

LiPo Cell Balancer

INSTRUCTIONS



The Equinox™ LiPo Cell Balancer is designed to regulate the voltages of all cells in a lithium-polymer (LiPo) pack to very tight tolerances during charge and discharge functions. As opposed to non-balanced packs, balanced LiPo's typically provide higher total voltage, which means more **power** to the motor system. In addition, balanced LiPo packs generally last longer as no individual cell ever becomes over-charged, which is a big reason why some LiPo's perform inadequately. A good balancing system also provides a very safe charging and discharging platform, which is critical when handling LiPo batteries.

Equinox is designed to balance LiPo packs containing anywhere from 2 to 5 cells **which are assembled in series**. Equinox will keep the voltages of all cells in the pack within 5mV (0.005V) to 30mV (0.030V) of each other at all times. **It's very important to understand that the LiPo battery MUST be wired for balancing in order to function with Equinox!** Contact your LiPo supplier if you are unsure if your battery is configured for balancing.

Unlike some balancers, Equinox has two separate functions:

QUICK-BALANCE MODE: By itself, Equinox can apply a small discharge current to gently balance the voltages of all cells in a LiPo pack. This function is called "Quick-Balance Mode."

INTERFACE MODE: Equinox can also be used as an "interface" – connected between the LiPo pack and a separate charger or discharger. In Interface Mode, Equinox will monitor and control how each cell in the pack is charged or discharged by the separate charger or discharger. Equinox is compatible with all ElectriFly™ brand LiPo chargers (Triton™, PolyCharge4™, etc.).

For a good overall understanding, it's strongly recommended to read through this entire manual once before attempting to use the Equinox Balancer.

SPECIFICATIONS

Compatible Input Devices: LiPo chargers and dischargers ONLY (operation based on nominal cell voltage of 3.7V per cell)
 Cell Balancing Range: 2-series to 5-series LiPo packs (7.4 – 18.5V)
 Max. Current (chg or dsch): 3 amps (3 – 6A requires special harness – see rear of manual)

Discharge Termination: auto-cut based on individual cell voltages
 2.75V per cell in Quick-Balance Mode
 3.0V per cell in Interface Mode with separate discharger
 Discharge Current: 120mA per cell (Quick-Balance Mode)
 Overload Protection: 7.5 amp auto (spade) fuse
 Physical Dimensions: 3.23 x 1.57 x 0.59 oz. [82 x 40 x 15 mm]
 Weight: 1.55 oz. [43.8 g]

SPECIAL FEATURES

- For LiPo packs with 2 to 5 cells assembled **in series (not parallel)**.
- Designed only for LiPo batteries which are wired for balancing. **NOT compatible with existing ElectriFly brand or other brand packs which have a 2-pin charge lead (and SafeCharge™ circuit).**
- Balances individual cell voltages during charge or discharge.
- Functioning alone it can quickly balance the voltage of all cells in the pack (Quick-Balance Mode).
- Used in conjunction with a separate charger or discharger it controls exactly how cells are charged or discharged so they are balanced at all times (Interface Mode).
- Includes 2S and 3S battery adapters. Adapters available separately for 4S and 5S packs (GPMM3162).
- Can handle 3 amps in Interface Mode (with separate charger or discharger). Can handle currents of 3 – 6A max. but requires optional high current adapters (GPMM3163).
- Automatically checks for poor quality cells.
- Banana plugs on input for easy connection to charger/discharger.

IMPORTANT PRECAUTIONS

- NEVER allow the input banana plugs to touch while a battery is connected to Equinox's output, as it could cause a short circuit and damage Equinox and the LiPo battery!
- NEVER attempt to use Equinox with batteries that are NOT lithium-polymer.
- NEVER allow water, moisture or foreign objects into Equinox's case.
- NEVER leave Equinox unattended while in use at ANY time.
- NEVER place Equinox, the charger/discharger, or battery on a flammable surface or near a combustible material while in use. Do not lay on a carpet, cluttered workbench, paper, plastic, vinyl, leather, wood, inside an R/C model or full sized automobile!
- Do not block the air intake holes, which could cause Equinox to overheat.
- Do not attempt to use batteries with more cells or total voltage than listed in the specifications.
- Do not attempt to charge or discharge a battery through Equinox at a current exceeding 6 amps, as permanent damage could result.
- **IMMEDIATELY disconnect Equinox from the charger/discharger and battery if Equinox or the battery becomes hot!!** Allow Equinox and battery to cool down before reconnecting.

- ALWAYS disconnect Equinox from the charger/discharger and battery when not in use.
- ALWAYS keep out of reach of children.

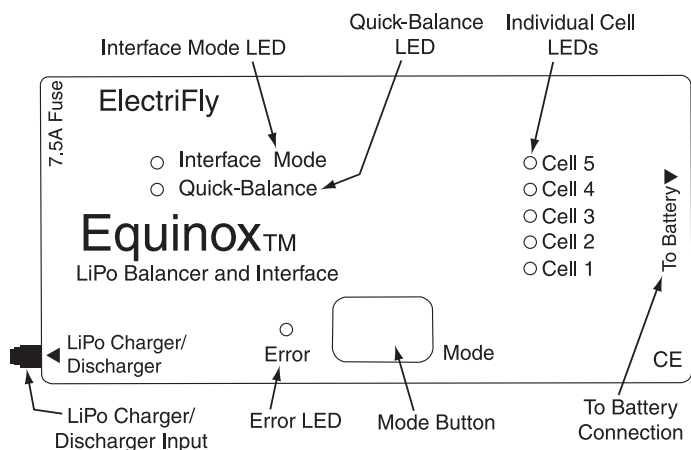
CARE & HANDLING OF LiPo BATTERIES

Never attempt to care for LiPo cells in the same way as other battery types! LiPo characteristics differ greatly 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 LiPo batteries during charge, discharge, while in use, and during storage.
- NEVER allow LiPo 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!**
- NEVER continue to charge LiPo batteries if the charger fails to recognize full charge. Swelling of LiPo cells is an indication that they are in an overcharge condition and they should be disconnected from the charger immediately.
- NEVER set the separate charger’s LiPo battery voltage to greater than the nominal rating of the LiPo battery, as such cells cannot handle overcharging in any way.
- NEVER charge LiPo batteries at currents greater than the “1C” rating of the battery (“C” equals the rated capacity of the battery).
- NEVER discharge LiPo batteries at currents which exceed the discharge current rating of the battery, as this can often cause a cell to overheat.
- * NEVER allow LiPo cells to come in contact with moisture or water at any time.
- * NEVER allow the internal electrolyte from LiPo 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!
- * ALWAYS store LiPo cells/packs in a secure location away from children.

CONTROLS & STATUS INDICATORS

Equinox contains one pushbutton to control certain operations, and eight (8) LEDs which indicate the status of certain functions.



“LiPo Charger / Discharger” Input: Used for Interface Mode only. Connect this input lead to a separate charger or discharger. Can be disconnected for use in Quick-Balance Mode.

“To Battery” connection: The LiPo battery is connected here.

“Mode” Button: Sets Equinox into Quick-Balance Mode, Interface Mode, or stops any function.

“Quick-Balance” LED: Green in color. Identifies when Equinox is in Quick-Balance Mode.

“Interface Mode” LED: Red in color. Identifies when Equinox is in Interface Mode.

“Error” LED: Control/operational errors are indicated on this green LED.

Individual cell LEDs: Five (5) amber colored LEDs. Each LED is tied to one respective cell on the output, noted as “Cell 1” to “Cell 5”. These LEDs have two functions. One function is to identify how many cells are in the LiPo pack. This “cell count” always shows before and after balancing is complete. The second function is for the LEDs to light individually while the respective cells are being balanced.

QUICK-BALANCE MODE

In Quick-Balance Mode, Equinox functions with the LiPo battery by itself. It doesn’t matter if Equinox’s input lead is – or is not connected to a separate charger or discharger. Equinox will act as though its input lead is physically **disconnected** from the separate charger or discharger. Here, Equinox will be powered entirely by the LiPo battery connected on its output.

In Quick-Balance Mode, Equinox can only discharge cells – it cannot charge cells. Equinox will apply a gentle discharge current of up to 120mA (0.12A) to unbalanced cells. Because of this low current, it may require an extended period of time in order for cells to balance (depending how far out of balance cells were beforehand). For packs having cells which are relatively well balanced, this mode typically takes very little time to complete.

To use Quick-Balance Mode, refer to the included flowchart and step-by-step instructions below:

1. Connect the LiPo to the “To Battery” connection using the appropriate adapter harness.

2. Equinox will immediately show how many cells are detected in the pack by lighting the respective cell LEDs for 2 seconds. Make sure the number of LEDs which are lit matches the number of cells in the pack. Read note at right.

3. All LEDs will turn off after the cell count is shown. No functions should be operating at this time. Equinox will be in “Idle Mode”, awaiting an input command.

Note: If the pack contains 3 cells, “CELL 1”, “CELL 2”, and “CELL 3” LEDs should light for 2 seconds, etc. If the number of LEDs lit does NOT match the number of cells in the pack, **DO NOT PROCEED**. Disconnect the pack and refer to the Troubleshooting Guide in the rear of this manual.

4. Press the button once to start Quick-Balance Mode, indicated by the respective green LED flashing. Read note at right.

5. Equinox will move from Quick-Balance Mode to "Balance Complete" when all cells are balanced, indicated by the cell LEDs flashing five times (x-x-x-x-x). In the likely event this occurred while you were looking away and looked at the Equinox again, it should be in "Finish Mode" awaiting a command. Simply press the button once and the LEDs will flash again to confirm the pack is balanced. You can manually reset Equinox back to Idle Mode by pressing the button WHILE the cell LEDs are flashing, or simply disconnect the pack.

Note: A 120mA discharge will be applied only to those cells whose voltage is out of balance (based on the cell in the pack having the lowest voltage). The amber cell LEDs may appear to flash erratically during this time which is normal (the respective cell is being balanced when it's LED is lit). To manually stop Quick-Balance Mode at any time, press and hold the button for 3 seconds to return to Idle Mode, or disconnect the pack.

3. Equinox will immediately show how many cells are detected in the pack by lighting the respective cell LEDs for 2 seconds. Make sure the number of LEDs which are lit matches the number of cells in the pack. Read note at right.

Note: If the pack contains 3 cells, "CELL 1", "CELL 2", and "CELL 3" LEDs should light for 2 seconds, etc. If the number of LEDs lit does NOT match the number of cells in the pack, DO NOT PROCEED. Disconnect the pack and refer to the Troubleshooting Guide in the rear of this manual.

4. All LEDs will turn off after the cell count is shown. No functions should be operating at this time. Equinox will be in "Idle Mode", awaiting an input command.

5. Press the button twice to set Equinox in Interface Mode, indicated by the respective red LED flashing.

Tech. notes on how Quick-Balance Mode should end (refer to table below):

- * If any cell in the pack drops below 2.75V BEFORE all cells become balanced, Equinox will automatically stop Quick-Balance Mode.
- * If all cells become within 5-30mV of each other.
- * If any cell in the pack is below 3.0V, Equinox will not allow Quick-Balance Mode to begin.

Cell 1	Cell 2	Cell 3	Equinox action
3.750V	3.750V	3.760V	Discharge cell to 3 to 3.755V, then stop all balancing
3.120V	3.130V	3.125V	Discharge cell to 2 to 3.125V, then stop all balancing
4.165V	4.155V	4.158V	Discharge cell to 1 to 4.160V, then stop all balancing
3.302V	3.305V	3.300V	Quick-Balance will not start, cell balanced within 0.005V
3.005V	3.005V	2.995V	Quick-Balance will not start, cell 3 voltage below 3.0V
2.760V	2.749V	2.760V	Quick-Balance will end, cell 3 voltage below 2.750V

INTERFACE MODE

"Interface Mode" operates quite differently than Quick-Balance Mode. In Interface Mode, Equinox works along **with** a separate charger or discharger and the LiPo. Equinox is connected **between** the charger/discharger and the LiPo – current is transferred between the charger/discharger and the LiPo *through* Equinox. Here, Equinox monitors the cell voltages and controls which cells will be charged or discharged by the separate charger/discharger to balance all cells.

The easiest way to think of Interface Mode is to pretend you are charging/discharging your LiPo with your charger or discharger like normal. BUT, first place Equinox in-line between the charger/discharger and the battery, set Equinox in Interface Mode, and then start the charger/discharger. Turn Interface Mode off after charge/discharge is complete – or at any time by pressing and holding the button for 3 seconds. Disconnecting the pack while charge/discharge is occurring should cause an error message to be displayed on the charger or discharger.

To use Interface Mode, refer to the included flowchart and step-by-step instructions that follow:

1. Connect Equinox's "LiPo Charger/ Discharger" input lead to the separate charger or discharger.
2. Connect the LiPo to Equinox's "To Battery" connection using the appropriate adapter harness.

IMPORTANT! While in Interface Mode, Equinox is NOT CAPABLE of knowing if current is actually passing through it (between the charger/discharger and the LiPo). Because of this, Equinox's amber cell LEDs will likely be active EVEN if the charger/discharger has NOT yet been started. **This is normal** (Equinox is gently discharge-balancing cells at this time). Then when the charger/discharger is started, the activity of Equinox's cell LEDs may still not appear to change. This is normal as well, but now the charger/discharger itself should give an indication that charge or discharge has begun. If so, Equinox will automatically begin to control which cells to charge/discharge to balance the cells.

6. Starting CHARGE or DISCHARGE:

- a. Set the LiPo charger or discharger to the correct voltage and currents to match the battery. Refer to the charger/discharger or battery's instruction manual for details.
- b. Start the charger/discharger. The charger/discharger's own display should indicate that it has started working with the battery (through Equinox). If not, make sure Equinox is in Interface Mode and that all connections are good. Refer to the Troubleshooting Guide at the rear of this manual for more details.
- c. Equinox will control **which cells** the charger/discharger will be balancing at all times, indicated by the activity on Equinox's amber cell LEDs.
- d. When charge/discharge is finished, it will be indicated on the **charger/discharger's own display – NOT on Equinox**. If you had been **charging** a battery, disconnect it from Equinox at this time as it is ready for use. If you had been discharging a battery you can leave it connected. Read note at right.

Note: After a charge/discharge ends, Equinox will **stay** in Interface Mode (which must be shut off manually). Because of this, Equinox will actually be quick balancing cells in the pack with a gentle discharge even though the charger/discharger is doing nothing. This is indicated by continuing activity on Equinox's amber cell LEDs. This is normal. If you had been discharging a battery, Equinox will continue trying to balance all cells in the pack until it is disconnected.

Notes for charging while in Interface Mode: For some chargers (such as Triton) the current may start at a very low level (even zero) as the charger performs its own diagnostic checks to determine if all conditions are safe to start delivering full current. This is a normal safety feature for some chargers. After a few minutes the current should gradually increase to near the full current selection (depending on the condition of the battery). Refer to the charger's own instruction manual for details.

Notes for discharging while in Interface Mode:

* To balance LiPo cells with **good accuracy**, Equinox will interrupt the external discharger when any cell drops to approximately 3.0V. The discharger **MIGHT SHOW AN "OPEN CIRCUIT ERROR"**, but this could be **NORMAL** and no cause for alarm. Many dischargers allow cells to be discharged down to 2.7V or 2.8V per cell. Equinox will stop discharge **BEFORE** such dischargers (at 3.0V). The discharger will think an error occurred, but actually Equinox stopped discharge on purpose.

* Equinox will not allow a discharger to begin discharge if any cell in the pack is below 3.0V. The red "Interface Mode" LED will stay on, and the cell LEDs might flicker (indicating that Equinox is trying to gently balance all cells), but the discharger should give an error notice.

* If the voltage of any cell is below 2.70V, Equinox will automatically go to Finish Mode.

ERROR LED

All errors are displayed on Equinox's green "Error" LED next to the pushbutton. **In the likely event** that Equinox went to error mode and you did not see the error code being displayed, press the button once and Equinox will show the error code again. See the included flowchart for how to use and exit error mode.

ADDITIONAL ADAPTERS

Adapters are included for connecting 2S (7.4V) packs and 3S (11.1V) packs to Equinox. Adapters are available separately to connect 4S (14.8V) and 5S (18.5V) packs. Adapters can be found at your local retailers.

If you wish to charge/discharge through Equinox at currents between 3-6 AMPS (not exceeding 6A), it will be necessary to purchase high current 6A adapters. **Note:** Charging at more than 3A is recommended **ONLY** for very large, high capacity packs. **ALWAYS** follow the maximum charge current recommendations from your battery supplier. **NEVER** charge LiPo packs at currents exceeding their maximum charge current rating.

GPMM3161	Replacement 3A Adapter Set 2S,3S
GPMM3162	3 Amp Adapter Set 4S,5S
GPMM3163	6 Amp Adapters 2S,3S,4S,5S

TROUBLESHOOTING GUIDE

Refer to the list of possible problems/errors which occur while using Equinox:

PROBLEM: Will not lock in Quick-Balance Mode.

- (1) All cells already balanced.
- (2) One cell in the pack is of too low a voltage.

PROBLEM: Cell LEDs do not show the correct number of cells in the battery.

- (1) Bad cell in the pack.
- (2) Incorrect adapter harness used.
- (3) Bad connector on battery, adapter or Equinox.
- (4) Cell voltage too low for Equinox to detect.

PROBLEM: No LEDs function.

- (1) Fuse blown.
- (2) Input leads were shorted, blowing fuse and possibly damaging internal circuitry.
- (3) Input leads connected backwards causing fuse to blow, possibly damaging internal circuitry.

- (4) Bad connection on input or output.
- (5) More than 6 amps were sent through Equinox, possibly damaging the internal circuitry. Contact Hobby Services.

PROBLEM: Can't charge through Equinox.

- (1) Equinox not set in Interface Mode before starting charge.
- (2) Bad connection on input or output.
- (3) Charger set to incorrect voltage, or identifies problem with battery and won't allow itself to start delivering charge.
- (4) Possible damage, contact Hobby Services.

PROBLEM: Batt voltage low after charging in Interface Mode.

- (1) Charger set to incorrect voltage.
- (2) Cell in LiPo pack bad, or at too low a voltage for Equinox to recognize.

PROBLEM: Can't discharge through Equinox while in Interface Mode.

- (1) Equinox not set in Interface Mode before starting discharge.
- (2) Bad connection on input or output.
- (3) Discharger set to incorrect voltage, or identifies problem with battery and won't allow itself to start discharging.
- (4) Possible damage, contact Hobby Services.

1-YEAR LIMITED WARRANTY – *USA & CANADA ONLY

ElectriFly warrants this product to be free from defects in materials and workmanship for a period of one (1) year from the date of purchase. During that period, ElectriFly 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, ElectriFly 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 ElectriFly product, warranty or non-warranty, send it post-paid and insured to:

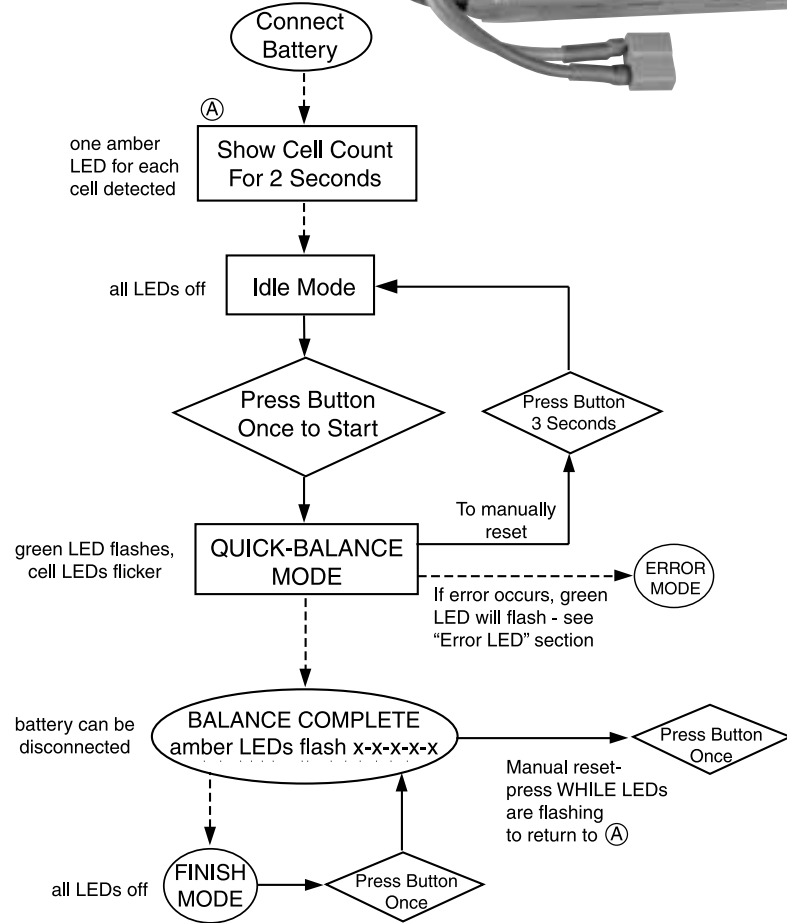
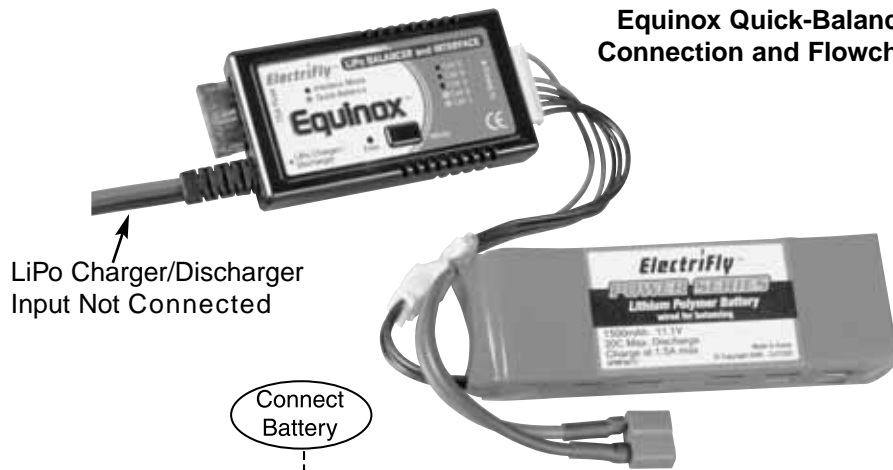
HOBBY SERVICES
3002 N. Apollo Drive, Suite 1
Champaign, IL 61822
(217) 398-0007

www.hobbyservices@hobbico.com

*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.



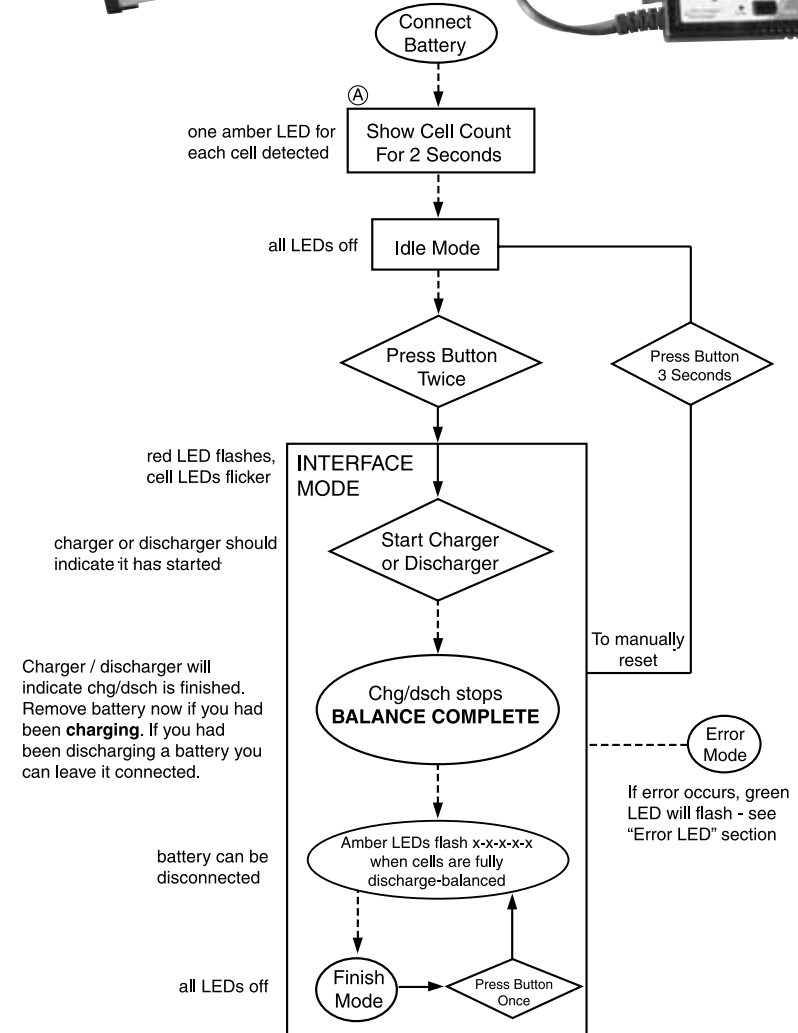
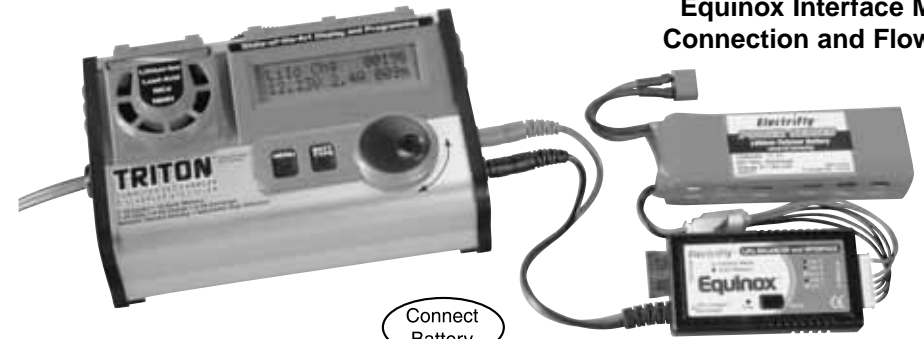
Equinox Quick-Balance Connection and Flowchart



Quick-Balance Mode

----- Automatic Equinox Movements
 _____ Manual Commands

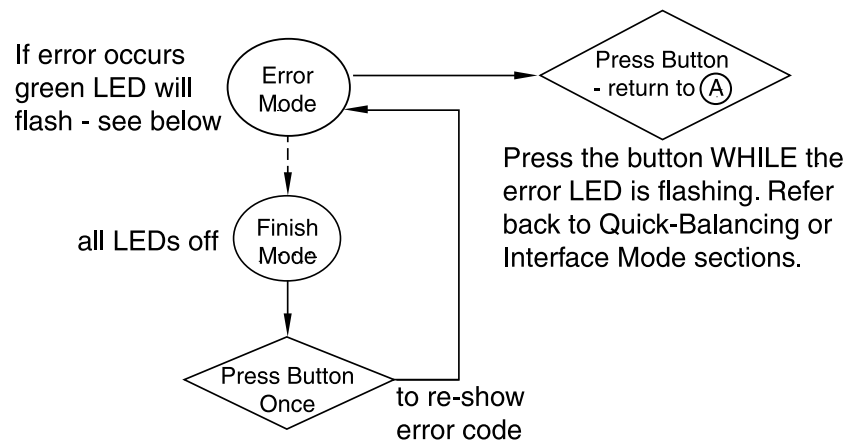
Equinox Interface Mode Connection and Flowchart



Interface Mode

----- Automatic Equinox Movements
 _____ Manual Commands

Equinox Error Mode Flowchart



LED State

One flash (x x x)
 Two flashes (xx xx xx)
 Three flashes (xxx xxx xxx)

Function

Batt volts too high - over 4.3V per cell
 Batt volts too low - under 2V per cell
 Connection error

Error Mode

----- Automatic Equinox Movements
 _____ Manual Commands