V for NiCd/MH batteries or 3.0V for Li-Ion/Li-Po 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 Ice’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 capacities and may need replacement soon.
6. **Charge Time:** 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.
7. **Discharge Time:** Records the amount of time needed to complete a discharge function. Shown in seconds.
8. **Graphic Data View:** Ice’s graphic display can also show voltage curve waveforms after a charge or discharge function has ended (not for cycles). To view the final voltage curve, scroll the arrow cursor down to the “graphic data view” line, then press the dial to view the graph.

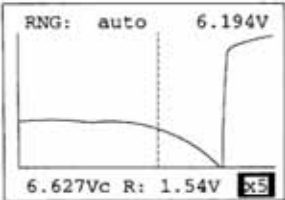
- a. A straight vertical line will appear in the middle of this graph (see diagram at right). This is the “graph cursor.” Rotating the dial will cause the



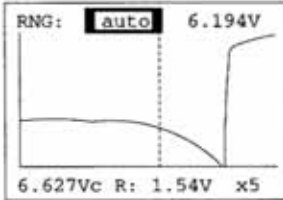
graph cursor to move sideways. To find the voltage at any point on the curve, move the cursor to that point on the curve. The voltage where the graph cursor line intersects the curve will be shown in the upper-right corner of the screen.

- b. Press → to select the other adjustable graph parameters, as shown in the diagrams below:

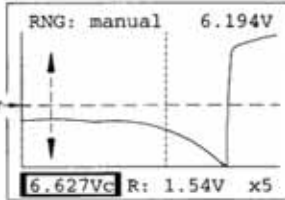
**MANUAL GRAPH VIEW - ADJUSTABLE PARAMETERS**



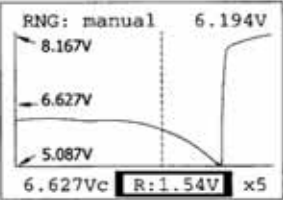
The zoom factor in the lower-right will be highlighted first. Rotate dial to select zoom factor. "x1" is closest view. "x5" is widest view.



Press → to highlight the "RNG:" setting at the top. Rotate dial to change to the "manual" setting if desired. Press → to remove highlight. If "auto" mode is selected, there are no other adjustable features.



If "manual" mode was selected previously, press → twice to highlight "Vc", the voltage at the center point of the y-axis (vertical). Rotate dial to change the voltage at the center point of the graph.



Press → to highlight "R:", then rotate to set the voltage range of the y-axis. As shown above, with R: being 1.54V, the highest point on the y-axis is  $(6.627 + 1.54)$  8.167V, and the lowest point is  $(6.627 - 1.54)$  5.087V.

- c. Press the dial anytime to go back to the Data View screen.

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/MH batteries, the overall graph should be shown in a 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). When using the automatic charge or discharge mode, the overall graph period will be 2 hours maximum.

Information is NOT shown in graph form for re-peak charge mode, time delays, top-off charge, cycles, or discharge-before-charge steps.

## **CYCLE DISPLAYS**

While in the Main Memory screen, press → three times to find the Cycle Data screen. This screen shows the battery's capacity and voltage readings for each charge and discharge period for up to 10 full cycles. The cycle number is shown on the left side of the screen. Rotating the dial will scroll the cursor up and down the screen (continue scrolling down to view data for cycles 4 through 10).

Charge data is marked by "C:", with the charge capacity shown in "mAh" and the *peak battery voltage* is shown on the right.

Discharge data is marked by "D:", with the discharge capacity shown in "mAh" and the *average battery voltage* is shown at right.

[ CYCLE DATA ]		
NO	CAPACITY	VOLTAGE
→ 1 C:	0mAh	0.000V
↑ D:	0mAh	0.000V
1 2 C:	0mAh	0.000V
↓ D:	0mAh	0.000V
2 3 C:	0mAh	0.000V
↓ D:	0mAh	0.000V
-----		
4 C:	0mAh	0.000V
D:	0mAh	0.000V
5 C:	0mAh	0.000V
D:	0mAh	0.000V
6 C:	0mAh	0.000V
D:	0mAh	0.000V
7 C:	0mAh	0.000V
D:	0mAh	0.000V
-----		
8 C:	0mAh	0.000V
D:	0mAh	0.000V
9 C:	0mAh	0.000V
D:	0mAh	0.000V
10 C:	0mAh	0.000V
D:	0mAh	0.000V

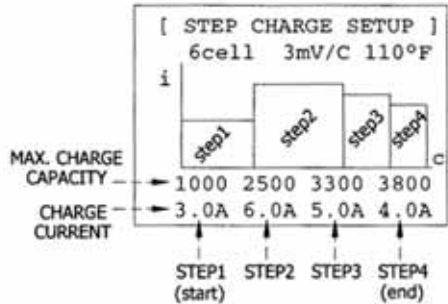
Cycling NiCds once monthly can help maximum the overall performance of the cells. NiMH batteries benefit much less from cycling. Cycling can help to determine a battery's ability to store its maximum rated capacity. If a battery can only store a small fraction of its rated capacity it's likely reaching the end of its useful life and may need to be replaced. New batteries, or older batteries which have not been used or cycled frequently may need to be broken-in before they will perform to their rated capacity.

Comparing how much charge energy, or "mAh," that was delivered to the battery vs. the subsequent discharge capacity in "mAh" can help to determine how well the battery held the previous charge. Also, comparing a battery's measured discharge capacity to its rated capacity is an indication of the battery's general condition. If a fully charged battery provides less than 70% of its rated capacity it may no longer be safe to use. Additional cycles can be attempted to try and increase the battery's storage capacity to near 100%, but if repeated attempts fail to improve performance the batteries should be replaced.

## **FOUR-STEP CHARGE SETUP**

**CAUTION!** The Four-Step Charge method is recommended for use by experienced users only!! If set improperly, the Four-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 Four-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 32). **NEVER USE THE FOUR-STEP CHARGE MODE WITH LI-ION OR LI-PO BATTERIES AS SEVERE, PERMANENT DAMAGE TO THE BATTERY AND ITS SURROUNDINGS WILL RESULT!!**



Parameters which are set in the Four-Step Charge screen do NOT affect those which are set in the Main Memory screen. The Four-Step and Main Memory screens are completely independent of each other. And, a temperature sensor is REQUIRED when using the Four-Step Charge mode. Ice will not allow Four-Step Charge to start unless a temperature sensor is connected.

The Four-Step Charge method divides the overall time needed to charge a battery into four separate periods or "steps" (see diagram above). The maximum charge capacity and charge current is set separately **for each of the four steps**. The purpose of the Four-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 Four-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 Four-Step charge mode for your battery. See the chart that follows for a breakdown of the settings for each step.

	Max. Charge Capacity Setting	Charge Current Setting
Step 1 – Getting started	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.
Step 2 – Delivering punch	Set to 50-75% of pack's rated capacity	Battery voltage should now be stable. A higher current can be set (up to the battery's 2C rating), to help deliver "punch" for racing.
Step 3 – Beware of heat	Set to 75-100% of pack's rated capacity	Reduce current to below the value in step 2 (to approx. 1.2 - 1.5C) to try and prevent the battery from generating excess heat.
Step 4 – Stabilize for good peak detection	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.

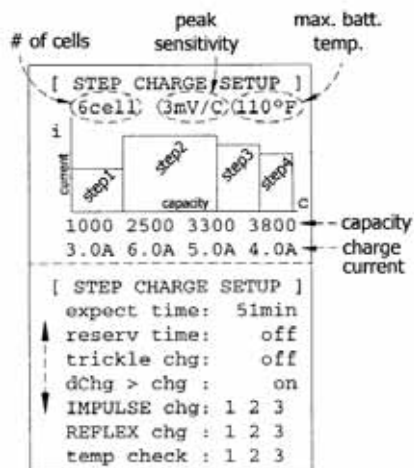
For example, see the following chart for how to set the Four-Step charge process for a 3300mAh battery and 3600mAh NiMH battery.

Battery Type	Setting	Step 1	Step 2	Step 3	Step 4
Sanyo 3600mAh	Battery Capacity	1600mAh (44%)	2200mAh (61%)	3000mAh (83%)	3800mAh (106%)
	Charge Rate	3.4A (0.9C)	7.2A (2C)	5.5A (1.5C)	4.5A (1.3C)
GP3300mAh	Battery Capacity	1500mAh (45%)	2000mAh (61%)	2800mAh (85%)	3600mAh (109%)
	Charge Rate	3.0A (0.9C)	6.5A (2C)	5.0A (1.5C)	4.0A (1.2C)

1. While in the Four-Step charge set-up screen (see next page), rotate the dial so the cursor is next to the line underneath the “Step Charge Setup” heading:

- Press the dial to highlight the **number of cells**. Rotate dial to adjust # cells to match the battery, ranging from 1 to 10 cells.
- Press → to highlight the **peak sensitivity** value. Rotate dial to adjust as desired ranging from 3-15mV/cell (or “ZEROpk” for NiMH batteries). Set this value slightly higher for NiCd batteries.
- Press → to highlight the **maximum temperature setting**. Rotate the dial to adjust as desired, ranging from 50-132°F (10-55°C).
- Press dial to confirm settings.

- 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 100-5000mAh.



- 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 8.0 amps.

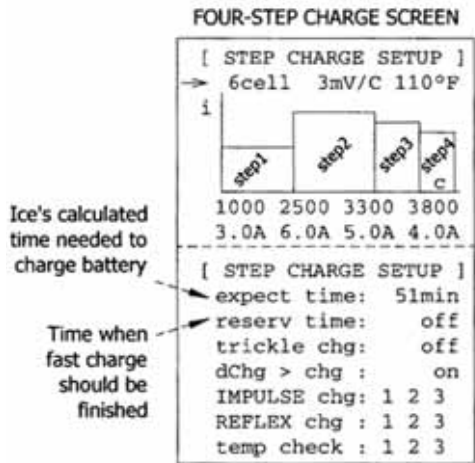
- Press the dial to highlight the charge current value on the left which is for step #1. Rotate dial to adjust this current value.
- Press → to select the next current value to the right, which is for step #2. Rotate dial to adjust this current value. Repeat this step 2 more times to adjust the current for steps 3 and 4.
- Press dial to confirm all charge current settings.

- Rotate the dial to move cursor down as there are 7 additional lines of features in this menu.



5. **Expect Time:** When the battery capacity and charge current values are entered into the Four-Step Charge menu, Ice will calculate how much time is “expected” to be needed to fully charge the battery while in four-Step Charge mode. This time will be shown on the “expect time” line. **Note:** This time does not include the temporary pauses that Ice needs to check battery temperatures (if applicable) and so on.

6. **Reserve Time:** Setting the reserve time function for the Four-Step Charge mode is done in the main Four-Step Charge screen as shown at right. Here, the reserve time feature operates the same way as in the CHARGE / DISCHARGE / CYCLE screens... Set the reserve time to be the number of minutes before the next race starts plus enough time to let the battery cool beforehand. The *minimum* reserve time setting cannot be lower than the calculated “expect” time above, and maximum is 600 minutes. The reserve time does NOT include the time needed for “discharge-before-charge” (see below). It is important to remember that the reserve time will vary depending on the charge current selection, capacity rating of battery, etc...

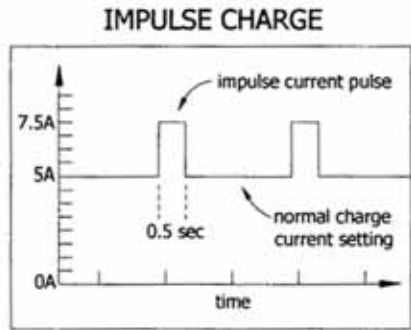


7. **Trickle Charge:** Rotate the dial to place the cursor in front of this line. This sets the trickle charge current that will be applied to the battery after fast charge ends. Press dial to highlight the value, and rotate to select the value which ranges from 0-500mA.

8. **Discharge > Charge:** Rotate the dial to place the cursor in front of this line. This “discharge-before-charge” simply instructs Ice to automatically discharge the battery before starting the charge process. Press 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 2b (on page 32) multiplied by 4. For simplicity, it is best to set this to “on” to empty the battery before starting the Four-Step Charge mode.

9. **Impulse Charge:** Refer to diagram at right. This feature functions in Four-Step 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 Four-Step Charge screen on page 32. 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, Ice 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. 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.



#### SETTING IMPLUSE & REFLEX CHARGE & TEMPERATURE CHECK

[ STEP CHARGE SETUP ]	
EXPECT TIME :	51min
reserv time :	off
trickle chg :	off
dChg > chg :	off
→IMPLUSE chg :	→ 1 2 3
REFLEX chg :	1 2 3
temp check :	1 2 3

[ STEP CHARGE SETUP ]	
EXPECT TIME :	51min
reserv time :	off
trickle chg :	off
dChg > chg :	fof
→IMPLUSE chg :	→ 1 → 2 3
REFLEX chg :	1 2 3
temp check :	1 2 3

[ STEP CHARGE SETUP ]	
EXPECT TIME :	51min
reserv time :	off
trickle chg :	off
dChg > chg :	off
→IMPLUSE chg :	→ 1 2 → 3
REFLEX chg :	1 2 3
temp check :	1 2 3

Press dial to place cursor before "1". Press -> to select or de-select "1".

Rotate dial to move cursor before "2". Press -> to select or de-select "2".

Rotate dial to move cursor before "3". Press -> to select or de-select "3".

Press ← anytime to remove the adjustment cursor arrow.

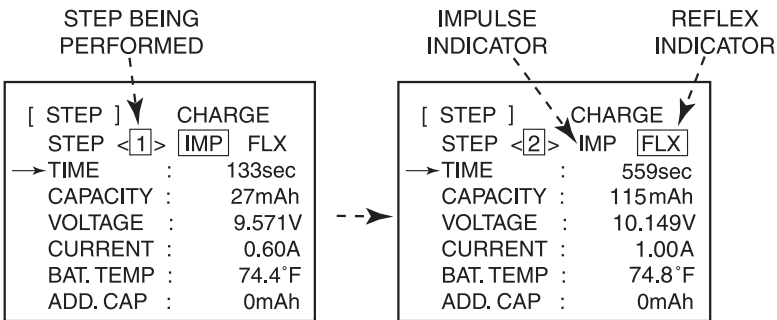
**10. Reflex Charge:** As with the impulse charge mode, reflex charge can be used in the Four-Step charge mode. Decide which steps to have the reflex charge mode function, which can be *any combination* of steps 1, 2 or 3. Reflex charge does NOT function during step 4. See the above diagram for how to set this feature. *Note that impulse charge and reflex charge can be applied to the battery at the same time!*

**11. Temperature Check: The Four-Step Charge mode REQUIRES use of a temperature sensor!** Ice will not allow the Four-Step charge mode to function without the sensor. This temperature sensing feature can be set to function in *any combination* of steps 1, 2 or 3 and is set the same way that

impulse and reflex functions are set (see diagram on the previous page). In steps 1-3, if the battery's temperature reaches the temperature setting at the top of the Four-Step Charge screen Ice will pause the charge function until the battery's temperature drops approx. 4°F (2°C) below the temperature setting, then charge will re-start automatically. The temperature sensing feature ALWAYS functions during the 4th step, and if the battery's temperature reaches the temperature setting during the 4th step Ice will automatically stop charging completely.

TO START THE FOUR-STEP CHARGE mode, when the Four-Step Charge screen is shown press the dial and hold it for 2 seconds. The Status Screen will then appear and show which charge step is being performed. For example, if impulse and reflex modes are set as shown at right (impulse for steps 1 and 3, reflex for steps 2 and 3) the Status Screen will show as below:

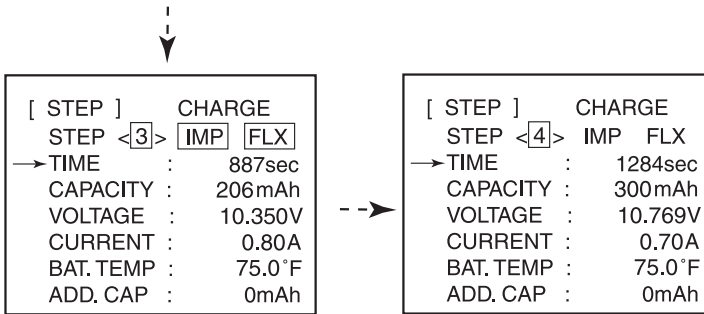
[ STEP CHARGE SETUP ]	
expect time	: 30min
reserv time	: off
trickle chg	: off
dChg > chg	: off
IMPLUSE chg	: 1 2 3
REFLEX chg	: 1 2 3
temp check	: 1 2 3



While the Four-Step Charge mode is functioning, the display will highlight the step that is being performed.

The type of charge being applied will also be highlighted - "IMP" for impulse or "FLX" for reflex...





...or both

Impulse and reflex charge are never applied in the 4th step. Peak detection and temp. protection will always function in step 4.

When Four-Step Charge ends, go to the Data View screen to see the final charge data.

## **ERROR MESSAGES & TROUBLESHOOTING GUIDE**

IntelliPeak Ice's solid-state circuitry offers protection against damage which could be caused by short-circuit or reverse polarity conditions, and more. Here is a list of possible error messages which might show on-screen, and an explanation of the problem:

*"Input voltage – The present input voltage is xx.xxV. Please check the input voltage. The input voltage must be 11V~15V."*

*"No battery – A battery is not connected to the output. Please connect the battery to the output then restart!"*

*"Reverse polarity – A battery is connected to the output in reverse! Please correctly connect the battery to the output."*

*"Open circuit – A battery is disconnected during an operation. Please reconnect the battery and restart!"*

*"Short-circuit – Output short-circuited. Please check the output."* Note: When short circuit occurs on the output Ice will continue to try and charge for 2 minutes at the selected current. This is by design, as sometimes cells which have previously been *completely discharged* (after a race, with a cell discharger, even with Ice which can discharge to 0.1V) will have such low voltage that it might APPEAR that the output is short circuited when really it is not. If a fully discharged cell is connected, its voltage will quickly rise when charge is applied and the charger will continue to charge as normal. However, if the output is truly short circuited the voltage on the output will never increase and after 2 minutes Ice will stop charge and display this message.

*"Low output voltage – Output voltage is lower than the selected cells or voltages. Please select proper cells or voltages."* Either Ice's voltage setting is incorrect, or the battery's rated voltage exceeds the setting.

*“High output voltage – Output voltage is higher than the selected cells or voltages. Please select proper cells or voltages.”* Either Ice’s voltage setting is incorrect, or the battery is in poor condition.

*“No motor – A motor is not connected to the output. Please connect the motor to the output.”*

*“Motor disconnection – A motor has become disconnected during an operation. Please reconnect the motor and restart!”*

*“Sensor Connection – A temp sensor must be used in 4 step mode. Connect DTXP4171 temp sensor.”*

*“Temperature sensor – A temperature sensor is connected in reverse or is defective.”*

*“Bat. Temp too low – Battery temp is too low to be operated!”* This message will show if the battery temperature is (a) lower than 32°F (0°C) during an operation, or (b) lower than 14°F (-10°C) when in idle mode. If this shows, allow battery to warm before proceeding.

*“Bat. Temp too high – Battery temp is too high to be operated!”* If this shows, allow battery to cool before proceeding. This message will clear when ◀ is pressed.

*“Charger too hot! Please wait until the charger cools!”* This message will show when Ice’s own internal temperature exceeds 239°F (115°C). Here, operations will pause temporarily, then resume automatically when internal temp. returns to below 158°F (70°C). This protects Ice’s electronics from damage due to excess heat.

*“Internal Sensor - Internal temp is too hot!”* If Ice’s internal temperature exceeds 239°F (115°C) the display will first show “Charger too hot” and all operations will temporarily pause. If the internal temperature continues to increase over 257°F (125°C) the “Internal sensor” error message will show. If this happens a problem must exist with the charger – contact Hobby Services for details.

*“Data Communication – Something is wrong with the internal circuit. Contact Hobby Services”* This message will show if the charger’s own logic experiences control problems. Contact Hobby Services if this occurs.

### **Other possible problems:**

**PROBLEM:** LCD does not work when unit is connected to input power. (1) Check power supply for improper power. (2) Check input connections for solid contact. (3) DC input power is connected backwards...reverse input connection. (4) Contact Hobby Services for further details.

**PROBLEM:** Charger doesn’t recognize battery. (1) Check for faulty connection or wiring...correct or replace charge lead. (2) Defective cell in the pack. Replace battery pack or cell.

**PROBLEM:** Battery voltage low after charge (below 1.2V per cell for NiCd/MH, or below 3.6V or 3.7V for Li-Ion/Li-Po batteries. (1) “Max chg capacity” setting too low...increase value. (2) NiCd/MH peak sensitivity setting too low or too high...re-adjust setting. (3) Poor quality charge leads...replace with new.

**PROBLEM:** Will not lock into discharge mode. (1) Battery’s rated voltage set improperly...set battery voltage to exactly match that of the battery. (2) Tx has diode in

charge circuit...remove battery and connect directly to charger, or contact your radio manufacturer for details. (3) Battery is already discharged. (4) Defective cell in pack...replace battery.

**PROBLEM:** Motor turning overheating, or turning too fast or slow during break-in. (1) The "set volt" value is too high or low...re-adjust to match the motor's specs. (2) The selected run time is too long...reduce run time setting.

**PROBLEM:** Low mAh/time readings after discharge. (1) Battery not fully charged prior to discharge. Fully charge batteries prior to discharge. (2) Old or unused batteries...cycle again to see if capacity improves. (3) Defective battery, needs to be replaced. (4) Discharge cutoff voltage set too high...reduce setting. (5) Discharge rate set too high...reduce setting. (6) Battery's rated voltage set improperly...set to exactly match that of the battery. (7) Possible internal problem with charger...contact Hobby Services for further details

**PROBLEM:** Battery gets too hot during Four-Step Charge mode. (1) Capacity setting is too high in one or more of the steps...reduce setting. (2) Charge current setting too high in one or more of the steps...reduce setting. (3) Max. battery temperature setting too high...reduce setting. (4) Contact Hobby Services for more information.

### **2-YEAR LIMITED WARRANTY – USA & CANADA ONLY**

DuraTrax® warrants this product to be free from defects in materials and workmanship for a period of two (2) years from the date of purchase. During that period, DuraTrax 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, DuraTrax 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 DuraTrax 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  
[www.hobbyservices@hobbico.com](mailto:www.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.



## **OTHER ITEMS AVAILABLE FROM DURATRAX**



### **DuraTrax® 20A Discharger**

Discharge up to six individual sub-C NiCd or NiMH cells at up to 20 amps! Unique lever-lock handles and spring-loaded contacts make cell insertion and removal fast and easy. Status lights indicate each cell's condition. The built-in cooling fan can be powered by load cells or an external DC power supply (not included). One-year warranty. **DTXP4320**



### **DuraTrax IntelliSpeed™ 8T Pro Racing Forward ESC**

Fully programmable and totally affordable, the Pro Racing Forward is ideal for racing with 6-7 cells and motors with 8 turns or more. Push-button set-up makes it easy to program any or all of six performance-tuning features, including: traction control, turbo start, quick start, current limit, independent high/low brake limits and switching frequency. Also included: 6V/3A BEC, solder posts for motor and battery leads and 120-day warranty protection. **DTXM1080**







