PRIMAL

Multi-Chemistry AC Peak Detection Balance Charger

Simple • Capable • **Safe**

Input power	AC, 100-240V, 50-60Hz		
Internal DC switching power supply	50W with cooling fan		
Charge current rate	LiPo	2s (7.4V)	0.5-4A
		3s (11.1V)	
	NiCd/MH	1-8 cell	
Current drain for balance port	300mAh		
Output connector	TAM style, Mini/Micro adapter		
Integrated balance plug	JST-XH (2s-3s)		
Weight	350g		
Dimensions	161x105x60mm		

- Before using your product, review all documentation and inspect the products carefully. If for some reason you decide it is not what you wanted, then do not continue with unpacking, setup or operation of your product. Your local hobby dealer cannot accept a product for return or exchange after partaking in actions that produce wear and tear.
- Product specifications are subject to change without notice. Due to ongoing development, the actual product may vary from images shown.
- This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.
- This product is not a toy! (14+) Recommended for ages 14 and up. Adult supervision required for ages under 18 years old. Contains small parts, keep out of reach of children 3 years of age and younger.

PACKAGE CONTENTS

- [1] Primal Charger
- [1] HCT-Plug to Mini/Micro plug adapter
- [1] Documentation package

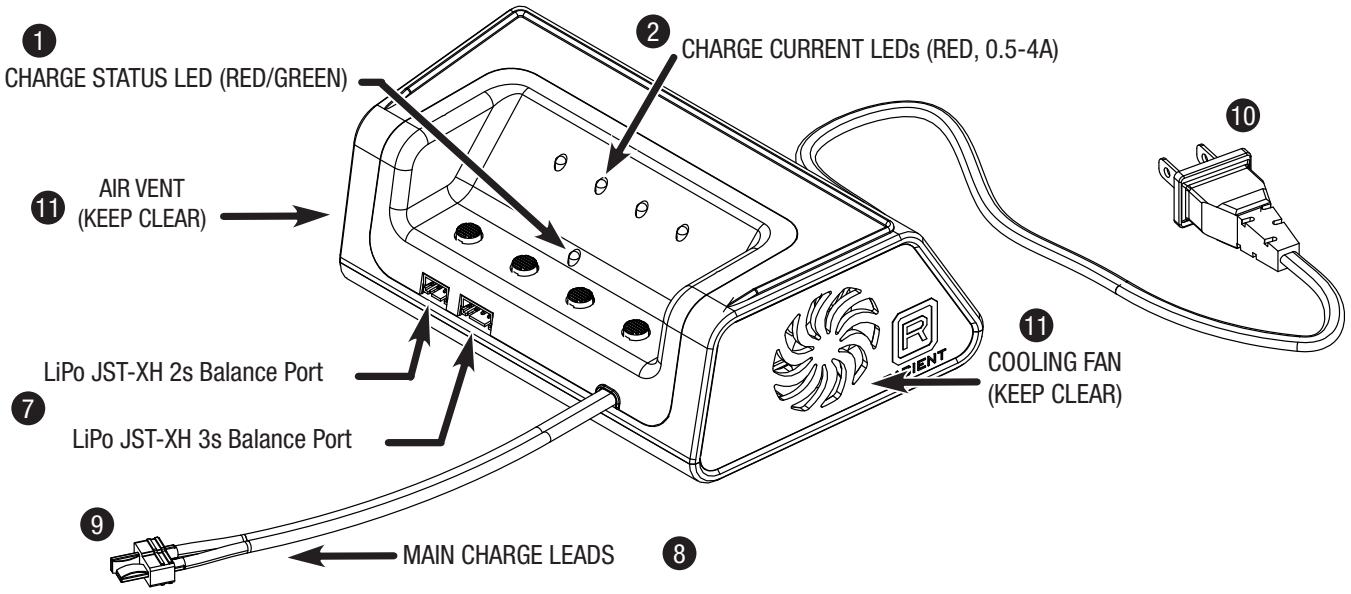
COMPATIBLE BATTERY TYPES FOR USE WITH YOUR CHARGER

- Nickle Cadmium (NiCd)
  - › 1 (1.2V) - 8 (9.6V) cells
- Nickle Metal-Hydride (NiMH)
  - › 1 (1.2V) - 8 (9.6V) cells
- Lithium Polymer (LiPo)
  - › 2s (7.4V) - 3s (11.1V) cells (series configuration)

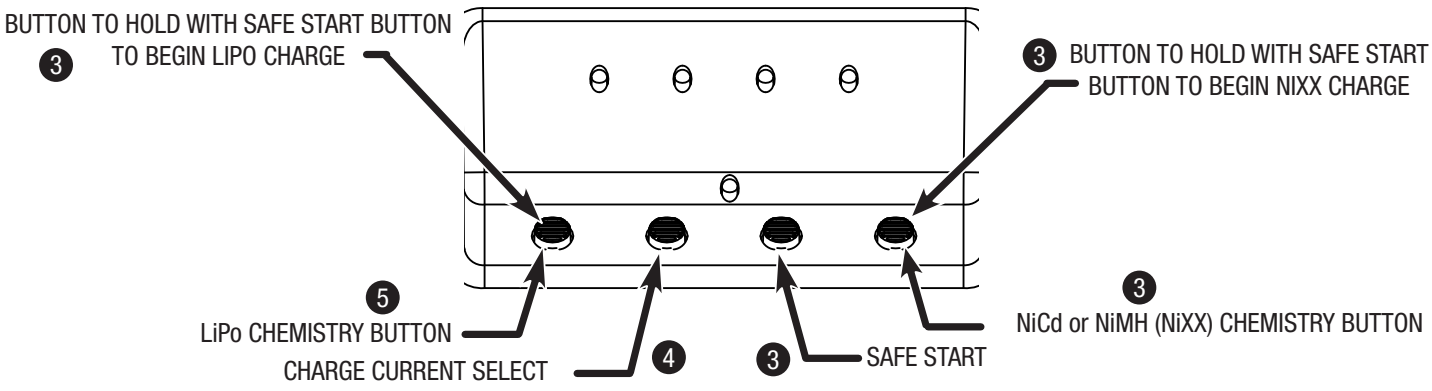
UNBOXING

1. Remove the charger from the box.
   a. Ensure the plug is compatible with your battery.
      i. NOTE: There are many different types of battery plugs on the market. If yours does not fit the standard supplied plugs, please visit your local hobby dealer to purchase the correct adapter.
2. Read charging instructions and understand all warnings and cautions before proceeding.
   a. This product is not a toy and should not be charged, operated, or maintained without supervision of an adult.
   b. It is necessary to follow all manufacturer's charging instructions per each battery type.

INTRODUCING THE PRIMAL CHARGER



THE CONTROL PANEL



1. Status LED
    a. OFF: Not in use
    b. SOLID RED: Charging
    c. FLASHING GREEN: Peak detection active
    d. NiXX: the charger has entered Delta-Peak mode, the battery is approximately 90% charged
    e. LiPo: the charger has entered CV charging mode, the battery is approximately 80% charged
    f. SOLID GREEN: Charge cycle complete
    g. ERROR
        i. FLASHING RED/GREEN: Charger is in thermal protection mode. Charging current has been reduced to minimum to allow for the charger to cool back down to normal operating temperatures. When charger has cooled, normal charging will resume. If you see this error, direct a cooling fan at the charger, with the air blowing away from yourself or any flammable objects.
    h. FLASHING RED:
        i. Connection problem or damaged battery (check for proper polarity and balance plug connection.
        ii. Input power is out of operating limits.
2. Amp LEDs
    a. LEDs flash RED indicating 0.5A setting.
    b. LEDs glow solid RED indicating the selected charge current.
3. Safe Start
    a. Pressing simultaneously for 3 seconds with the LiPo OR NiXX button is the only way to start a charging cycle.
    b. Press to *STOP* charging at any time while charging.
4. Amps
    a. Press repetitively to cycle through available charge rates for use with the connected battery. Stop pressing when the LED above the desired charge rate is illuminated.
5. LiPo
    a. Pressing simultaneously for 3 seconds with the 'Safe Start' button is the only way to start a charging cycle.
6. NiXX
    a. Pressing simultaneously for 3 seconds with the 'Safe Start' button is the only way to start a charging cycle.
7. 2s-3s JST-XH Balance ports.
    a. Connected your LiPo balance plug to the appropriate port to enable LiPo balance charging.
        i. If your battery has a different connector, do not try to modify your connector or the charger. Visit your local hobby dealer and purchase a Radient Primal Universal Balance Adapter (RDNA0003) for use with your balance plug.
8. Main charging lead
    a. Connect to the main charge leads of your battery using the appropriate connector type. Visit your local hobby dealer for assistance if the plug on your battery and charger do not match.
    b. WARNING: Never try to force connectors together.
9. Charge plug adapter, High Current T-Plug
    a. Connect the main charge leads of your charger to the battery for batteries using HCT compatible plugs.
    b. Connect the main charge leads of your charger to the included micro/mini adapter to charge batteries with the micro/mini plug installed. Visit your local hobby dealer for assistance if the plug on your battery and charger do not match.
    c. WARNING: Never try to force connectors together.
10. AC input plug
    a. For use with 2 and 3 prong grounded US receptacles (plugs) supplying 100-120V @60Hz AC power.
11. Cooling fan and vents
    a. Always keep clear and never stick anything into the charger through these or any other holes in the case.

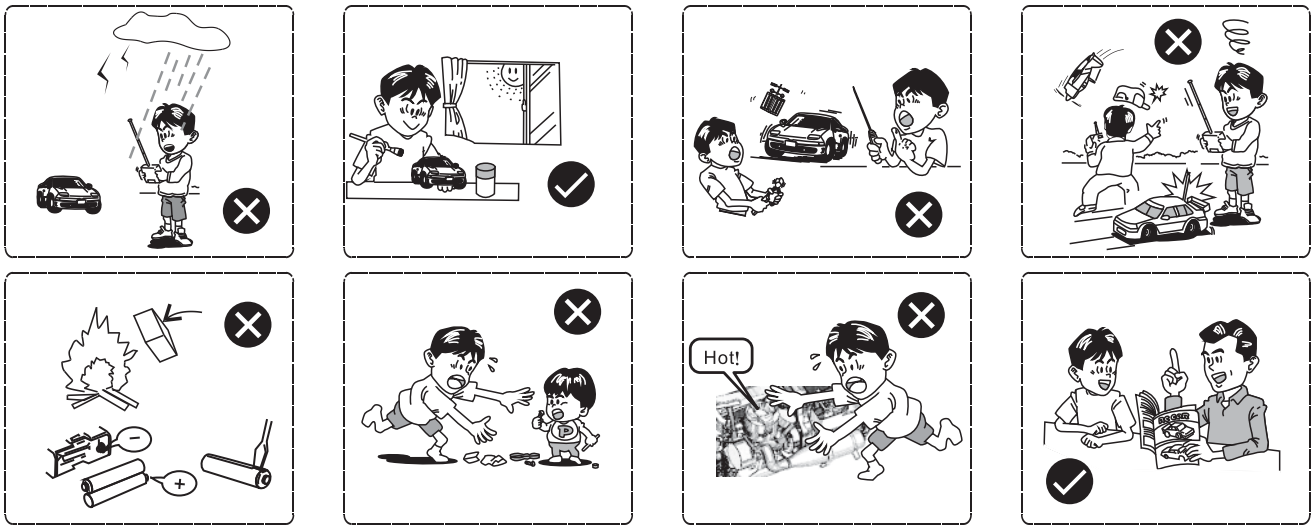
GENERAL CHARGING PRECAUTIONS

Although great for first time users, Radient RC products are indeed advanced and sensitive electronics that could result in injury if used improperly. Always use caution and common sense as failure to operate your Radient RC product in a safe and responsible manner can result in damage to the product or other properties. Therefore this product is not intended for use or maintenance by children without direct adult supervision. Radient RC, and your local hobby dealer shall not be liable for any loss or damages, whether direct, indirect, special, incidental, or consequential, arising from the use, misuse, or abuse of this product or any product required to operate or maintain it. Following are some general tips that will help increase the safe operation and enjoyment of using your charger.

- Do not operate your charger in direct sun light, rain, electrical, or thunder storms.
- The charger should never be connected to a battery without being connected to an input power source.
- Never operate your charger where input power is highly unstable.
- Never attempt to charge a non-rechargable battery or battery type that is not compatible wit this charger
- Operate in a dry, open environment away from property, and cars (never run into the street for any reason).
- Always disconnect the battery from the charger after charge is complete.
- Never connect the battery to the charger when the charger is powered off. The charger should always be powered on before connecting the battery.
- Never stick anything into the charger case due to risk of electrical shock or interference with the cooling fan
- Always allow batteries to completely cool before charging.
    - › NOTE: Only use genuine replacement or aftermarket parts available from your local dealer to ensure proper operation of your Radient RC product.

TIPS FOR SAFELY OPERATING YOUR CHARGER

- Avoid charging on or around flammable items.
- Never attempt to charge a swollen or damaged battery.
- Never leave the battery unattended while charging.
- Never operate the charger without adult supervision.
- Never charge a warm battery, always allow the battery to cool to room temperature before charging.
- Never drop the charger or battery.
- Inspect the battery and charger before use. Never charge a battery or operate a charger if the wire or connector has been damaged or if the battery has experienced a short circuit.
- Incorrect use of the battery, connections, or charging equipment can cause personal injury or property damage.
- Never allow batteries or charger to come in contact with moisture at any time; avoid environments with high humidity.
- Disconnect input power and battery immediately if the battery, connector, or charger becomes hot or changes form during use.



THIS PART IS REALLY IMPORTANT, PLEASE READ AND UNDERSTAND IT

WARNING: The Radient Primal charger has the capability of charging both LiPo and NiCd/NiMH (NiXX) batteries which require significantly different charging modes. It is extremely important to choose the correct charging mode when charging your batteries. Choosing the wrong charging mode can cause fire or explosion. Be sure to properly identify the battery chemistry, voltage and capacity of every pack before attempting to charge it to ensure the correct settings. Some LiPo battery packs are designed to look like NiXX battery packs. One indication of a LiPo battery is the presence of a balance plug either exiting the battery with small wires and small plug on the end or a small female plug embedded into the end of the battery pack. If you are unsure of the battery type you are attempting to charge; please consult your local hobby dealer for assistance.

To help ensure the correct charging mode is used when charging your batteries, the charger is equipped with Safe Start technology. Safe Start is a start sequence technology used to deter the use of the incorrect charging mode for batteries of different chemistry. When battery packs are connected properly per chemistry the system is very robust; however if some batteries are improperly connected it is possible to charge LiPo batteries in NiXX mode, exactly what you should NEVER do, so caution is always required when operating the charger. Safe Start is used by requiring the simultaneous pressing of both the Safe Start button and the appropriate charge mode button for 3 seconds to begin the charge cycle.

LETS GET CHARGING

Now that you are familiar with the charger, its features, and general precautions of what not to do and some of what to do, we should get started charging your first battery. Just a reminder...set some time aside so you ***DON'T*** have to walk away and ***STOP THE CHARGER, MID CHARGE*** since you should never leave the charger unattended while charging. Finally, confirm the battery chemistry type, capacity, voltage and cell count of the battery you will charge and ensure all connector plugs are compatible. Here are the basics of what you will be doing.

1. Plug the charger into a properly grounded AC wall plug.
2. Plug the battery into the charger and place the battery on/in a non-flammable surface/container and away from any flammable objects.
3. Follow the appropriate charge instructions for your battery chemistry type listed on the following page.
4. Unplug the battery from the charger when the charge is complete.
5. Remove charger from wall plug when not in use.
    a. NOTE: Only use batteries with labels that are legible and clearly state the capacity, cell count (or voltage), and chemistry type as either NiCd, NiMH, or LiPo.

CHARGING A LiPo BATTERY

The Radient Primal charger supports charging of LiPo batteries using Constant-Current Constant-Voltage (CC-CV) charge mode for 2s-3s cell configurations with available charge current range from:

- 0.5-4 Amps for 2s (7.4V) configuration
- 0.5-4 Amps for 3s (11.1V) configuration
    - › NOTE: Your charger is equipped with a safety shut-off timer set to 120min. Charging of batteries with capacity higher than 5000mAh may require a greater charge time and thus require more than one charge cycle to achieve full charge. It is always recommended to allow your battery to cool to room temperature before charging either the first or second time.

To charge a LiPo battery in CC-CV charge mode, perform the following steps:

1. Connect your LiPo battery's balance plug connector to either the JST-XH (2s or 3s) balance port built into the charger or into a connected external balance adapter board (RDNA0003 for example).
    a. NOTE: Charging of LiPo batteries on LiPo mode without connecting the balance connector is not supported. As an added feature to our Safe Start technology, if a balance plug is detected by the charger, use of the NiMH charge mode is disabled and cannot be circumvented.
2. Connect the main charging leads to your battery.
    a. NOTE: it is critical that the battery always be connected with the correct polarity, Negative (-) = Black, and Positive (+) = Red. Only connect Like color and symbol together.
3. Select the appropriate charge current for your battery by pressing the 'Amps' button repeatedly until the desired charge current is selected, indicated by the row of glowing RED LEDs. For 0.5A, the 1A LED will flash, for 1A, only the 1A LED will glow, for 1.5A, the 1A LED will glow and the 2A LED will flash, for 2A, both the 1A and 2A LEDs will glow. The pattern continues through 4A at which time another button press will cycle around to 0.5A again.
    a. WARNING: Selecting the appropriate charge current is critical to the safe charging of your batteries. To achieve the safest operating conditions and longest life from your batteries it is recommended to charge your batteries at no more than 1C. See the Index at the back of this manual for charge rate calculations.
        i. Note: Although you may select charge currents up to 4A, the maximum final charge current may be reduced as needed to keep the charger operating within safe limits. Typically this occurs when charging a 3s LiPo at 4A.
            01). Example: A 3s LiPo may start to charge at 4A but as the voltage of the battery increases the charge current will reduce to approximately 3A.
        ii. Utilizing this method of charge current control enables the charger to always try to charge your battery as close as possible to the setting you specify, while keeping the system within safe operating limits.
    b. You have 30 seconds from the last 'Amps' button press, to start the charge cycle. After 30 seconds the charger will reset to the default of 1A charge current.
4. Press both the Safe Start and LiPo buttons at the same time and hold for 3 seconds to start the charging cycle. The center 'Status' LED will change to solid RED.
    a. NOTE: If the LED begins to flash RED or if the charger is unresponsive to your input, see the troubleshooting guide at the back of this manual.
5. Near the end of charge completion the LED will flash GREEN, indicating the charger has entered Constant Voltage (CV) mode, the battery is typically 80% charged at this point.
6. When the charge is complete, the LED will glow solid GREEN. The LED will glow solid GREEN until the battery or AC power is disconnected.
    a. NOTE: If the charger encounters an error throughout the start or charging process, the center 'Status' LED will flash RED. See the trouble shooting guide at the back of this manual for possible solutions.
7. Pressing the 'Safe Start' at any time while charging will STOP the charge cycle.

CHARGING A NiCd/NiMH (NiXX) BATTERY

The Radient Primal charger supports charging of NiXX batteries from 1-8 cell series configurations with a delta peak value of 8mV and available charge current range from:

- 1-4 Amps for 1-8 cell (1.2V-9.6V) configurations
  - › NOTE: Your charger is equipped with a safety shut-off timer set to 120min. Charging of batteries with capacity higher than 5000mAh may require a greater charge time and thus require more than one charge cycle to achieve full charge. It is always recommended to allow your battery to cool to room temperature before charging either the first or second time.

To charge a NiXX battery in Delta-Peak charge mode, perform the following steps:

- › **WARNING: Ensure your battery is truly a NiCD or NiMH battery. Some LiPo battery packs are designed to look like NiXX battery packs. If you are unsure of the battery type you are attempting to charge; please consult your local hobby dealer for assistance.**
- › NOTE: As an added feature to our Safe Start technology, if a balance plug is not detected by the charger, use of the LiPo or LiFe charge modes are disabled. By the same logic, if a balance plug is detected the use of NiMH and NiCd charge modes are disabled. This cannot be circumvented.

1. Connect the main charging leads to your battery.
   a. NOTE: it is critical that the battery always be connected with the correct polarity, Negative (-) = Black, and Positive (+) = Red. Only connect Like color and symbol together, any other form of connection may cause fire or explosion.
2. Select the charge appropriate charge current for your battery by pressing the 'Amps' button repeatedly until the desired charge current is selected, indicated by the row of glowing RED LEDs. or 0.5A, the 1A LED will flash, for 1A, only the 1A LED will glow, for 1.5A, the 1A LED will glow and the 2A LED will flash, for 2A, both the 1A and 2A LEDs will glow. The pattern continues through 4A at which time another button press will cycle around to 0.5A again.
   a. **WARNING: Selecting the appropriate charge current is critical to the safe charging of your batteries. To achieve the safest operating conditions and longest life from your batteries it is recommended to charge your batteries at no more than 1C. See the Index at the back of this manual for charge rate calculations.**
      i. Note: Although you may select charge currents up to 4A, the maximum final charge current may be reduced as needed to keep the charger operating within safe limits. Typically this occurs when charging a 8 cell NiXX at 4A.
         01). Exp: A 8 cell NiMH may start to charge at 4A but as the voltage of the battery increases the charge current will reduce to approximately 3A.
      ii. Utilizing this method of charge current control enables the charger to always try to charge your battery as close as possible to the setting you specify, while keeping the system within safe operating limits.
   b. NOTE: You have 30 seconds from the last 'Amps' button press, to start the charge cycle. After 30 seconds the charger will reset to the default of 1A charge current.
3. Press both the Safe Start and NiXX buttons at the same time and hold for 3 seconds to start the charging cycle. The center 'Status' LED will change to solid RED.
   a. NOTE: If the LED begins to flash RED or if the charger is unresponsive to your input, see the troubleshooting guide at the back of this manual.
4. Near the end of charge completion the LED will flash GREEN, indicating the charger has entered Delta-Peak (dV) mode.
5. When the charge is complete, the LED will glow solid GREEN. The LED will glow solid GREEN until the battery or AC power is disconnected.
   a. NOTE: If the charger encounters an error throughout the start or charging process, the center 'Status' LED will flash RED. See the trouble shooting guide at the back of this manual for possible solutions.
6. Pressing the 'Safe Start' at any time while charing will STOP the charge cycle.

GENERAL CARE AND MAINTENANCE

WARNING: This charger contains a built in AC to DC converter which can store electrical power for a short time after disconnection from the AC input power source. Always unplug the charger from both input power and output charging leads before performing any cleaning or maintenance to prevent electric shock. It is advisable to wait at least 1 minute before starting your cleaning or maintenance.

Care:

- Always use clean, dry cloth or soft bristle brush to clean your equipment.
- Never use chemical cleansers to avoid damage to the sensitive electronics and plastics.
- Before every use, inspect the input and output power cords and plugs and discontinue use if there are any signs of damage.
  - › Contact your local hobby dealer or Radient RC Customer Support for assistance with repair needs.
  - › NOTE: Continued use of a damaged battery or charger will void the warranty and could cause personal injury and property damage.

Maintenance:

- Periodically use compressed air to blow out dust that has been trapped inside the charger to help prevent excessive heat due to dust build up.
  - › **WARNING: Always wear eye protection when using compressed air to clean your charger.**
  - › NOTE: Ensure the charger is disconnected form input power and any battery before performing any care or cleaning procedures.

STORAGE AND DISPOSAL

Storage:

- There is a cord wrap feature located on the bottom of your charger. Use it to coil the unused length of input power cord.
  - › NOTE: Never “kink” (or bend sharply) any electrical wires. Doing so may damage the internal electrical wire even if the outside appears undamaged.
- Never store the charger (or your batteries) in direct sunlight for extended periods of time.
- Since every battery and manufacturer is different, refer to the storage instructions from your battery manufacturer for proper information.

Disposal:

- Your product and the various batteries it is intended to be used with are considered electronic waste and should never be discarded in standard garbage containers. Please visit your local hobby dealer and use the FREE battery disposal center for proper disposal/recycling of batteries. Consult your local city waste disposal center for information on disposal of electronics other than batteries.
- Please do your part to protect our environment.

RELATED SPARE PARTS LIST

RDNA0003..... PRIMAL UNIVERSAL LIPO BALANCE ADAPTER BOARD (2-S) .....

Problem / Symptom	Possible Cause	Possible Solution
Status LED is flashing RED	Battery voltage too low	Battery may be dead and in need of replacement
	Battery voltage too high	Battery voltage could already indicate a full charge, attempt to use your battery then charge again.
	Input voltage is too low	Check for stable input power with proper voltage
	Reverse polarity	Check battery connection and ensure red wires are connected to red wires and black wires are connected to black wires
	Balance plug not connected properly when attempting to balance charge LiPo battery	Check balance plug is properly connected
		Ensure the correct charge mode is being used for your battery type
	Balance plug connected when trying to charge NiXX battery	Check balance plug is not connected
		Ensure the correct charge mode is being used for your battery type
Status LED is flashing Red/Green	The charger has over-heated and reduced the charge current to minimum. Your battery will continue to charge but at a very slow rate until the internal temperature of the charger is back down into operational limits	Stop charging, unplug your charger from all connections and blow compressed air through the side vents to remove dust. See the 'General Care and Maintenance" section of this manual.
		Remove charger from direct sun light or area of high ambient temperature and allow to cool
		Direct a cooling fan onto the charger
The charger is unresponsive to starting when using Safe Start sequence	The charge mode is incorrect for the connected battery	Check battery connections and confirm battery type and charge mode
	The buttons are not being depressed at the same time for long enough	Ensure you are pressing down 2 buttons simultaneously for at least 3 seconds
	There is a connection problem	Check input and output connections
The charger resets charge current to 0.5A automatically	This is a built in safety feature and is executed after 30 seconds of standby or charge completion	Be sure to start your charge within 30 seconds of your last button press when selecting the charging current (Amps button).
The charger is unresponsive to any input	The input power is unstable	Check input power connections and appropriate voltages are present
The fan is not working	Charger is not in use	Start a charge and pay attention as the charge nears completion.
	The fan is controlled by the internal microcontroller and will only come on when needed, however it could still become damaged.	Look for the charger to flash the red/green error code indicating it has reached an internal temperature that is too high, if the fan does not come on, it is damaged or could have become unplugged. Contact support.

Understanding C Ratings:

Many battery manufacturers do not list the definition of or explain the purpose of C ratings and how to use that information. For LiPo batteries there is typically listed both a C rating for charging and discharging of the batteries. You must use caution that you calculate your charge rate based on the charge C rating and not the discharge C rating.

- Charge Rate Calculation
  - The charge C rating of a battery refers to a ratio between the battery's capacity and the maximum safe charge current as determined by each manufacturer for each battery. This value is typically listed in the lower ranges between 1C-5C. It signifies the maximum current the battery should be charged at in a multiple of the capacity of the battery cells (on a per cell basis, not per pack basis).
    - For example: if a battery cell is 2000mAh and the charge C rating is listed at 2C, the maximum charge current that should be used with this battery is equal to 2000 x 2 = 4000mA = 4.0A.
    - NOTE: 1000mAh = 1Ah. For simplified annotation, although charge rates are actually units of Ah, we refer to them as A only. Thus 1Ah = 1A.
    - Since the Primal charger only increments in values of 1A, if the calculated maximum charge rate is a decimal value (4.4) it is highly recommended to round this value down to the nearest whole number and use that as the *maximum* charge rate, but not necessarily the *best* charge rate option.
    - If the calculated charge rate is over the maximum capability for this charger, you can simply use the maximum allowed.
  - Radient RC recommends charging at 1C for the maximum cycle life of your batteries.
  - Always check the instructions provided with your batteries for proper charge and care. Those instructions should over-ride these since they pertain to the particular battery that you have and this is a general statement.
- Discharge Rate Calculation
  - The discharge C rating of a battery refers to a ratio between the battery's capacity and the maximum safe discharge current as determined by each manufacturer for each battery This value is typically listed in the higher range from 15C upwards. It signifies the maximum current the battery should be discharged at in a multiple of the capacity of the battery cells (on a per cell basis, not per pack basis).
    - For example: if a battery cell is 2000mAh and the discharge C rating is listed at 30C, the maximum discharge charge current that should be used with this battery is equal to 2000 x 30 = 60000mA = 60A. This means you can continuously discharge this battery at a rate of 60A per hour without damage.
    - Since the Primal charger does not discharge, this information is only for reference in helping you understand the terminology of the battery industry.

Termination Voltages (Peak Detection):

- LiPo Batteries: The peak detection of a LiPo battery works by increasing the voltage of the battery pack to a specified range. The goal of the charger is to increase the voltage of the battery into this range while injecting the most mAh into the battery as possible. The charge cycle terminates when this value is reached.
  - The nominal voltage of a LiPo battery cell is listed at 3.7V.
  - The Primal charger will terminate the charge of a LiPo battery pack when it measures a voltage of 4.18-4.2V per cell.
  - For a 2s 7.4 nominal voltage battery pack, the termination voltage would be 2 x 4.2 = 8.4V.
- NiXX Batteries
  - The nominal voltage of a NiXX battery cell is listed at 1.2V.
  - The Primal charger will terminate the charge of a NiXX battery pack when it measures a maximum voltage of the battery pack in a specified range and then also measures a drop in that voltage of 8mV.
  - The maximum voltage a battery pack reaches changes during the life of the battery (increasing with age). The characteristic behavior of the voltage drop remains the same however thus allowing the charger to continue to detect a "peak" voltage (maximum voltage - 8mV) regardless of age.

Power Rating (Watt-hour):

- Some products state a recommended Watt hour rating for a battery to be used with that product. The Watt hours can be approximately calculated knowing the battery capacity and the voltage.
  - For Example: if a battery is 2000mAh and the voltage is 8.4V the Watt Hours (Wh) is equal to 2000 x 8.4 = 16,800mWh = 16.8Wh.

Recommended Discharge Voltage Cut-offs:

- For maximum cycle life and safety, LiPo batteries should never be discharged below 3.3V per cell when discharged at a rate of 1-4C. For this reason, many electronic speed controllers have a special "LiPo Mode" which activates a cut-off of power when the ESC measures the battery voltage in a dangerous range.
- For maximum cycle life and safety, NiXX batteries should never be discharged below 0.9V per cell when discharged at a rate of 1-4C. The use of an ESC low voltage "cut-off" mode is not necessary with NiXX batteries.

Storage Voltages:

- Although the Primal charger does not offer discharge capabilities it is important to understand this information about your batteries since it is critical to both the safety of the battery and the cycle life.
  - › Always consult the battery manufacturer's documentation for storage information specific to that battery.
    - » **WARNING: You should NEVER store LiPo batteries at full charge for more than a few hours at most (and they should be stored at temps of 40-75 degrees Fahrenheit whenever possible to help prevent swelling and/or loss of performance/capacity).**
  - › LiPo batteries should be charged (or discharged depending on their state prior to storage) to approximately 50% of their rated capacity (approximately 3.85V per cell). The storage time at this voltage should not exceed 6 months and a use cycle and return to storage mode is recommended every 3 months.
  - › The storage voltage of NiXX batteries is not as critical as LiPo but they should be stored in cool conditions and at a low cell voltage to prevent memory buildup and loss of capacity and performance.

NOTES

RADIENT