Bump Controller

User's Guide

Firmware v4.0 and later

Updated: 7/17/2017

Contents

About BUMP Technology

BUMP is an exclusive new Revolectrix concept for Battery Management. The BUMP Controller utilizes Near Field Communication (NFC) Technology to communicate with any battery equipped with a BUMP Compliant Tag, or “BumpTag”. The BumpTags will be pre-installed and pre-configured on most Revolectrix batteries in the near future. BumpTags will also be available for sale separately, so a customer can configure them for use with any battery of his choosing using the BUMP Controller. Once a tag is programmed for any given battery, a simple “BUMP” of the battery on the BUMP Controller configures any Revolectrix PowerLab Battery Workstation to the ideal settings for performing all battery management tasks. The BUMP Controller can independently address up to 4 PowerLab units (or channels of the Dual PowerLab 8) – each PowerLab connected is able to operate completely independent of the others.

About the BUMP Controller

FEATURES:

• Simple, intuitive color touchscreen user interface
• Complete charger setup with a simple "bump" of the battery ... just bump, connect, and press Start
• No need to configure or select presets although native PowerLab operation is still possible for non-BumpTag equipped batteries
• Optimizes charger settings for each individual battery, speeds up the charging setup process
• Reduces accidental mistakes that could lead to expensive (and potentially dangerous) battery damage
• Automatic calculation for parallel charging, even for different battery capacities and C-ratings
• Each BumpTag contains the full factory ratings of the battery (write-once), as well as user preferences and settings that can be changed at any time
• Each BumpTag contains a unique ID which enables automatic battery history and performance tracking – battery cycle history is automatically cached and uploaded to the mobile app whenever it connects via Bluetooth
• Works with all existing Revolectrix Cellpro PowerLab 6, PowerLab 8v2, and Dual PowerLab (8x2) Battery Workstations
• Connect up to 4 PowerLab Workstations to a single BumpController (any combination of PL models)
• Supported Chemistries: LiPo (including LiHV), LiFe, Li-Ion, NiMH, NiCd, and Pb
• Supported Operations: Accurate Charge, Normal Charge, Fastest Charge, Discharge, Storage Charge, Analyze Cycle
• Analyze Cycle allows battery performance characteristics (Fuel Table, actual capacity, IR, etc.)

to be stored back to the BumpTag for accurate fuel level and cycle time estimates
• The Bump Controller can serve as a remotely-mounted user interface for the PowerLab Battery Workstations, allowing the chargers to be completely hidden inside a charging case or beneath charging tables/benches. This frees up valuable workspace for batteries, connectors, adapters, parallel adapters, etc.

HARDWARE CAPABILITIES:

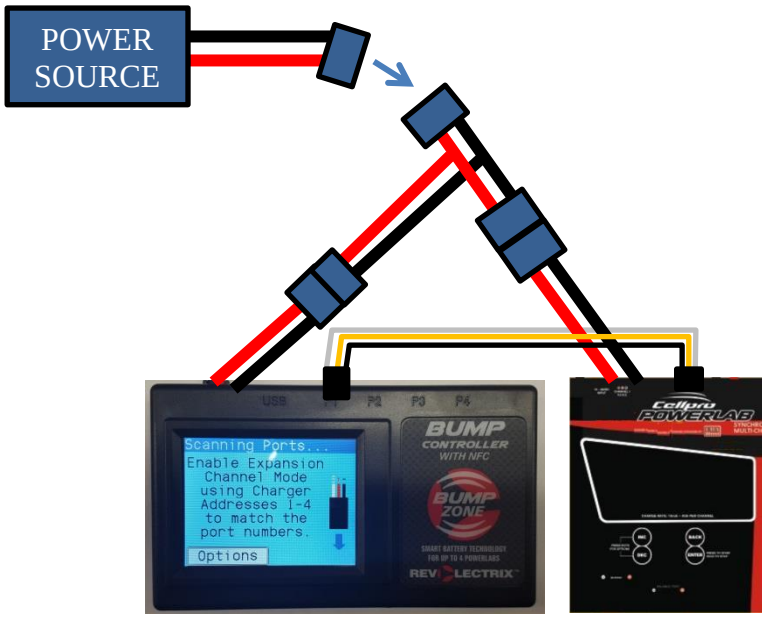
• High-brightness, 2.8" QVGA TFT LCD with resistive touchscreen
• Integrated BUMP wireless interface for configuring and reading BumpTags on batteries
• Integrated Bluetooth 4.0/LE support for wireless real-time monitoring, control, and firmware upgrades (Android, Apple iOS, and Windows mobile devices)
• Integrated USB port for direct connection to Windows PC for firmware updates, as well as powering/charging mobile devices
• Four (4) 3-wire serial interfaces for connection to PowerLab Workstations (uses standard male-to-male servo connectors/extensions)
• Powerful 32-bit ARM Cortex-M3 main processor, plus dedicated co-processors for Bluetooth and NFC
• Wide (10v-52v) input voltage range matches PowerLab Workstations for simple power setup (use standard EC-5 Y-cables to power the Bump Controller and PowerLabs simultaneously)

Cabling and Installation

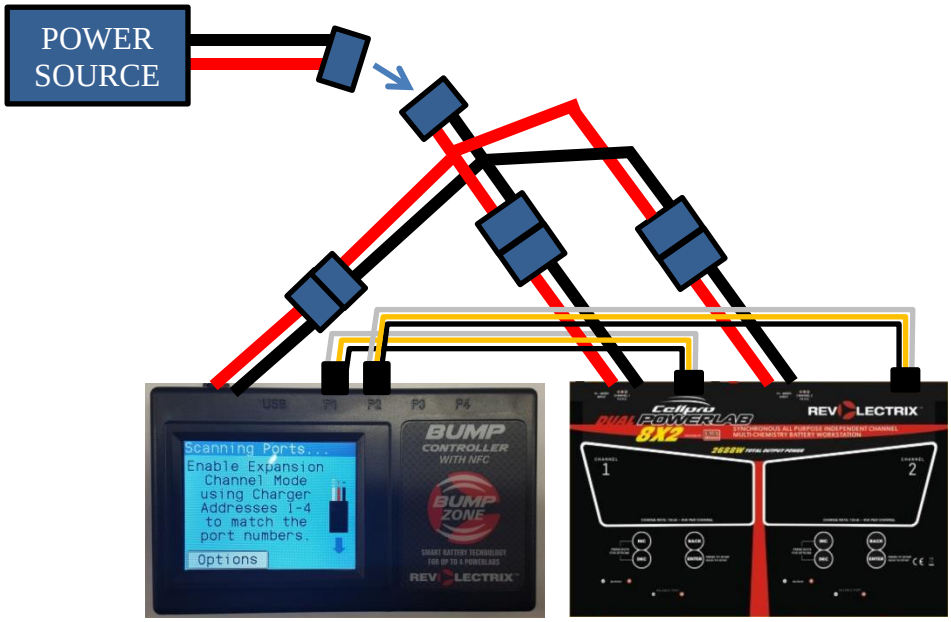
CAUTION: ALWAYS INTERCONNECT THE BUMP CONTROLLER AND POWERLAB POWER CONNECTIONS FIRST, BEFORE APPLYING POWER TO ANY OF THEM

Failure to comply with the above may result in damage to the Bump Controller and/or the connected PowerLabs which would not be covered under warranty.

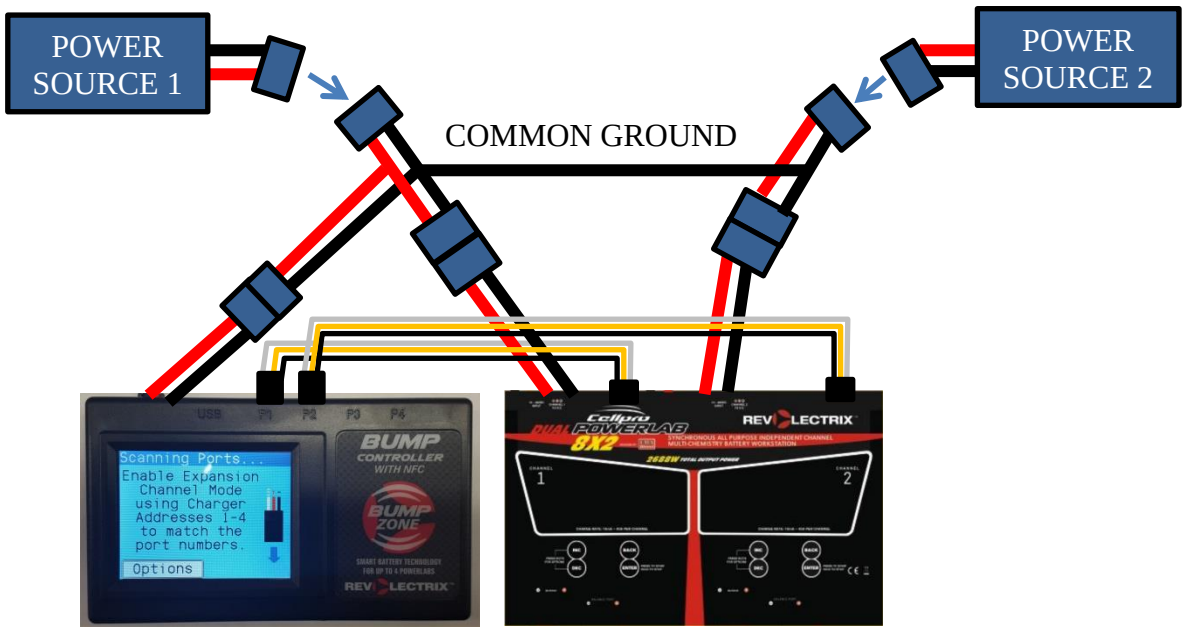
SINGLE POWERLAB, SINGLE POWER SOURCE



MULTIPLE POWERLABS, SINGLE POWER SOURCE



MULTIPLE POWERLABS, MULTIPLE POWER SOURCES



- The BUMP Controller **must always** have a common power ground (negative) connection to all connected PowerLab Battery Workstations. If the common ground connection between BUMP Controller and PowerLabs does not exist at the instant when the positive power wire is connected, excessive current may flow through the PowerLab port(s) and damage the BUMP Controller and/or PowerLab(s).
- Since the positive pin of the EC-5 input power connector may touch a split-second before the negative pin, this ground-fault problem can occur even when just plugging in the EC-5 connection to the BUMP Controller.
- To avoid this risk, make sure you always interconnect the BUMP Controller and PowerLab power cables first (typically using Y-cables), then apply power to that common cable - this ensures the BUMP Controller and PowerLabs always have a common ground connection at the instant the positive connection is made and current starts flowing through the system.
- The BUMP Controller and its connected PowerLab(s) **can** use separate power supplies, however, all of those power supplies must share a common ground connection which is capable of handling high current loads, and that ground connection must remain connected as long as any one of the power supplies is active. It's okay to turn on one power supply (and PowerLab) at a time, as long as all of the ground connections remain interconnected.
- Finally, whenever possible, and at least the first time you connect up system components, it is also recommended that the BUMP Controller and any/all PowerLabs are powered up and running prior to connecting the PL ports (labeled P1-P4 on the back of the BUMP Controller) to the PowerLab data ports (on the back of each PowerLab) using the supplied JR style male-to-male extensions. After the BUMP Controller boots up, you will then see a graphic on the BUMP Controller display which illustrates the proper polarity for these interface cables when plugging them into the BUMP Controller PL ports. Always ensure you make PL port interconnections at the BUMP Controller using proper polarity (black/ground wire to the right when viewed from above). Proper polarity for each PowerLab data port side of the cable (listed as “TO PC”) is illustrated on every PowerLab top panel label and varies from model-to-model.

Configuring PowerLabs for BUMP Control

The BUMP Controller uses the Expansion Channel Mode interface for controlling the PowerLab chargers. By default, all PowerLabs are configured to act as the MASTER, so in order for the BUMP to be MASTER and control them, you must change this default setting in your PowerLabs.

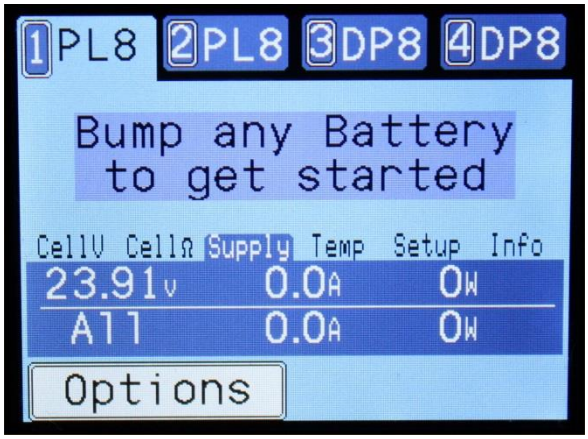
To change the Expansion Channel Address of the PowerLab, perform the following steps:

1. Press INC+DEC to display the Options menu (Choose TASK?).
2. Press INC or DEC until you see Charger Options, then press ENTER.
3. In the Charger Address? screen, select EXPANSION CH. n , where 'n' is equal to the BUMP Controller port number where you will connect this PowerLab, then press ENTER.
4. Press and hold BACK to exit options.

NOTE: The Expansion Channel Address of the PowerLab must match the number of the BUMP Controller port to which it is attached. This improves safety by ensuring PowerLabs are not accidentally connected to the wrong BUMP Controller port.

Using the BUMP Controller

Status Screen - Charger Tabs



The main Status Screen displays the current status of all connected PowerLabs. The tab text and background color will indicate the current charger state.

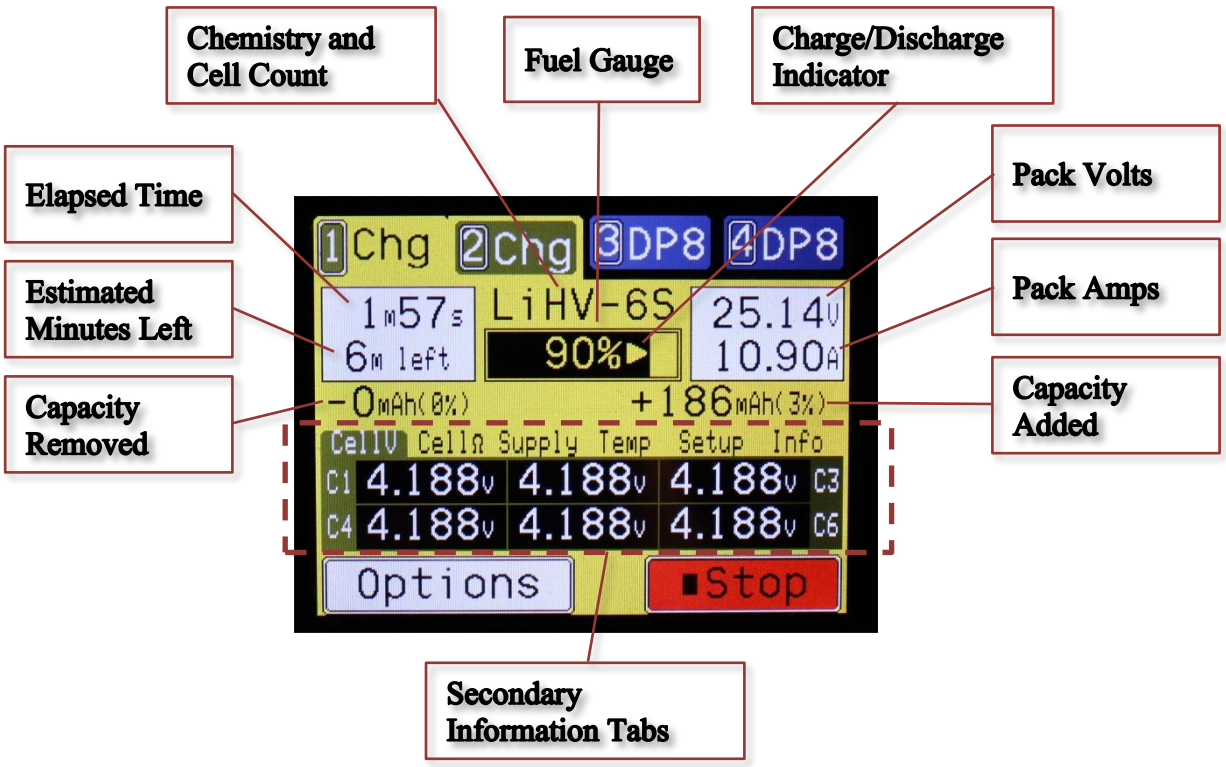
Selecting Options will open the BUMP Controller Options screen (see Options section).

Touching the charger tabs at the top of the screen will change the current selected charger.

NOTE: When you bump a BumpTag, that battery will be added to the setup list for the current selected PowerLab, so select the PowerLab you want to use first, then bump the battery you would like to charge.

If more than one charger is currently in an active state (charging, discharging, etc.), touching the selected tab a second time will switch to an Overview screen. In this mode, only the active chargers are displayed and the charger status information consumes the entire display. From this screen, touching any charger will select that charger and return to the main Status screen.

Status Screen - Primary Information



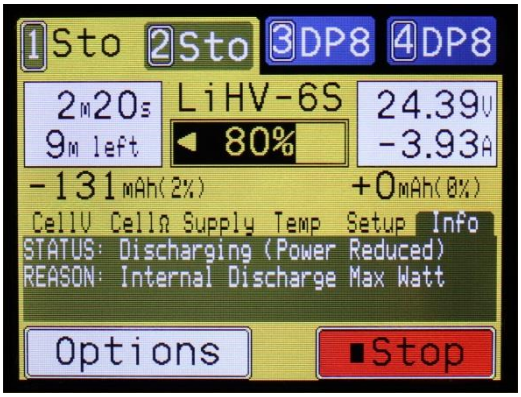
Status Screen – Secondary Information Tabs

The Information tabs are located near the center of the Status Screen and can be touched to change the information displayed on the lower half of the Status screen. The selected Information tab will also be automatically changed when the charger changes state – for example, the idle charger screen will switch to the Supply tab to show input power status since there is not much else useful to display in that state.

NOTE: Some Information tabs, such as the Setup tab, will contain multiple pages of information – touch the selected tab again to toggle through the available information pages.

Pack (Info)

The Pack tab shows other state information which varies depending on the current charger state. This view is helpful to understand why the charger might be limiting power or performing in any way other than expected.



NOTE: In the latest firmware, the "Info" tab has been renamed to the "Pack" tab and moved to the far left. The behavior remains the same.

Cell Volts

The Cell Volts tab displays the current measured cell voltages. This information is only available when the charger is in an active state with balance leads connected. Cell voltages which are unusually higher or lower than average will be highlighted in red or yellow.

Figure 1 - Cell Voltages

Cell IR

The Cell Internal Resistance tab displays the current measured IR values. This information is only available when the charger is charging and balance lead is connected. Cells with significantly higher IR than average will be highlighted in red or yellow.

Figure 2 - Cell Internal Resistance (IR)

Supply

The Supply tab displays the voltage, amperage, and wattage being supplied to the selected charger. The second line of the display shows the total combined input amperage and wattage for all chargers currently connected to the BUMP Controller which is very useful for monitoring the overall load on your power source.

NOTE: When Regenerative Discharge is used, the amperage and wattage values will be denoted with a minus sign to indicate that power is flowing out of the charger and back into the power source, and the totals values will properly reflect what is actually flowing into or out of the power source.

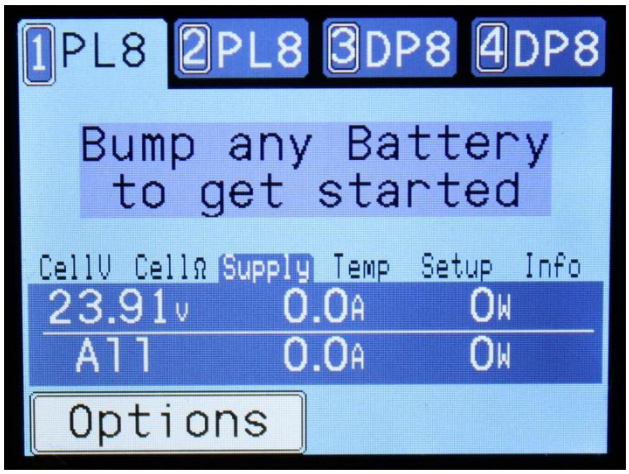


Figure 3 - Power Supply Information

Temp

The Temp tab displays the reported internal temperature of the current selected charger.

Figure 3 - Temperature Readings

Setup

The Setup tab shows the actual configured values that have been sent to the PowerLab to perform. This is essentially a “dynamic preset” which is calculated from the bumped battery (or batteries in the case of a parallel charge).

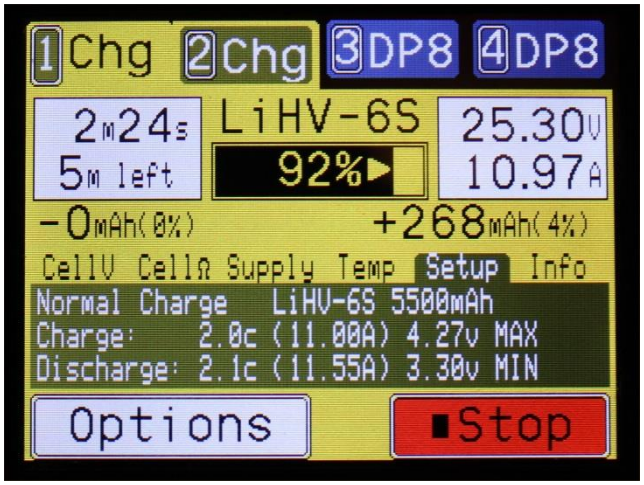


Figure 4 - Charger Setup

BUMP Controller Operation

The Bump Controller supports several methods of providing charger setup for battery management. The primary method is installing and configuring BumpTags for each battery pack, but that might not always be feasible or desirable.

The table below gives a comparison of setup methods and should help to determine when it makes sense to use each.

	BumpTag (Attached to Battery)	**BumpTag (Shared by multiple batteries of same type)**	**Battery Preset**	**Manual Operation**
Per-pack identification	**Yes**	No	No	No
Battery history tracking	**Yes**	No, history can be uploaded, but all packs of that type are combined	No	No
Automatic "bump" setup	**Yes**	**Yes**	No, must select Preset from list	No
Portable across multiple Bump Controllers / chargers	**Yes, all setup stored on BumpTag**	**Yes, all setup stored on BumpTag**	No, configured and stored on Bump Controller	No, nothing is stored for Manual setups

Typically, the BumpTag is attached directly to the battery pack and serves to uniquely identify that pack and to perform automatic charger setup when "bumping" it against the Bump Controller. If individual battery history tracking is needed, then use separate BumpTags for each pack. Sometimes you may want to use a single BumpTag for several batteries of the same type – this will not allow you to track battery history per-pack, but can be useful in situations where history tracking is not critical – see **BumpTag Installation** for more ideas for BumpTag placement and usage.

Battery Presets can be used in situations where the features of the BumpTags (per-pack or shared) are not required. In many cases, a Battery Preset will serve the same purpose as a shared BumpTag, and the decision comes down to which one is more convenient – to have a shared BumpTag handy (on a keychain, battery container, etc.), or to manually select a Battery Preset from your list of presets configured in the Bump Controller. If multiple Bump Controllers are used, then a shared BumpTag may be more convenient since there's no need to configure/manage the Battery Preset across multiple Bump Controllers – the BumpTag makes it portable.

Manual Operation is used for one-off operations for packs that you don't normally maintain – possibly someone else's pack that needs charging in a pinch. The Manual Operation screen accepts a minimal set of parameters needed to setup the charger – similar to many entry-level chargers.

Operation – Using BumpTags

Starting a battery operation using BumpTags is as simple as:

1. Select the charger you want to use by touching the corresponding charger tab
2. Bump the battery on the “BUMP Zone” of the BUMP Controller
3. Press the operation button at the bottom of the display to change to the desired operation, if needed
4. Connect the battery
5. Press ‘Go’

When you bump a BumpTag, all of the battery ratings and settings are read by the BUMP Controller and the following Battery Details screen is displayed.

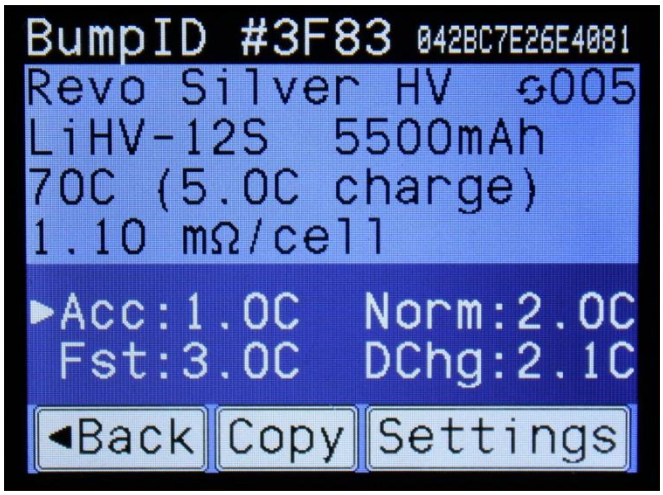


Figure 5 - Battery Details Screen

The top line shows the unique identifier for this particular BumpTag. The long 14-digit hexadecimal number is the complete ID, which is guaranteed to be unique. The short 4-digit hexadecimal number is a “hash” of the complete ID – this value is most likely unique across all of your batteries (but not guaranteed) and serves as a more convenient identifier that can be more easily recognized and written on your battery, if desired. This is also the identifier that is shown on the Bump Setup screen, as well as any other place in the user interface where an ID is needed (including in the mobile apps).

Factory Ratings (write-once) for the battery are displayed below the ID line, and the user Settings (read/write) are displayed below Ratings. The arrow indicates which operation has been set as the default for this BumpTag – in the example above it will default to an Accurate Charge operation any time this BumpTag is used.

The value in the upper-right corner of the screen (with the circular arrows) is the charge counter. This value tracks how many times this particular battery has been charged. The charge counter is stored in the BumpTag itself and will only be incremented if 10% or more of the rated capacity has been added to the battery. So if you need to immediately stop a charge for any reason (possibly to add another battery in a parallel charge), the charge counter will not get falsely incremented.

NOTE: The charge counter value on the BumpTag isn't actually incremented when it is bumped. Once the 10% capacity threshold is reached, the Bump Controller caches (in non-volatile memory) the unique ID of that battery (or batteries) to ensure the charge counter gets properly incremented on the next bump. This method works properly even when the battery is charged on multiple Bump Controllers.

The Copy and Settings buttons allow you to create a copy of this BumpTag or change its settings, respectively. See the "BumpTag Configuration" section for more information.

When you remove the BumpTag from the BUMP Controller, the battery details screen closes and the idle Status screen will now display the current charger setup. This display will contain a list of batteries and quantities.

Figure 6 - BUMP Charger Setup

The top line of the charger setup information gives a summary of how the PowerLab will get configured based on the batteries in the setup list. The chemistry and cell count must obviously be the same for all batteries in the list (i.e., all batteries in the parallel charge), so that information is only displayed once at the top of the list. Each different type of battery is then listed as a separate item in the list. Bumping multiple batteries with the exact same Ratings will increment the battery count (i.e., "x1P). Bumping a battery with different Ratings will cause a second battery item to appear in the list which corresponds to that new battery type.

NOTE: Bumping a battery which is not compatible with the existing setup for parallel charging will cause a warning screen to be shown and the previous setup to be replaced with the new battery.

Touching the battery count button ("x1P") lets you directly change the number of batteries of that type. This is useful for times when you're not concerned about tracking individual battery charge counts or history and want a quick easy way to parallel charge multiple batteries of the same type without having to bump every one of . You can bump a single BumpTag, touch the battery count button, and select 1 to 8 batteries of that same type.

Touching the battery item itself will open a popup action menu which provides more actions that can be taken on that particular battery. The following operations can be selected :

- Clear - removes this particular battery from the setup list

- Add/Drop Favs - adds or removes this battery from Favorites (see “Favorites” for details)
- Details – opens the battery details screen to show more information and operations

Pressing the ‘Go’ button will start the selected operation using the current setup.

Pressing the operation select button will pop-up an operation list where you can select a different charger operation.

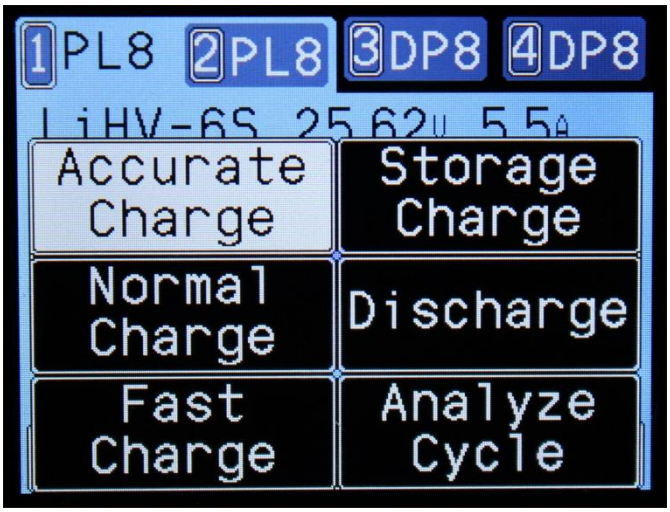


Figure 7 - Select Operation Popup

Pressing the Monitor button will toggle the Monitor operation on and off. Monitor activates the charge circuitry in the PowerLab and allows you to see the actual pack and cell voltages. The BUMP Controller also uses this information to provide more precise operation time estimates.

Accurate, Normal, and Fast Charge

These standard charge operations will perform a charge with the charge rate specified in the corresponding user setting. The max cell voltage setting will determine the termination voltage.
For Lithium chemistries, termination current is set to C/20, C/10, and C/5 for Accurate, Normal, and Fast Charge, respectively. So Accurate Charge will have the longest balance cycle at the end, but will also charge the battery to maximum capacity. Fast Charge will perform a much shorter balance cycle and terminate more quickly, but with slightly less capacity. Normal Charge is somewhere in the middle. Each of the charge currents are individually configurable in BUMPTag settings.

TIP: During any balanced charge cycle, the BUMP Controller will monitor the cell internal resistance measurements – if they exceed the warning threshold, a warning will be displayed at the end of the charge cycle.

To change the Internal Resistance warning threshold, go to Options->Analyze Warnings (default is 200% of Rated IR).

Storage Charge

The Storage Charge operation will take the battery pack to the hard-coded storage voltage based on its chemistry. The Normal Charge or Discharge settings in the BUMPTag will be used to perform the storage charge, depending on the level of charge in the battery.

NOTE: Constant Voltage mode is enabled on Storage, so the charge/discharge currents will decrease slowly as it approaches the target storage voltage.

Discharge

Discharge will drain the battery to the specified minimum cell voltage setting, using the specified Discharge Rate setting. CC/CV mode is not enabled, so the discharge will terminate as soon as the target discharge voltage is reached.

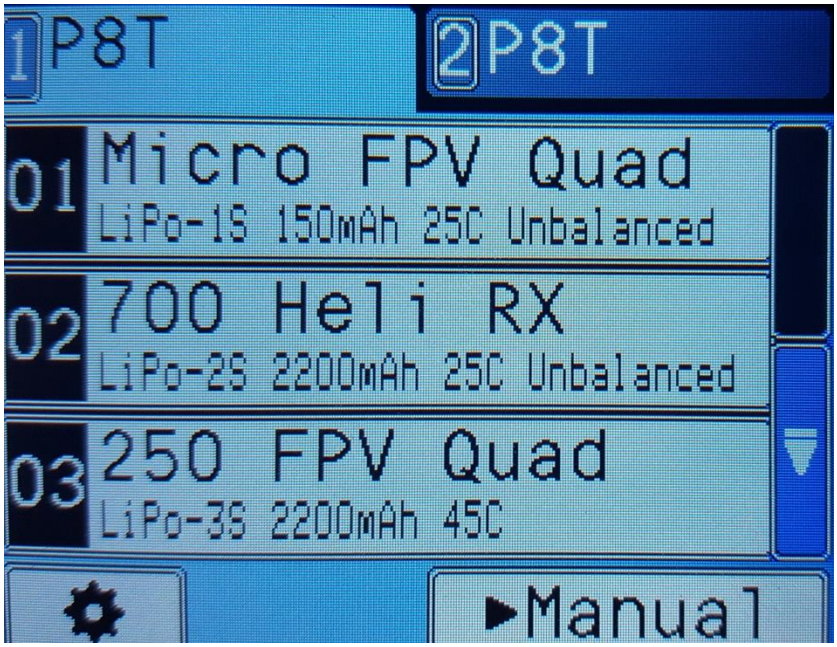
Analyze Cycle

Analyze Cycle performs a charge/discharge/charge operation (same as the PowerLab itself performs on a Cycle). During this cycle, the BUMP Controller gathers analysis data which can then be written back to the BUMPTag after it complete. This data includes average cell IR, actual measured capacity (measured on discharge), and the fuel table (measured on final charge). Writing this data back to the BUMPTag will improve the BUMPController automatic analysis, as well as the cycle time estimates displayed before and during a charge.

TIP: During an Anaylze Cycle, the BUMP Controller will compare the actual measured capacity of the battery against its rated capacity – if they exceed the warning threshold, a warning will be displayed at the end of the charge cycle. To change the warning threshold value, go to Options->Analyze Warnings (default is 80% of factory rated capacity)

Operation – Using Battery Presets

Battery Presets are used to store battery management details for a specific type of battery. The settings and parameters for a Battery Preset are nearly identical to those of a BumpTag, but of course a BumpTag is intended to identify a specific battery, not just a type of battery. Since a Battery Preset does not identify a specific battery pack, the Bump Controller does not cache and upload Battery History data to the CCS app – only BumpTags allow you to track battery history.



The Battery Presets feature can be enabled in Settings by checking the “Show Battery Presets when Idle” checkbox. If Battery Presets are disabled, the idle screen will simply show a “Bump any Battery” message, along with the normal tabbed user interface.

If Battery Presets are enabled, the idle screen will show a scrollable list of 99 Battery Presets.

Touching an empty Preset will launch the setup wizard for configuring that Preset. The flow of the setup wizard is nearly identical to BumpTag setup, so those details will not be duplicated here – refer to **BumpTag Configuration** for more details.

Touching a non-empty (already configured) Preset will select that Preset as the current active setup for charging.

To edit an existing Preset, first select it from the list, then touch it and select Settings. Step through the settings screens, modifying any settings as needed, then continue to the end where the Preset will be saved and updated.

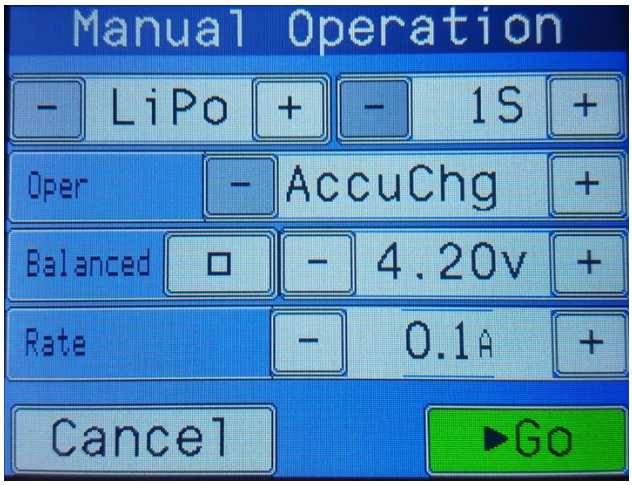
Operation – Using Manual Operation

The BUMP Controller also supports a Manual Operation feature which allows you to perform operations on batteries without the use of a BumpTag. The Manual Operation mode has a more limited feature set than BumpTag operation and is not intended to be used as the primary method of charging. The Manual operation button is available on the main charger status screen whenever the charger is idle and no BumpTag setup has been performed.

Manual Operation is intended to be used for one-off charging tasks where it isn't practical to setup or use a BumpTag – for example, charging someone else's batteries, or charging seldom-used batteries.

TIP: For small batteries where a BumpTag cannot be physically attached, we recommend applying a single BumpTag to the bottom of the container in which they are stored – that way, the container itself can be bumped to perform setup.

See the BumpTag Installation section for more information.

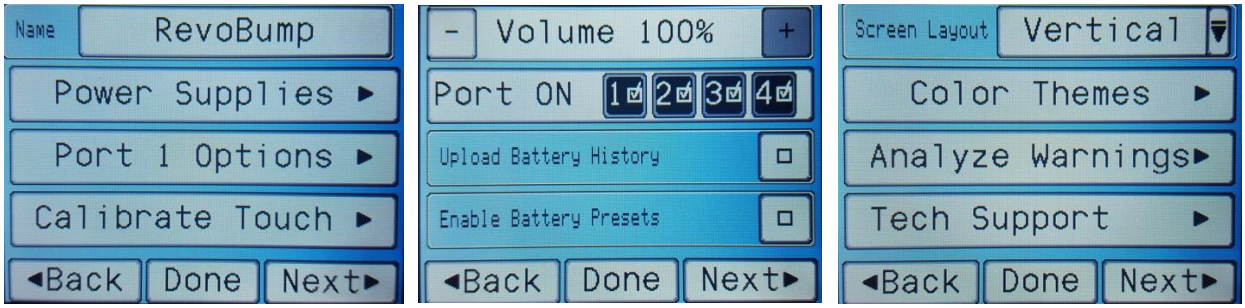


The Manual Operation allows you to specify the following operating parameters:

- Chemistry (default is LiPo)
- Cell Count (default is 1S)
- Operation (default is Accurate Charge)
- Cell Termination Voltage (default is operation and chemistry-specific)
- Operation Rate (default is 100mA)
- Balanced (default is enabled for LiXX packs with more than 1 cell)

Settings

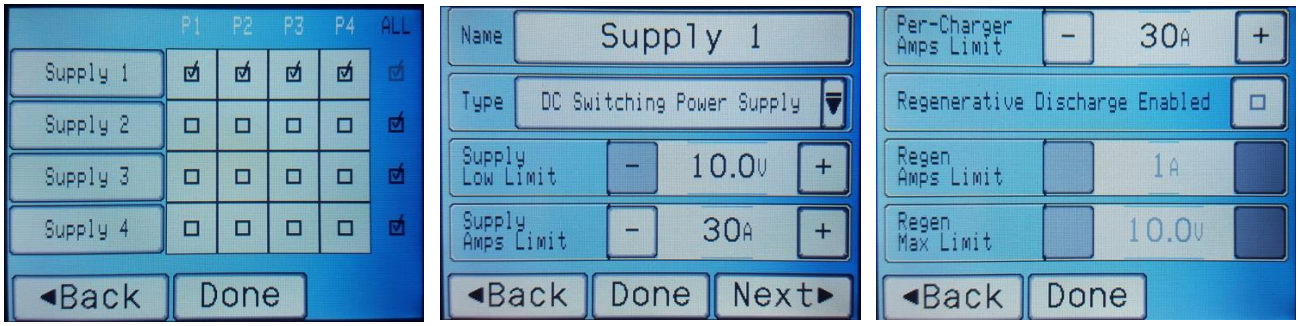
The BUMP Controller Settings menu allows you to change preferences for the BUMP Controller itself. The Settings menu is accessed by pressing the Settings button which is visible any time an idle charger is selected (or when no chargers are connected).



The following items are accessible from the Settings menu:

- Name: Specify the name of this controller – shows in CCS mobile app
- Power Supplies: Configure specifications for the power supplies used by your chargers
- Port Options: Configure options which are specific to the selected charger port
- Calibrate Touch: Launches the touchscreen calibration wizard
- Volume: Sets the speaker volume level
- Ports ON: Enables/disables individual PowerLab ports on the Bump Controller
- Upload Battery History: Enables caching and upload of battery history to the CCS mobile app
- Enable Battery Presets: Enables the Battery Presets feature – Presets list is shown in idle screen
- Screen Layout: Change user interface layout to match your charger layout
- Color Themes: Switch between different preset themes or define your own color theme
- Analyze Warnings: Adjust warning threshold for automatic analysis
- Tech Support: Show technical data used for debugging connectivity problems
- Clear History Cache: Deletes any cached battery history on this device
- Factory Restore: Resets all Bump Controller settings to their factory defaults

Settings – Power Supply Configuration



To ensure that your chargers do not overload or damage your DC power supply, the Bump Controller needs to know the types and power output capabilities of your power supply (or supplies if you have multiple).

When the Bump Controller first boots up (or after a Factory Restore which clears all settings), it will prompt you to configure your power supply settings before proceeding. At this point, select the settings icon (gear) and walk thru the setup for your power supply.

The Bump Controller stores profiles for up to 4 different power supplies and allows each charger port to be associated to one of those 4 power supplies. This allows the Bump Controller to know which chargers are connected to which power supplies and to properly manage the amount of power being drawn by each charger to ensure it does not overload the corresponding power supply.

By default, all charger ports will be associated to “Supply 1”, but this can be changed under Power Supplies settings page to accommodate multiple power supplies. The “Supply 1” name can (and should) be renamed to something that makes it easily recognized. For example, if using the standard Revolectrix desktop power supply, name it “Revo 55A Supply” or something similar. The ability to configure multiple power supplies serves two primary purposes:

A) Allowing multiple power supplies to be used to meet the power demands of multiple chargers
B) Ability to switch between different power supplies based on charging conditions – for example, benchtop power supply versus portable power supply or battery

TIP: The name of the current selected power supply is shown by default in the idle screen, so you can see which power supply is selected – this is particularly useful if you use different power supplies and regularly switch between them.

Basic Setup: Single Power Supply for all connected PowerLabs

The most basic, and most common, configuration is where a single DC switching power supply is used to power all chargers connected to the Bump Controller (as well as the Bump Controller itself). The following steps will get your Bump Controller up and running quickly for this configuration:

1. In Settings, select Power Supplies, and confirm that each charger port is associated to the first power supply profile, named “Supply 1” (default).
2. Touch the “Supply 1” button to configure settings for that power supply.
   a. Change the default “Supply 1” name to describe the actual type of power supply used
   b. Change the Supply Low Limit low voltage cutoff to be appropriate for your power supply
   c. Change the Supply Amps Limit to the max output rating of the power supply
   d. Select Done to save the changes and apply

BumpTag Installation

BumpTags are small enough and light enough to offer a great deal of flexibility in installation. This section provides some guidelines for attaching the BumpTags to your batteries and some alternative approaches for situations where direct attachment may not be feasible or desirable.

1. **BumpTag attached directly to the battery**
   This is the ideal scenario since the BumpTag always stays with the battery and each battery has its own unique ID for purposes of logging history and performance analysis. The most convenient location on the battery is normally the end opposite the power/charge leads. This location makes it easy to align the BumpTag to the Bump Zone area of the BUMP Controller and typically doesn't interfere with installation of the battery.
   For smaller batteries (where the end of the battery is less than the 25mm diameter of the BumpTag), the BumpTags can also be applied to the side of the battery, assuming it doesn't interfere with installation. In this case, we recommend installing on the back side of the battery, closest to the end opposite the power/charge leads – having it in a consistent location, near the end of the battery makes it faster and easier to align with the Bump Zone during use.
   BumpTags can be attached pretty much anywhere as long as they aren't bent at sharp angles or installed in such a way that they are repeatedly bent back and forth during use – either of those situations will result in the internal antenna being broken and the BumpTag will stop functioning.
   Wrapping the BumpTag around the gradual curve of the power/charge leads end of a Lithium battery will normally work pretty well for accommodating batteries that are slightly thinner than the 25mm diameter of the BumpTag, although thick power/charge leads can be difficult to bend out of the way when bumping the battery, so it may not always be acceptable.

   TIP: Clear packing tape or heat shrink can be used over the top of the BumpTag to keep it secured in situations where the edge of the BumpTag is vulnerable to peeling during use.

2. **BumpTag attached to bottom of a small battery container**
   This approach works well for micro-size batteries. Not only are micro-size batteries too small to directly attach a BumpTag, but they may also be so inexpensive that the cost of a BumpTag per battery may be excessive.
   If possible, use a container roughly the size of the Bump Zone to simplify alignment.
   For larger containers, place BumpTags under the bottom of one or more corners in such a way that that the BumpTag is aligned with the Bump Zone when the container corner is aligned with the Bump Controller.
   Clear containers (like servo boxes) are ideal because you can see the location of the BumpTag from the top side of the container to simplify alignment with the Bump Zone.

3. **BumpTag attached to keychain, card, or other small object**
   This approach works well for larger, fixed batteries or batteries permanently installed inside of models. Attached a BumpTag to a small non-metallic object, like a plastic keychain ring, and write a description on the opposite side. Leave it inside your charge case and bump it whenever you need to charge that stationary battery.

4. **BumpTag attached to model (canopy, cowl, fuselage, etc.) using mobile device with NFC**
   If you are using the Bump Controller CCS app on an NFC-enabled mobile device, then you have an alternative to #3. BumpTags can be attached directly to your model (or large fixed battery) and the BumpTag can be scanned from your mobile device. As long as the model surface is non-metallic, the BumpTag can be installed on the inside of your model so it isn't visible or vulnerable to damage on the outside. For example, inside the fuselage, next to the charge jack for the receiver pack.

BumpTag Configuration

BumpTags contain a wide range of information about your battery.

- Factory Ratings fields describe the physical capabilities and specifications of the battery
- User Settings fields contain your preferences about how you like to handle that battery
- Analysis Data fields contain information obtained by the charger while running an Analyze operation

Factory Ratings

The Factory Ratings set hard limits which cannot be exceeded by the BUMP Controller – they serve as the safety "guardrails" to ensure that any user settings (or even potential software errors) cannot exceed the capabilities of the battery.

NOTE: For safety reasons, Factory Ratings can only be written to the BumpTag one time – once they are written, they cannot be modified.

MAKE SURE ALL VALUES ARE CORRECT BEFORE PROGRAMMING !!!

STANDARD RATINGS

The following standard ratings must be given the appropriate values for your battery. There is no such thing as a reasonable default value for these ratings – they must be set to match your battery. Appropriate values should be easily located on the battery label (see BumpTag Ratings example below).

- **Chemistry:** LiPo, LiHV, LiFe, LiIn, NiMh, NiCd, Pb
- **Cells:** total number of cells in this battery (includes all packs, if multi-pack)
- **Capacity:** The rated capacity of the pack
- **Pack Max**: The max discharge "C-rating" of the pack – typically 20-80C for modern LiPo
- **Brand Name**: The name of the pack manufacturer

NOTE: For NiXX and Pb batteries, Pack Max Discharge and Charge ratings are typically specified in amps or millamps, not in the form of a C-rating, so use the amperage value displayed right below the C-rating when adjusting these values for non-Lithium batteries.

ADVANCED RATINGS

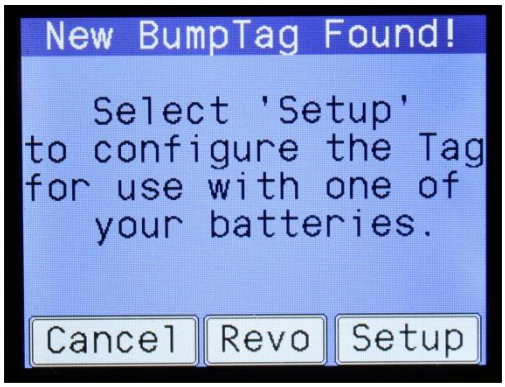
The following ratings are also important and required, however they are intended for more advanced users and default values will be automatically generated – do not change these values unless you know what you're doing:

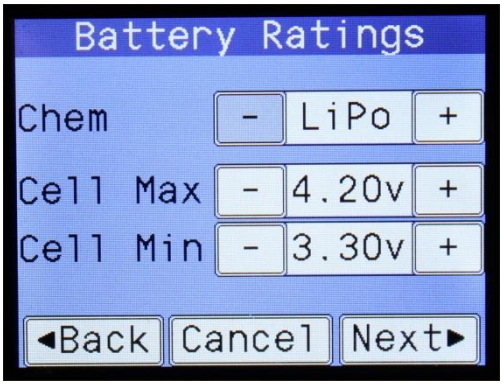
- **Charge Max C:** The highest charge rate recommended by the manufacturer for this pack. Many times this value is specified on the back label of the pack. For any Lithium pack, a default value of 10% of the Pack Max C-rating (up to 5C charge) will be used unless you specify otherwise.
- **Cell Max Volts:** Maximum cell voltage allowed (default is based on Chemistry type)
- **Cell Min Volts**: Minimum cell voltage allowed (default is based on Chemistry type)
- **Cell IR:** Cell Internal Resistance (default is calculated from Capacity and Pack Max C-rating)

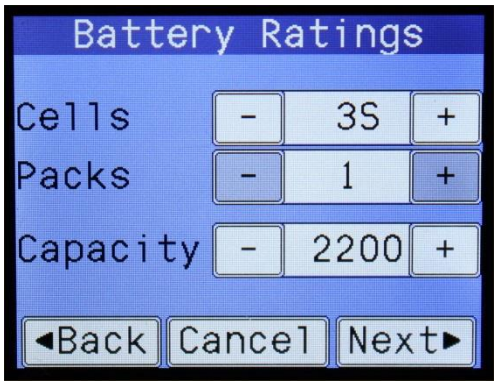
- **Packs:** number of separately-charged packs in this battery (default is 1, change for Multi-Packs)

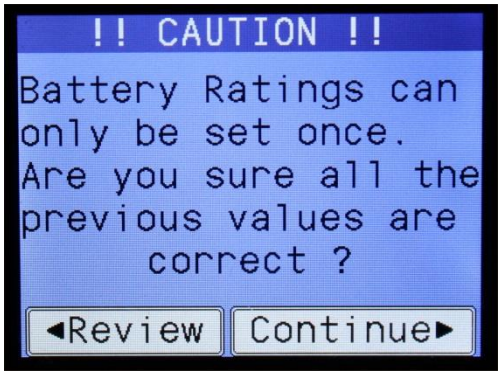
BumpTag Ratings Example: Pulse 3700 LiPo 4S 25C

Factory Ratings Screenshots









Multi-Pack Batteries

The **Packs** field in Factory Ratings is used to specify that a battery consists of separate packs which have their own mains power leads and can be charged separately.

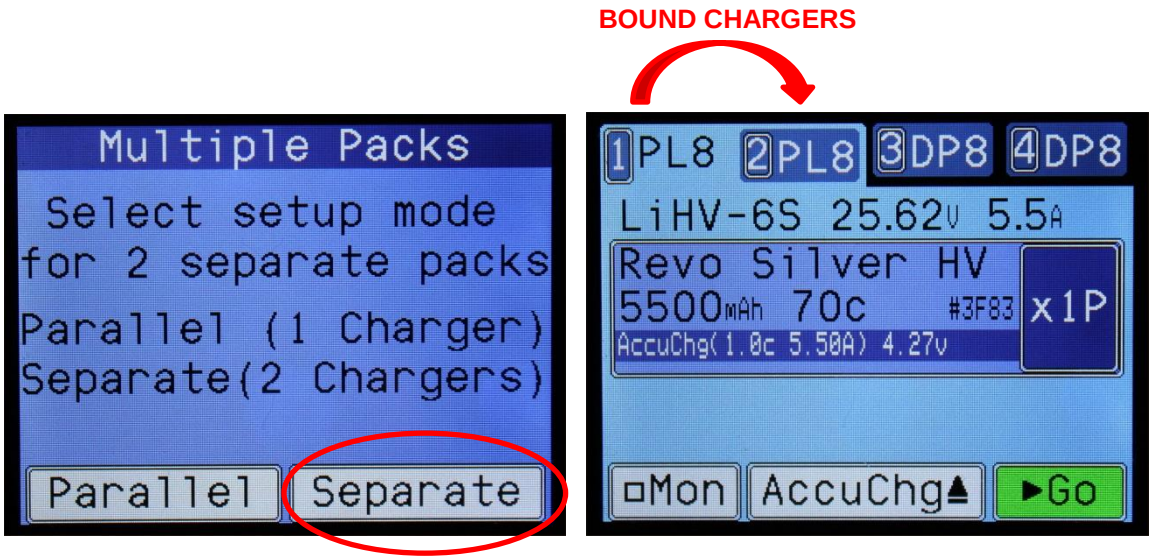
The most common use-case is for large-scale models that use 12S to 16S packs, but a battery can be configured as multi-pack for any cell count, as long as it has an equal number of cells in each pack.

The following example is how a large 12S 5500 mAh “stick” pack could be setup for a 700-size helicopter:

When the **Cells** count exceeds 8 (the maximum that can be charged on PowerLab chargers), then the **Packs** count is automatically incremented to 2. This is done to discourage (but not totally prevent) creating a BumpTag which couldn't be charged with the BUMP Controller and PowerLab chargers.

NOTE: Multi-pack batteries can also be setup with separate BumpTags, each one as a single pack, each bumped and started separately. This is the preferred method if the packs are ever separated and used/charged individually - because the individual battery history will be tracked appropriately.

When a multi-pack battery is bumped for charger setup, a "Multiple Packs" screen will pop-up to ask how those multiple packs should be charged – either in Parallel on a single charger (the current selected charger), or Separate using 2 chargers (the current selected charger plus the charger immediately after it). So in the example below, the 12S 5500 pack was bumped with charger 1 selected, then Separate was selected. Notice that the tabs for chargers 1 and 2 have been "bound" to show that those 2 chargers are now setup to charge together – their setup is automatically copied and when you press 'Go', both chargers will be started together, and control will remain "bound" together until the setup is cleared.

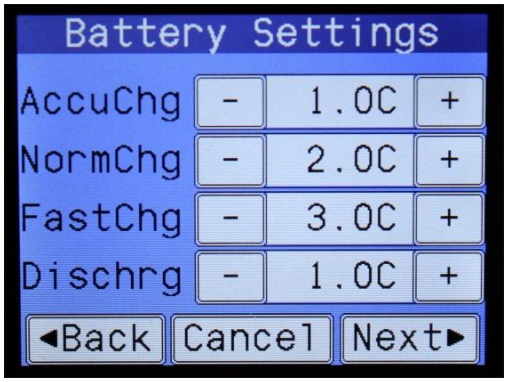


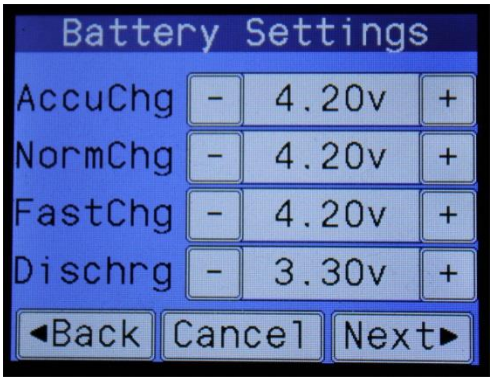
BumpTag User Settings

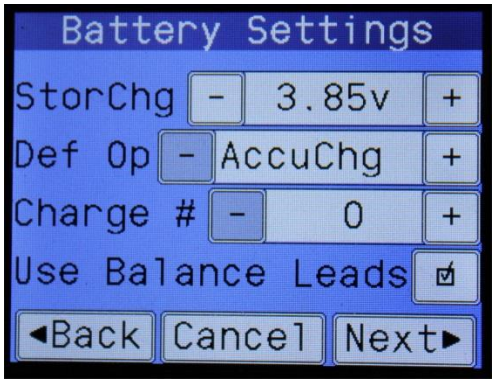
Unlike BumpTag Factory Ratings, the BumpTag User Settings fields can be changed as often as you like, however the BUMP Controller will not allow you to specify any values which would exceed or violate any of the Factory Ratings values.

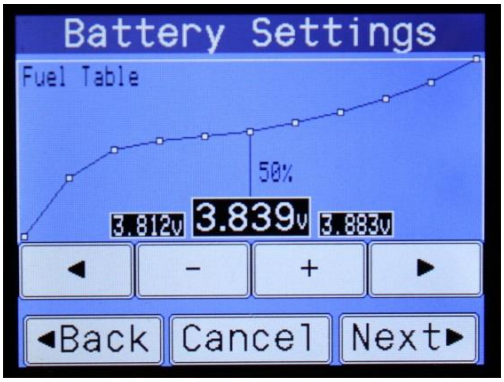
BumpTag User Setttings contain the following fields:

- **Accurate Charge Rate**: (default is lesser of 1.0C or 33% of Rated Max Charge C)
- **Normal Charge Rate:** (default is lesser of 2.0C or 50% of Rated Max Charge C)
- **Fast Charge Rate:** (default is lesser of 3.0C or Rated Max Charge C)
- **Discharge Rate:** (default is 1.0C)
- **Accurate Charge Voltage:** (default is Rated Max Cell Volts – can be adjusted up or down slightly)
- **Normal Charge Voltage:** (default is Rated Max Cell Volts – can be adjusted up or down slightly)
- **Fast Charge Voltage:** (default is Rated Max Cell Volts – can be adjusted up or down slightly)
- **Discharge Voltage:** (default is Rated Min Cell Volts – can be adjusted up or down slightly)
- **Storage Charge Voltage:** only applies to Lithium chemistries (default is chemistry-specific)
- **Default Operation:** operation to selected by default when tag is bumped (default is Accurate)
- **Charge Counter:** counts number of charge cycles on the battery (default is 0 – adjust this up if battery is used and already has some cycles)
- **Use Balance Leads:** enable/disable the use of balance leads on Lithium packs (default is enabled, can only be disabled for 1S-2S Lithium)
- **Fuel Table:** the table of cell voltage vs fuel level (default is chemistry-specific)









NOTE: For NiCD or NiMH batteries, the preferences for termination voltages for any of the charging operations are configured as Fallback Voltages, not maximum cell voltages.

BumpTag Analysis Data

Analysis Data is measured by the charger during Analyze Cycle operations. Analysis Data is not typically edited directly by the user, but is used for analysis, reporting, and historical purposes.

- Measured Cell IR
- Measured Capacity
- Fuel Table (can also be changed manually as a setting)

Copying BumpTags

The BumpTag Copy operation will let you make an exact copy of another BumpTag (except for the unique ID and charge counter fields). The Copy command can be used for 2 different purposes:

1. Programming a new BumpTag using Copy

   If the target BumpTag is new (un-programmed), then the entire contents of the source BumpTag (both Ratings and Settings) will be programmed into the new BumpTag. Use this to quickly setup new batteries which are identical to some you already have.

2. Copying user Settings between BumpTags

   If the target BumpTag is programmed and the Ratings fields all match **exactly**, then the Copy can be used to copy user Settings to other BumpTags. Use this to quickly change Settings for a particular type of battery – just change the Settings on one battery, then select Copy and bump the rest of the batteries of the same type. Now they will all have the exact same Settings. If the Ratings of the target do not exactly match the source, the Copy will fail and error message will be displayed.

NOTE: The Measured values will be copied in addition to the Settings values – this includes the Fuel Table.

After pressing Copy, the battery operation screen will open and you simply bump as many target BumpTags as you need to setup, one after the other. Once all BumpTags are written, press Cancel to return to the main Status Screen.

Upgrading BUMP Controller Firmware

The BUMP Controller firmware updates can be downloaded over the USB or Bluetooth interfaces, depending on the application used. The PC Firmware Update Utility is strictly for firmware upgrades over USB. The Mobile CCS App includes full control of the BUMP Controller, along with firmware upgrades, over Bluetooth 4.x Low Energy.

PC Firmware Update Utility

The PC Firmware Update Utility is compatible with Windows XP, Window 7, and Windows 10 and automatically updates from the web every time it is launched.

The application installer is free and can be downloaded from the Revolectrix website:
http://www.revolectrix.com/new_applications/software/BC_software.html

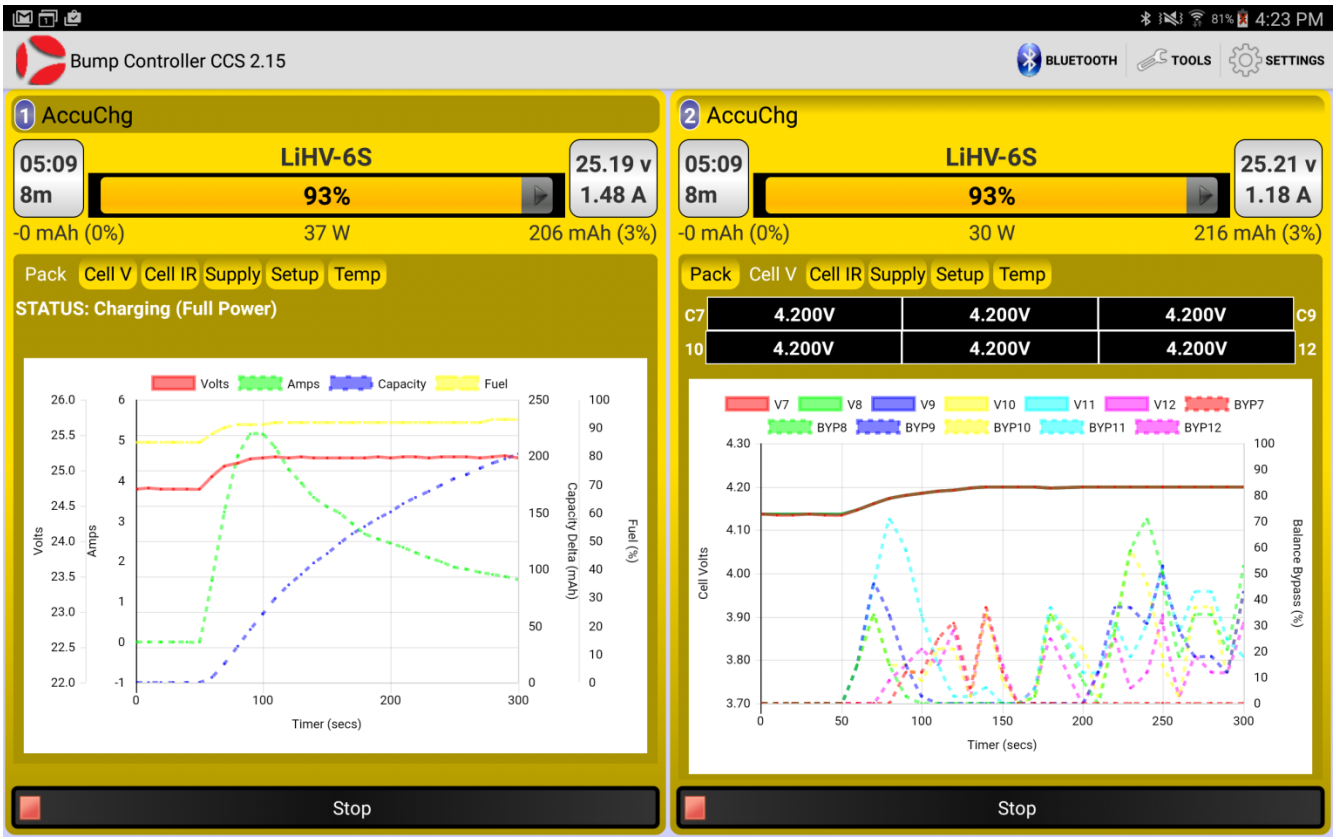
Follow these steps to perform the firmware update:

1. Download, install, and run the Update Utility
2. Click on the “Download USB Driver” link in the lower-left corner of the application window
3. Follow the instructions to download and install the USB drivers for the BUMP Controller
4. Connect your BUMP Controller to your PC using the included micro-USB cable
5. Select the firmware version you want to install (normally the latest)
6. Click “Update Firmware”

The Update Utility will scan for connected BUMP Controllers and begin the firmware upgrade. Wait until the upgrade complete message is displayed, then disconnect the BUMP Controller from the PC.

NOTE: The BUMP Controller can be powered via the USB connection to the PC, so no need to apply power to the EC-5 connector to perform a firmware upgrade.

BUMP Controller CCS Mobile App



The BUMP Controller Charge Control Software (CCS) Mobile App provides complete control over the BUMP Controller using a Bluetooth 4.x Low Energy wireless link. The CCS App also includes automatic firmware upgrades and the latest BUMP firmware is bundled with each release of the CCS App.

The Android version of the CCS is available now and can be purchased and downloaded from Google Play:
https://play.google.com/store/apps/details?id=com.revolectrix.bump.ccs

The Apple iOS version of the CCS app is available now and can be purchases and downloaded from Apple iTunes:
https://itunes.apple.com/th/app/revolectrix-ccs/id1173067290

NOTE: Windows 10 Universal Web App (UWA) version of the CCS Mobile App is in development and planned for release in late 2017.

Software features for the Bump Controller CCS Mobile App are growing fast, but as of the latest release, the following features were supported:

- Real-time monitoring, control, and charge setup of all 4 connected PowerLabs at the same time
- Automatic Bump Controller firmware upgrades over Bluetooth
- PowerLab firmware upgrades over Bluetooth (thru Bump Controller)

- Automatic upload and storage of battery history and cycle graphs
- History, reporting, graphing of battery charge graphs
- Battery historical performance trending charts (Capacity History and Cell IR History)
- Quick BumpTag setup (faster data input)
- Quick Manual operation setup (faster data input)
- Replace BumpTag Wizard (migrates history data from old BumpTag to new)
- Remote BumpTag scanning from Android mobile device (NFC support required on mobile device)
- DropBox integration for backup and sync of battery history data

Enabling Battery History Upload to CCS App

Since the BumpTag provides a unique identifier for every battery, the Bump Controller is able to automatically cache battery history by battery ID and upload to the CCS app for storage and analysis.

By default, battery history caching is **disabled** on **both** the BUMP Controller and the CCS app.

To enable battery history caching, perform the following steps:

1. On the BUMP Controller, go into Settings and select the checkbox for “Upload Battery History” This will enable history caching locally on the BUMP Controller and cause the BUMP to notify the CCS app whenever it has history data available for upload.

2. In the CCS app, go into Setttings for each Device (i.e., BUMP Controller) for which you want to upload history to that particular mobile device. Note that multiple mobile devices can be used to connect to the same BUMP Controller, so history upload can be enabled on some devices, but not others. For example, you may want to monitor and control your BUMP Controller from your mobile phone, but you don’t want it to upload battery history to your phone because you use your tablet for uploading, storing, and analyzing battery history.

Troubleshooting

SYMPTOM: 'Lost Data Link' Safety Code #21/55

Losing the communication link between the Bump Controller and the PowerLab is almost always a sign of excessive noise from the power supply. The switching noise levels increase as supply voltage and charging current increases, so it is quite common that everything operates fine until a high-current charge is performed and then the communication link is lost as the current is ramping up to a high-current charge.

SOLUTION:

The most effective way to fix the noise problems is to apply clip-on ferrite chokes to one or more of the following locations:

1. Bump Controller communication JR cables, closest to the Bump Controller end, or both ends
2. Bump Controller power input cables, close to the Bump Controller
3. Power supply positive and negative output wires, close to the power supply (or supplies)

For the JR cables, 7mm cables work well and problem enough space for the cable to be looped through twice.
For the Bump Controller power cable, use 10mm+ to allow the cable to be looped 2 or more times.
For larger power cables, use 10mm+ and loop multiple times, if possible.

If applying ferrite chokes as described above does not resolve your communication problems, please contact Revolectrix support below for further assistance.

SYMPTOM: BUMP Controller screen is all white on power-up

SOLUTION:

If the screen is all white on power-up, it means that the Bump is bypassing the normal application startup - there are a couple possible reasons:

1. The firmware is corrupted (failed checksum calculation) and cannot be executed

   This state can be confirmed by listening to the startup beeps. If the normal startup tone (3 quick ascending beeps) is followed immediately by a single long beep, then the firmware is corrupt and needs to be reloaded over USB via the PC Firmware Update Utility (see Upgrading BUMP Controller firmware section). Firmware corruption should be extremely rare, but is possible, especially when operating in conditions with extreme electrical noise. Taking precautions against electrical noise, such as applying ferrite chokes to power supplies and cabling, can greatly reduce the risk of corruption.

2. Pressure is being applied to the LCD touchscreen on power-up

   If the touchscreen is held for 10 seconds on power-up, it will enter a forced firmware upgrade mode. This state can be confirmed by listening to the startup beeps. If the normal startup tone (3 quick ascending beeps) is followed by a 10 second delay, then a single long beep, then the BUMP Controller believes the touchscreen is being held to force a firmware upgrade.

   Screen protectors or mounting methods cannot result in pressure being applied to the LCD touchscreen. If the BUMP Controller is mounted "under deck" or in any way squeezed by the mounting method, make sure the pressure is light, otherwise it can deflect the case far enough to cause the front of the case to

apply pressure against the LCD touchscreen. To test, loosen the mounting method to relieve the pressure, then press firmly in all 4 corners of the LCD with your finger – this will ensure the LCD pressure is removed by creating clearance between the plastic case and the touchscreen.

SYMPTOM: Fuel gauge reading changes drastically as charge/discharge current changes

SOLUTION:
This is most likely caused by an incorrectly configured BumpTag.
The fuel gauge primarily relies on pack voltage to determine the fuel level of the pack. However, it fine-tunes that reading by compensating for any internal voltage drop/rise in the pack due to the amount of current flowing through the pack. This calculation uses the rated Cell Internal Resistance which gets its default value from the Pack Max C-Rating and rated Capacity.
So if either the Pack Max or Capacity fields of the BumpTag are set incorrectly, then the Fuel Gauge readings will not be accurate when the pack is being charged or discharged. The solution is to make sure your all of the Factory Ratings fields are programmed correctly in the BumpTag.

Support options

For Sales Support on REVOLECTRIX Brand Products:

Email: sales@revolectrix.com

or phone: (301) 798 2770

For Sales or Technical Support on "Other Brands" in the REVO Store:

Email: brandsupport@revolectrix.com

To request information about a REVOLECTRIX product you are considering purchasing:

Email: info@revolectrix.com

or phone: (301) 798 2770

Support is also available for any of the following areas:

For technical support on a REVOLECTRIX product you already own

To request Refunds or Exchanges of merchandise

To request warranty or non-warranty repair work

To request support via email:

Email: support@revolectrix.com

or phone: (301) 829-5533

To initiate a case directly on line for any of the above:

1. Log on to your account at www.store.revolectrix.com
2. Click the "My Account" tab
3. Under Support, click "Contact Support"
4. On the case form, enter a subject which contains the product name, part number, or description
5. Type a message in the message field
6. The fields on the top right of the form are optional
7. Click Submit

A customer representative will contact you via email.

REVOLECTRIX limited warranty

REVOLECTRIX warrants this product to be free of manufacturing defects for the term of one year from the date of purchase. Should any defects covered by this warranty occur, the product shall be repaired or replaced with a unit of equal performance by REVOLECTRIX or an authorized REVOLECTRIX service station. Unit must be returned to the original place of purchase.

Limits and exclusions

This warranty may be enforced only by the original purchaser, who uses this product in its original condition as purchased, in strict accordance with the product's instructions. Units returned for warranty service to a REVOLECTRIX service center will be accepted for service when shipped postpaid, with an assigned Return Merchandise Authorization (RMA) form to the service station designated by REVOLECTRIX. To obtain an RMA, contact REVOLECTRIX. If you purchased the unit directly from REVOLECTRIX, you may also file a case on line at REVO USA (US web store) or REVO Intl (International web store) to start the RMA process. If you purchased the product from an authorized distributor or dealer, contact the distributor or dealer for further instructions.

This warranty does not apply to:

- Consequential or incidental losses resulting from the use of this product.
- Damage resulting from accident, misuse, abuse, neglect, electrical surges, reversed polarity on connectors, lightning or other acts of God.
- Damage from failure to follow instructions supplied with the product.
- Damage occurring during shipment of the product either to the customer or from the customer for service (claims must be presented to the carrier).
- Damage resulting from repair, adjustment, or any alteration of the product by anyone other than an authorized REVOLECTRIX technician.
- Installation or removal charges, or damage caused by improper installation or removal.

Call (301) 829-5533 for more information about service and warranty repairs.