Bump Controller

User's Guide

Firmware ver 1.36 or newer

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,
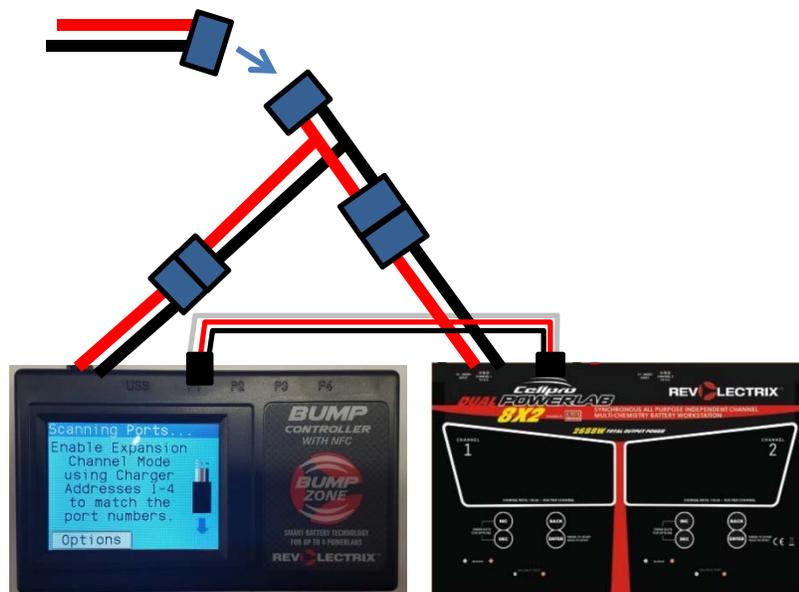adapters, parallel adapters, etc.

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

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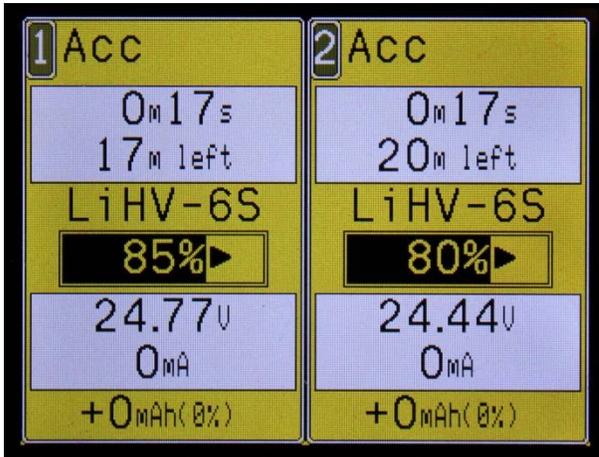
Status Screen - Charger Tabs
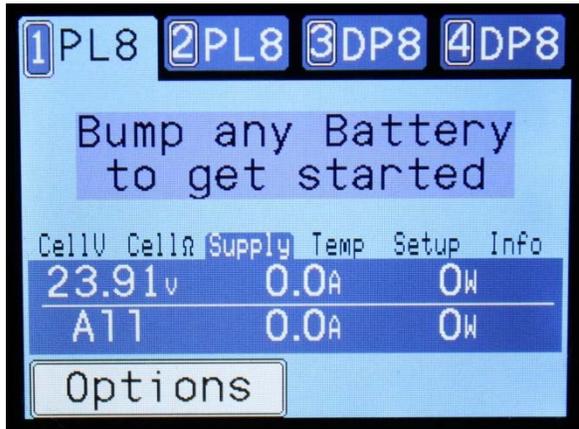
The main Status Screen displays the current status of all connected PowerLabs. The tab text and background color will indicate the current charger state.

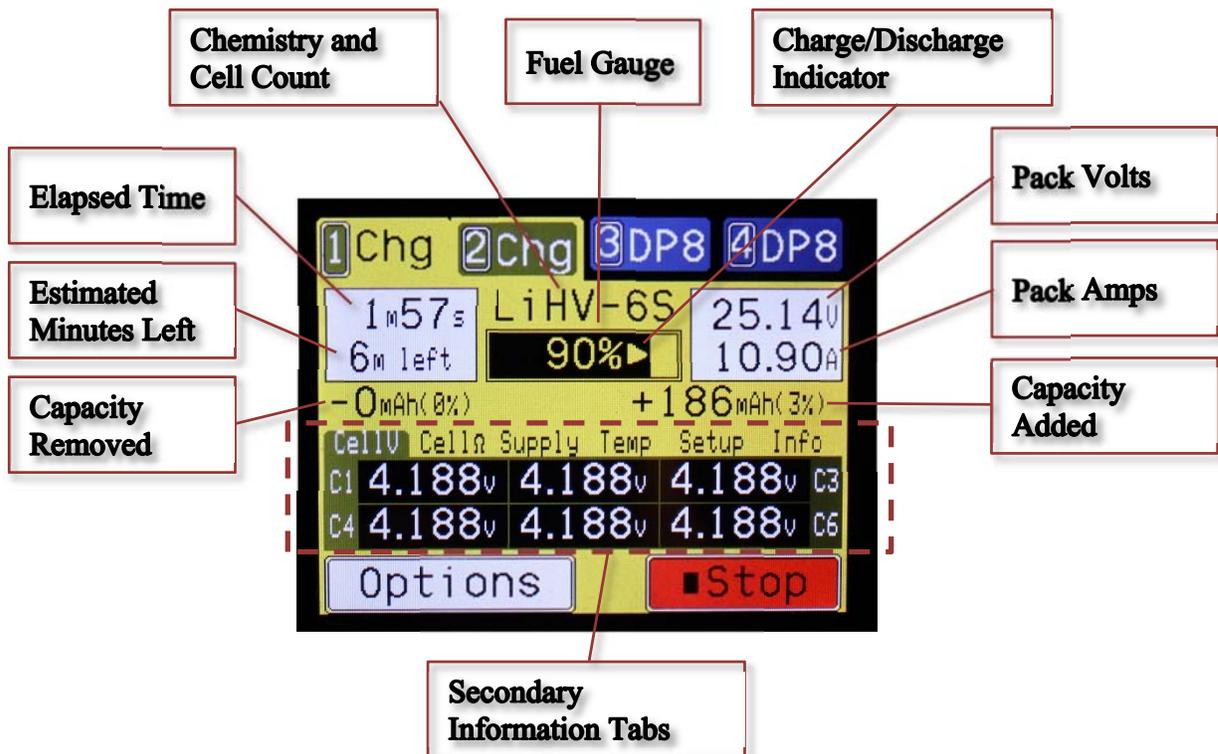Selecting Options will open the BUMP Controller Options screen (see Options section).

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

Chemistry and Cell Count

Fuel Gauge

Charge/Discharge Indicator

Pack Volts

Elapsed Time

Estimated Minutes Left

Pack Amps

Capacity Removed

Capacity Added

Secondary Information Tabs

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.

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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.
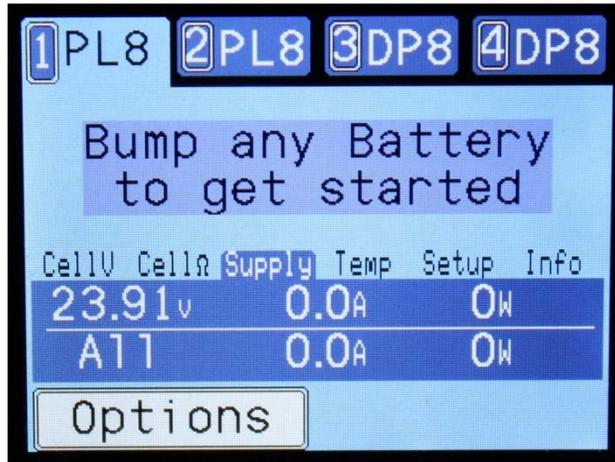
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Figure 3 - Power Supply Information

Temp

The Temp tab displays the reported internal temperature of the current selected charger, as well as the temperature of the BUMP Controller itself.


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

Info

The Info 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.
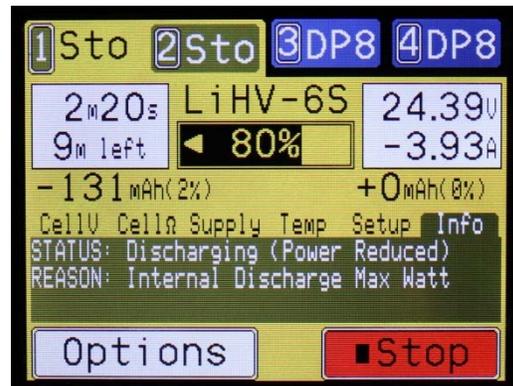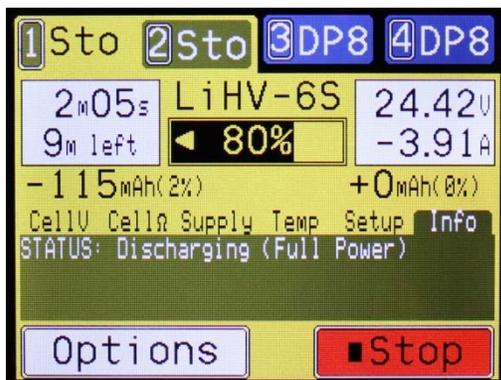
BUMP Controller Operations

Starting a simple battery operation using BUMP 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.
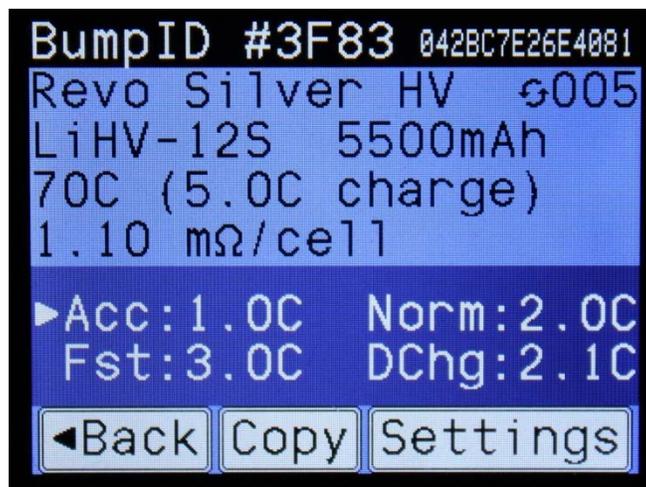

Figure 5 - Battery Details Screen

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 parallel), the charger counter will not get falsely incremented.

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.

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 Cache - adds or removes this battery from the local battery cache (see "Battery Cache" 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.
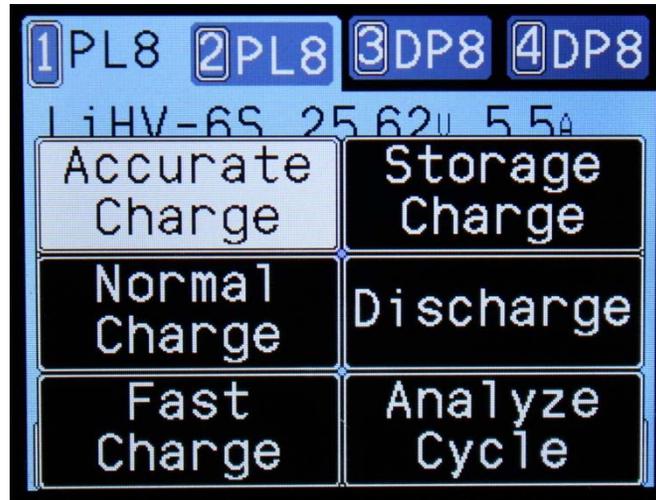

Figure 7 - Select Operation Popup

Pressing the Mon 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 Resitance warning threshold, go to Options->Analyze Warnings (default is 200% of factory 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.

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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)

Options

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

The following items are accessible from the Options menu:
- Volume: Sets the speaker volume level
- Ports ON: Enables/disables individual PowerLab ports
- Screen Layout: Change user interface layout to match your charger layout
- Calibrate Touch: Recalibrate the touchscreen
- Color Themes: Switch between different preset themes or your own custom theme
- Analyze Warnings: Adjust warning threshold for automatic analysis
- Tech Support: Used for debugging
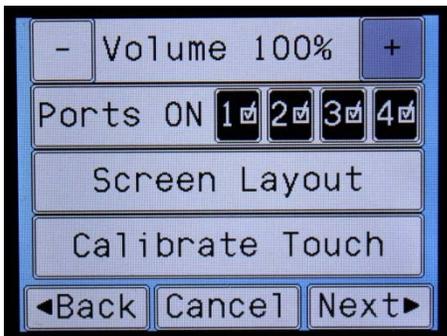
BumpTag Configuration

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
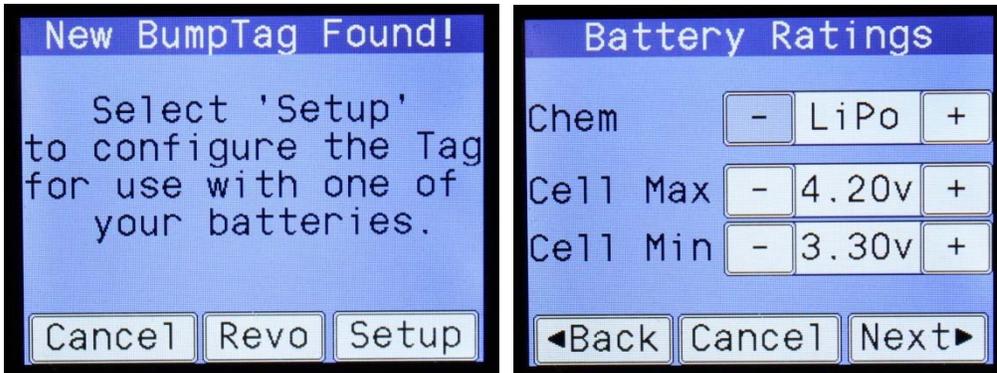- Analysis Data fields contain information obtained by the charger while running an Analyze operation
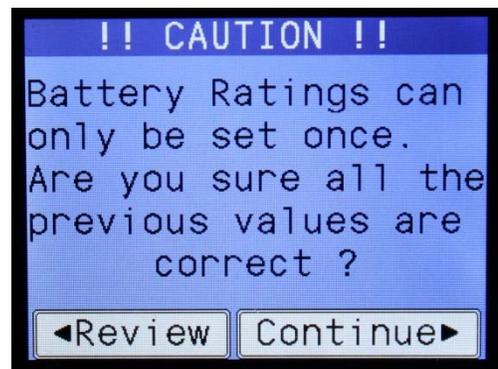
Factory Ratings

Factory Ratings contain the following fields:
- Chemistry: LiPo, LiHV, LiFe, LiIn, NiMh, NiCd, Pb
- Cell Count: total number of cells in this battery (includes all packs)
- Pack Count: (see Multi-Pack Batteries section below)
- Capacity
- Max Discharge C
- Max Charge C
- Max Cell Volts (default is recommended value based on Chemistry)
- Min Cell Voltage (default is recommended value based on Chemistry)
- Cell IR (default value is calculated from capacity and C rating)

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.**

Battery Ratings				Battery Ratings		
Cells	–	3S	+	Dchg Max	–	45C	+
Packs	–	1	+	Cell IR	–	4.24mΩ	+
Capacity	–	2200	+	Chrg Max	–	5.0C	+
◄Back	Cancel	Next►		◄Back	Cancel	Next►

Battery Ratings				!! CAUTION !!
Brand Name				Battery Ratings can only be set once. Are you sure all the previous values are correct ?
Abc				
◄	–	+	►	
◄Back	Cancel	Next►		◄Review	Continue►

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:

Battery Ratings			
Cells	–	12S	+
Packs	–	2(6S)	+
Capacity	–	5500	+
◄Back	Cancel	Next►	

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.

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.
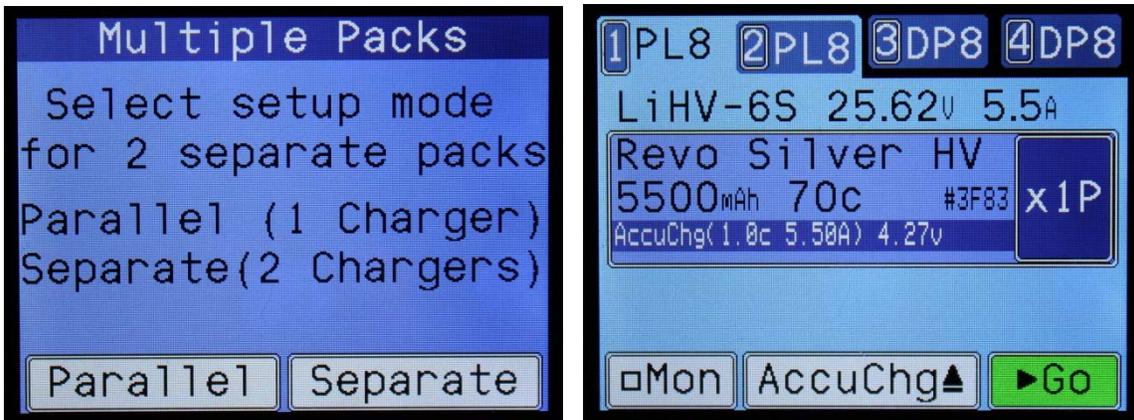
User Settings

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)
- Default Operation (default is Accurate Charge)
- Cell Max Voltage (default is Rated Max Cell Volts – can be adjusted up or down slightly)
- Cell Min Voltage (default is Rated Min Cell Volts – can be adjusted up or down slightly)
- Charge Counter (default is 0 – adjust this up if battery is used and already has some cycles)
- Fuel Table (default is applied per-Chemistry type)
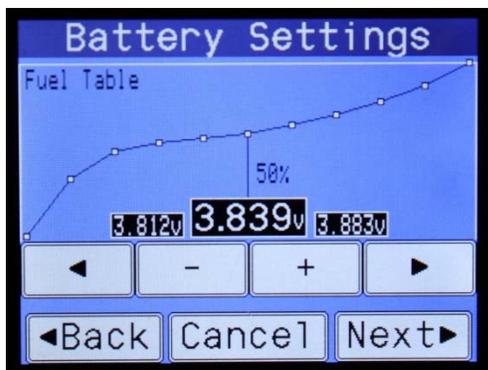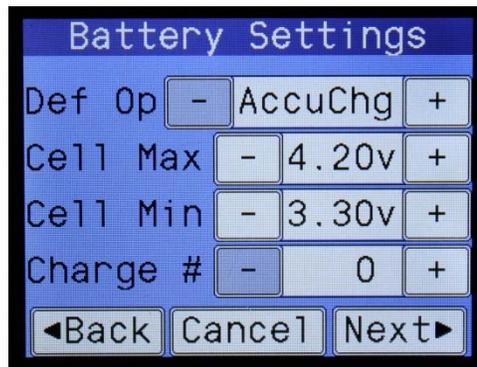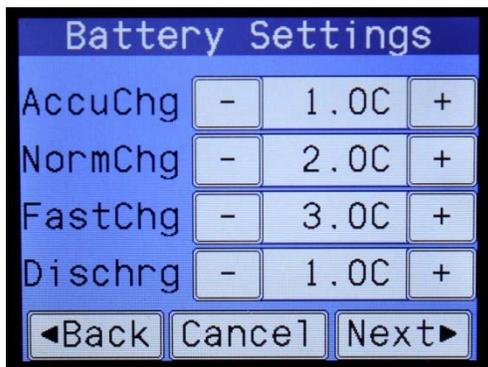
Analysis Data

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

    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.

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.

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.