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ABC

ADVANCED BATTERY CHARGER

OPERATION MANUAL

BTC-70100

NSN: 6130-01-660-3696

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WARNING

**HIGH VOLTAGES ARE PRESENT IN THE
OPERATION OF THIS EQUIPMENT**

Avoid contact with AC supply voltage connections during installation, operation or maintenance of the battery charger.

CAUTION

**ACID CONTAMINATES NICKEL-CADMIUM, LITHIUM-ION,
LITHIUM-POLYMER and NICKEL-METAL HYDRIDE BATTERIES**

Every effort must be made to keep Nickel-Cadmium, Lithium-Ion, Lithium Polymer and Nickel-Metal Hydride batteries as far away as possible from Lead-Acid batteries because Lead-Acid batteries contain sulfuric acid. Do Not use the same tools and materials, such as screwdrivers, wrenches, syringes, hydrometers, and gloves for both types of batteries. Any trace of acid or acid fumes will permanently damage Nickel-Cadmium, Lithium-Ion, Lithium Polymer and Nickel-Metal Hydride batteries on contact.



WARNING

NO SMOKING IS PERMITTED NEAR THE CHARGING STATION

Batteries can produce explosive gases during charging or discharge cycles. Never smoke or allow open flames near the charging station. This equipment is not suitable for use in locations where children are likely to be present.

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Patent pending.

Visit <http://www.bren-tronics.com/patents> for Bren-Tronics patent statement

ABC Operation Manual

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1 INTRODUCTION

1-1 SCOPE

This manual provides operating instructions for the Advanced Battery Charger (ABC).

Equipment Name

Advanced Battery Charger.

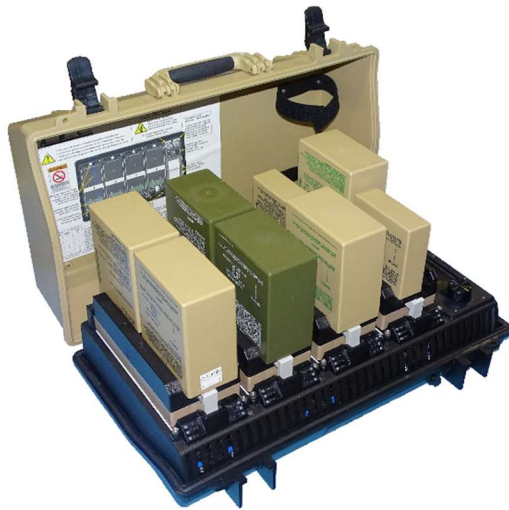


Purpose of Equipment

The ABC serves as a portable battery charging solution that offers improvements over previous charging systems in size, weight and efficiency, while providing selectable power, faster charging times and increased environmental survivability.

Equipment Characteristics and Capabilities

The ABC is a lightweight, rugged, portable battery charging solution (**Figure 1-1.1**) that provides state-of-the-art performance, minimizing the time required to charge one or more batteries from a wide range of AC and DC power sources, in a small, lightweight, and easy-to-set-up package.



The system, with its associated battery adapters is designed to charge a wide range of commonly used rechargeable batteries and will automatically detect an installed battery, apply a safe charge, and terminate the charge cycle without operator intervention. The use of type-specific adapters assures that each battery type supported by the ABC – from NiMH AA cells to large Li-Ion and other advanced-chemistry configurations – is charged with the proper voltage/current/temperature profile for that battery, assuring safe charging in minimal time while preserving battery life. Adapters are mechanically and/or electrically keyed so that charging of batteries other than those the adapter is designed to accept is prevented.

When charging “smart” batteries that are equipped with a SMBus, DQ, or other data-communications interface, the combination of the type-specific adapter and active polling of the interface by the ABC allows even more optimization of the charging process. With these batteries, the ABC operates as a Level 3 charger (*as defined by the Smart Battery Charger Specification Version 1.1, published by the Smart Battery System Implementers Forum*), leveraging information from the battery and type-specific information programmed in the charger to intelligently deliver a full charge in minimal time, while avoiding abusive charging that shortens battery life.

Access to pertinent data from the connected battery also enables the ABC to assess the state-of-health of the battery, so that users know what level of energy storage they can expect from that battery at that point in time, and when it is time to dispose of it. Adapters can also be provided to facilitate Level 2 operation when called for, where the “smart” battery exercises full control over the charging process and the ABC simply responds to commands from the battery.

A multifunction, color Liquid Crystal Display (LCD) color screen displays charger status, battery identification, and state-of-charge/state-of-health information (for “smart” batteries) for each battery connected to the ABC. LED indicators at each adapter position provide quick indication of charging status for the connected batteries – amber for CHARGE, red for FAULT, and green for READY (including a blinking-green indication of close-to-full-charge status, that assures you get >90% state-of-charge when you just can’t wait for 100%).

Depending on mission requirements, the ABC provides users an option to charge batteries with a quick or a slow charge. These selections are made in the SETTINGS window using the Charging mode option. For a slow charge, the user selects “Charge for Life”. For a quick

charge, the user selects “Charge for Speed”. If no selection is made, the factory default setting is “Charge for Speed”. Batteries charged using the “Charge for Life” mode are charged at a lower rate resulting in less capacity loss and longer battery life. Batteries charged using the “Charge for Speed” mode are charged at an optimal rate to get the fastest charge time. In either option, the ABC automatically customizes the charge profile to charge the battery to 100% SOC in a safe manner.

The ABC will also simultaneously charge at least eight operational Tactical Hand Held Radios (THHR) batteries, with the radio attached. In the event of a charger failure, a failsafe mechanism in the interface between the ABC and the battery protects the radio from damage.

All of the above is controlled by firmware that is user upgradeable, via a firmware update port, to enable charging of new battery chemistries and new battery form factors as they become available with no hardware modifications to the ABC required.

Batteries and adapters can be removed and installed with the system powered on, off, or at any time, including during the charge cycle without damage occurring to the ABC, battery or adapter.

The ABC also includes four USB Type A and one USB Type C charging ports, suitable for charging smartphones, tablets and other equipment designed to accept USB power.

The ABC is designed to operate in extreme weather conditions, including heat, cold, sand, dust, moisture, altitude and at an omnidirectional grade of 15%. This includes sensor-based thermal management that reduces charging power at high temperatures, so that continuous operation is maintained. The case is designed to protect the ABC electronics from the effects of loose-cargo bounce, shock/drop and water immersion during transport; the case is opened for operation. The case top can be removed from the ABC, to make it easier to use the ABC on bench platforms.

The ABC can be powered from any of the following power sources:

- 90-264Vac, 47-440Hz, 1000W
- 11-22Vdc, 46A maximum
- 22-36Vdc, 1000W maximum
- A solar-panel array with the following characteristics at Standard Test Conditions (STC):
 - Open-circuit voltage: 38V or less
 - Voltage at the maximum-power point: 11-36V

The ABC utilizes Maximum Power Point Tracking (MPPT); the input power PCB monitors the DC input voltage and current, and throttles back charging currents to keep the input voltage at the level that delivers maximum power to the ABC when it is powered from solar panels or other “soft” current-limited sources. When MPPT is active, the LCD display’s Home Screen and Charger Status Screen indicates that MPPT is active.

1-2 END USER “DOs AND DON’Ts”

DON’T attempt to open the chassis. There are no user-serviceable parts inside; breaking the tamper-proof Inspection Seal will void the warranty.

DON’T power the ABC from AC power without a connection to protective earth (ground). The power cord provided with the ABC includes this connection; do not use “cheater” plugs or other means to connect to AC mains without a PE/ground connection. **OPERATION WITHOUT A GROUND CONNECTION EXPOSES USERS TO THE RISK OF ELECTRIC SHOCK, WHICH CAN CAUSE SERIOUS INJURY OR DEATH!**

DON’T attempt to charge primary batteries of any type – including alkaline AAA, AA, C, or D size cells (that will mechanically fit into the adapters that charge single-cell commercial batteries).

DON’T smoke or allow open flames near the ABC when in use. Some batteries may emit potentially-flammable gases during charging and discharging cycles.

DON’T attempt to remove an adapter by pulling upward on the rear of the adapter. This will cause damage.

DO use the front-hold ejector levers to remove an adapter.

DO make sure the adapter is fully seated on the chassis, before using.

DO periodically inspect the battery-interface contacts on adapters for contamination, corrosion and damage, and repair/replace as needed.

DO periodically clean the battery-interface contacts and battery-resting surfaces on the adapters, using swabs/tissues/cloths, and – if necessary – small amounts of water, alcohol or electronic-contact cleaner (apply cleaner to the swab/tissue/cloth – not directly to the adapter).

DO make sure that the contacts and adjacent surfaces of the batteries to be charged by the ABC are clean, before placing them on the adapter. Dirty connections can extend charging time and/or prevent charging.

1-3 TECHNICAL SPECIFICATIONS

Dimensions..... 20 in. (508 mm) W x 13 in. (330 mm) D x 6.3 in. (160.0 mm) H

Weight..... 22 lbs. (10 kg)

Power Requirements

- AC operation..... 90-264Vac, 47-440Hz, 1000W
- DC operation..... 11-22Vdc, 46A maximum
22-36Vdc, 1000W maximum
- Solar operation..... From a panel array with the following characteristics (at STC):
 - Open-circuit voltage: 38V or less
 - Voltage at the maximum-power point: 11 to 36V

Charge Voltage/Current..... Automatically selected for each battery type.

USB Charging Ports..... Four Type A: 5V, 2A maximum
One Type C: 5V, 3A maximum

Ethernet port..... Contact Bren-Tronics for more information.

Upgrade port..... USB Type C (for firmware upgrade only; not a charging port)

Duty Cycle..... Continuous

Operating Temp. Range..... -25°F (-32°C) to 131°F (55°C)

Storage Temp. Range..... -40°F (-40°C) to 160°F (71°C)

Case Material..... Polypropylene

Case Color..... Top cover, Lusterless Tan
Bottom cover, Lusterless Black

Chassis..... Powder coated aluminum.

CAUTION:

*Heavy Load – Lift correctly to avoid injury.
Keep back straight, legs bent and load close to body.*

1-4 DECLARATIONS OF CONFORMITY



EU Declaration of Conformity

In accordance with EN ISO/IEC 17050-1

Object of the declaration:

Product	Advanced Battery Charger (ABC)
Models	Charger: BTC-70100 Series Adapters/Cables: BTA-70100-x
Manufacturer	Bren-Tronics Inc.
Address	10 Brayton Ct, Commack, NY 11725, United States of America

This declaration is issued under the sole responsibility of the manufacturer.

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

2014/30/EU	Electromagnetic Compatibility Directive (EMC)
2014/35/EU	Low Voltage Directive (LVD)
2011/65/EU	Restriction of use of certain Hazardous Substances Directive (RoHS)
2015/863	Amendment to RoHS Directive

Conformity is shown by compliance with the applicable requirements of the following documents:

EN 61000-6-2:2005 - Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments

EN 61000-6-3:2007/A1:2011/AC:2012 - Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light industrial environments

EN 62368-1:2014/A11:2017 - Audio/video, information and communication technology equipment - Part 1: Safety requirements

EN IEC 63000:2018 – RoHS Assessment

Signed for and on behalf of Bren-Tronics Inc:

Place of issue: Commack, NY, USA

Date of issue: 19 April 2024

Name and Position: George Tun, Compliance Manager

Signature:

DC-CE-BTC-70100 Rev E

Page 1 of 1

UKCA Declaration of Conformity

In accordance with EN ISO/IEC 17050-1

Object of the declaration:

Product	Advanced Battery Charger (ABC)
Model	BTC-70100 Series
Manufacturer	Bren-Tronics Inc.
Address	10 Brayton Ct, Commack, NY 11725, United States of America

This declaration is issued under the sole responsibility of the manufacturer.

The object of the declaration described above is in conformity with the relevant UK legislation for UKCA marking:

UK SI 2016 No. 1091	Electromagnetic Compatibility (EMC) Regulations
UK SI 2016 No. 1101	Electrical Equipment (Safety) Regulations
UK SI 2012 No. 3032	Restriction of use of certain Hazardous Substances (RoHS) in Electrical and Electronic Equipment Regulations

Conformity is shown by compliance with the applicable requirements of the following documents:

EN 61000-6-2:2005 - Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments

EN 61000-6-3:2007/A1:2011/AC:2012 - Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light industrial environments

EN 62368-1:2014/A11:2017 - Audio/video, information and communication technology equipment - Part 1: Safety requirements

EN IEC 63000:2018 – RoHS Assessment

Signed for and on behalf of Bren-Tronics Inc:

Place of issue: Commack, NY, USA

Date of issue: 25 May 2023

Name and Position: Peter Burke, Senior VP of Engineering

Signature:



1-5 ACCESSORIES

CAUTION:

Bren-Tronics adapters are designed with keying and identification features that automatically assure the application of the proper charge profile to a battery that the adapter is designed to accept. **Do not attempt to modify and/or add improvised connections to any adapter** in order to charge batteries other than those the adapter is designed to accept ... **this can result in damaged batteries, a damaged adapter and/or charger, or even a battery fire!**

Table 1 shows a sample of the various batteries (and matching ABC adapters) the ABC can charge at the time of the writing of this document. In addition, the ABC can use adapters that are used with the (legacy) SPC charger. For additional compatible adapters and other pertinent information, visit <http://www.bren-tronics.com>.

Table 1 – Various Batteries and Appropriate Adapters







Adapter Part Number (P/N)	Used for charging	Batteries per Adapter	Photo
BTA-70100-1 Charges Li ION Batteries to 16.5V	BB-2590/U; BB-2590A/U BT-70791xx Family BB-390B/U BB-2557/U	2 2 2 2	
BTA-70100-1A Charges Li ION Batteries to 16.8V	BB-2590/U; BB-2590A/U BT-70791xx Family BB-390B/U BB-2557/U	2 2 2 2	
BTA-70100-2	AN/PRC-148 Radio Battery AN/PRC-152 Radio Battery D Size NiMH Batteries AA Size NiMH Batteries	2 2 2 4	
BTA-70100-3	AN/PRC-153 Radio Battery C Size NiMH Batteries	2 2	
BTA-70100-4	BB-2001A/U BB-2847A/U	2 2	
BTA-70100-8	CSEL Radio Battery	4	

Table 1 – Various Batteries and Appropriate Adapters (cont.)





Adapter Part Number (P/N)	Used for charging	Batteries per Adapter	Photo
BTA-70100-148	AN/PRC-148 Radio Battery	4	
BTA-70100-152/163	AN/PRC-152 Radio Battery AN/PRC-163 Radio Battery	4 4	
BTA-70100-838	BT-70838xx Family BT-70838-2/3xx Family BT-70838-1/3xx Family	4 4 4	
BTA-70100-909	BT-70909Ax Family	4	
BTA-70100-910	BT-70910xx BB-2525/U	4 4	
BTA-70100-1120	RRC1120	10	
BTA-70100-DCB	DCB201 DCB203 DCB205 DCB606 DCB609	2 2 2 2 2	

Table 2 shows a sample of various power cables and other accessories compatible with the ABC as of the writing of this document. For more information and additional compatible power cables and other accessories, visit <http://www.bren-tronics.com> .

Table 2 - Power Cables and Other Accessories









DESCRIPTION	PART NUMBER	PHOTO (OR DESCRIPTION)
AC POWER, 6', NEMA5-15P (US)	BTA-70100-AC-1A	
AC POWER, 10', NEMA5-15P (US)	BTA-70100-AC-1	LONGER VERSION OF BTA-70100-AC-1A
AC POWER, 6', CEE 7/7 (EU)	BTA-70100-AC-2	SIMILAR TO BTA-70100-AC-1A, BUT WITH EU (CEE 7/7) PLUG
AC POWER, 6', BS 1363 (UK)	BTA-70100-AC-3	SIMILAR TO BTA-70100-AC-1A, BUT WITH UK (BS1363) PLUG
AC POWER, 6', AS/NZS 3112 (AU)	BTA-70100-AC-4	SIMILAR TO BTA-70100-AC-1A, BUT WITH AU/NZ PLUG
12VDC POWER, RING LUG	BTA-70100-DC12-1	
12VDC POWER, ALLIGATOR CLIPS	BTA-70100-DC12-2	
12VDC POWER, CIGARETTE LIGHTER	BTA-70100-DC12-3	

Table 2 - Power Cables and Other Accessories (cont.)

DESCRIPTION	PART NUMBER	PHOTO (OR DESCRIPTION)
24VDC POWER, NATO	BTA-70100-DC24-1	
24VDC POWER, RING LUG	BTA-70100-DC24-3	
24VDC POWER, ALLIGATOR CLIPS	BTA-70100-DC24-4	
SOLAR POWER, 4-PANEL	BTA-70100-DCS-2	

**NOT ALL CABLE CONFIGURATIONS ARE SHOWN.
VISIT <https://www.bren-tronics.com> FOR MORE INFORMATION.**

1-6 CHARGE CYCLE DESCRIPTION

POWER INPUT, DISTRIBUTION, AND BATTERY CHARGING

AC Power Operation

The ABC operates between 90-264Vac, 47-440Hz on AC power. On low line AC power, as the line voltage decreases from 115-90Vac, there is a 20% linear power derating. On AC power, the ABC converts the input voltage to DC using two AC/DC power supplies. When AC and DC power are both detected on the Input Power PCB, the DC power input is disabled. This is a hardware-based operation that takes place within the Input Power PCB to prioritize the ABC to only operate on an AC source, when both an AC source and DC are present.

DC Power Operation

To protect against overdischarge of a vehicle battery, the Input Power PCB automatically adjusts the ABCs low-voltage charge-disable settings based upon the connected input-power cable. For 24V cables, the ABC will operate down to 21V and will turn back on at 22V. For 12V cables, the ABC will operate down to 8V and will turn back on at 9V. In all cases, the ABC controls its power consumption such that the DC input current is limited to 44A or less. Refer to Table 2 above for DC power cable options.

User Selected Power Management

The ABC is normally configured to provide a maximum of 1000W, in total, to the four charging ports (subject to other hardware limitations, input-voltage levels, and environmental conditions). To support operation with limited-power sources, this maximum can be reduced via the Power Limit Sub Menu configuration screen described in Section 2-6. These settings apply to operation from an AC or DC source. The ABC reads the power consumed by the batteries and negotiates power distribution; reducing charge currents (and increasing charge times) as needed to stay within the total power limit.

Power Switch Operation

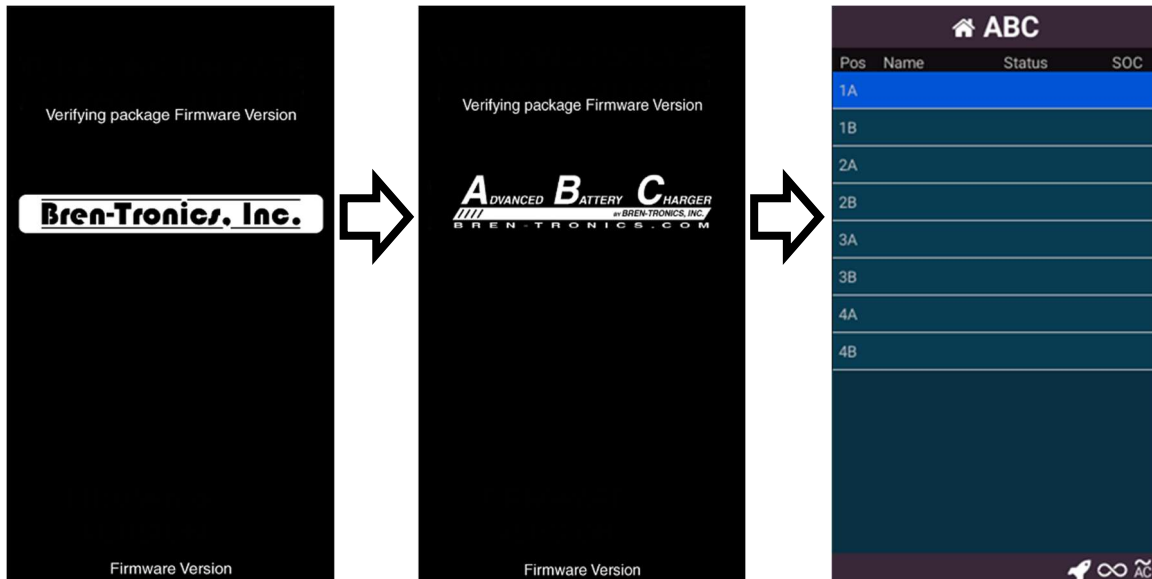
The Power Switch has three positions: OFF, BLACKOUT, and ON. When the ABC is powered on, all the PCBs are powered and simultaneously begin their start up self-tests. In BLACKOUT mode, all LEDs and the System Display are turned off, but the ABC still self-tests and supports battery charging.

ABC Display Startup

When the Power Switch is placed in the ON position, the System Display turns on and displays in sequence the Manufacturer splash screen, the Product Splash Screen, and the Home Screen.

NOTE

The current firmware version is displayed at the top and bottom of the Manufacturer and Product Splash Screens



Adapter Recognition/Identification

Adapter identification (ID) and battery charging state will be indicated by the LEDs located in the four front holds. Each front hold represents an individual adapter charging port, and the corresponding two positions of the charging ports, positions A and B. Adapters utilizing a position C have LEDs located on their adapter.

Each adapter type has ID pins that represent the adapter. When an adapter is installed, the ID is read by the charger. If the charger reads an unknown ID, all of the LEDs will light up in that position identifying that an unknown adapter has been installed. If no LEDs light, the ID is not being read by the charger.

Once an adapter is recognized, the charger begins to search for any battery that could be charged with that adapter. This is indicated by a flashing amber light on the LEDs for both the A and B position of that charging port. The ABC supports adapters with 18-pin (legacy) and 27-pin charger-interface connectors. An adapter with 27 pins will communicate with compatible smart batteries, while one with 18 pins will not. Using an 18-pin adapter may result in the loss of identifying a battery and could affect battery charge times.

Battery Charging

Each of the battery types that is capable of being charged by the ABC is connected to the charger via its respective battery adapter (plate or cable). The appropriate battery adapter is installed on one battery adapter port and serves as the electrical interface between the batteries being charged and the charger circuits. The battery charger control circuits constantly monitor the following battery conditions during the charge cycle, as appropriate, to ensure that the battery is properly being charged:

All battery types: Voltage (V) Current (I) Temperature (T) Time (t)

Ni batteries only: Voltage change (ΔV) Temperature rate of change ($\Delta T/\Delta t$)

“Smart” batteries with communications: Battery status flags

The charger operation during a typical charge sequence is automatic and the battery charge status is displayed to the user by the panel LED indicators as follows:

- a. **Detection** - The charger is waiting for detection of a battery in an adapter. The CHARGE LED (amber) blinks slowly.
- b. **Pre-charge** – The charger brings the battery voltage up to a safe level before the rapid charge process begins. This step may take several minutes for a very discharged battery. The CHARGE LED (amber) blinks rapidly..
- c. **Fast Charge** – A timed fast charge cycle brings the battery to approximately 90% of full charge capacity. The CHARGE LED (amber) is on and not blinking.
- d. **Trickle / Top-off** – When fast charge is complete, the charger will top off of the battery to 100%. Each battery is charged for five minutes at a time (10 minutes for dual section batteries – i.e. BB-390B/U, BB-2590/U). For Lithium Ion and Lithium Polymer batteries the top-off cycle will stop after the battery is 100% charged. For all other types, the Trickle / Top-off cycle is repeated indefinitely to keep the battery at 100% charge. Leaving the battery on the charger will not harm the battery. The battery may be removed and used at this time. The READY LED (green) blinks during this process.
- e. **Ready** – Charging is complete. The battery may be removed and used at this time. The READY LED (green) is on and not blinking.

The battery may be removed and used at any time during the charge cycle without damage to the charger or battery. The state-of-charge indicator (SOC) will display the battery condition.

NOTE: After removing a battery from the charger, wait for the corresponding battery status LEDs to indicate a return to Detection status, before installing a new battery.

USB Charging

The ABC is capable of charging devices through its USB ports. There are four USB Type A ports and one USB Type C port. Each Type A port can deliver up to 2A at 5V for charging smartphones and other devices; the Type C port can deliver up to 3A at 5V. Power for the USB charging comes from the input power of the ABC Display PCB. USB charging status is indicated by the USB symbol on the LCD screen.

2 OPERATING PROCEDURES

2-1 PANEL CONTROLS AND INDICATORS

Battery charger panel components are described below and shown in **Figure 2-1.1**

Item	Function
AC Input Connector.....	Connection point for AC input power.
DC Input Connector.....	Connection point for DC input power. Cable selection is determined by the DC power source.
Power Switch.....	This 3-position switch is the power selection for OFF-BLACKOUT-ON. The OFF function turns the ABC off. The BLACKOUT function maintains operation of ABC in a safe, no visibility function but removes the LCD screen display and LED front hold illumination. The ON function powers the ABC and re-establishes the LCD screen and LED illumination.
Firmware Update Port.....	Located under the upgrade cover, this normally covered USB-C port is where the user will insert a provided flash drive to update the ABC firmware.
System Display.....	Located below the firmware update port, this color display screen provides system and status information. The information is displayed to the user by way of graphical icons and text formats for the purpose of enhancement and added ease of readability.
Selector.....	This rotary control, with integral pushbutton, is located in front of the System Display and provides interactive capabilities to support the ABC functions. This control configures ABC operating modes and provides access to review real-time charger/battery information.
<div style="border: 2px dashed green; border-radius: 50%; padding: 10px; text-align: center;"><p>USER INTERFACE INTERACTIONS <i>(unless otherwise noted):</i></p><p>HIGHLIGHT choices by rotating the Selector.</p><p>SELECT choices by momentarily pressing and releasing the Selector.</p><p>RETURN (to the Home Screen, from a Battery Info Screen) by momentarily pressing and releasing the Selector.</p><p>ENTER MENU Screen (Section 2-6) by pressing the Selector down until the screen changes, then releasing the Selector.</p></div>	
USB Charging Ports.....	One Type C and four Type A charging ports are located on the right side of the ABC chassis, for charging smartphones and other user-selected ancillary items.

Ethernet Port..... This port is sealed with a non-removable plug and is not enabled as of the writing of this manual. It is a future charger capability. Contact Bren-Tronics for more information about this port.

Battery Adapter Ports..... There are four 27-pin electrical receptacles on the top of the charger chassis. These receptacles are the connection point for battery adapters that interface with the ABC. The four ports are designated 1 thru 4 (left to right, respectively); the various System Display screens use the port designations to identify data/information associated with that port during operation.

There is a Back Hold bracket associated with each port, where the back of an installed adapter can be secured to the ABC+ with a captive screw.

There is also a Front Hold latch that holds the front of the installed adapter in place, with a movable hold-down latch that is also an ejector lever for adapter removal. The Front Hold also contains the six LEDs (three per charging channel) that indicate the status of the charging channel in accordance with the Charging Status LED Indicators table on the Instruction Label, located on the inside of the ABC cover. (Table 5 of this user guide, below, also documents these indications).

LOCATION OF CONTROLS, INDICATIONS AND POWER CONNECTIONS

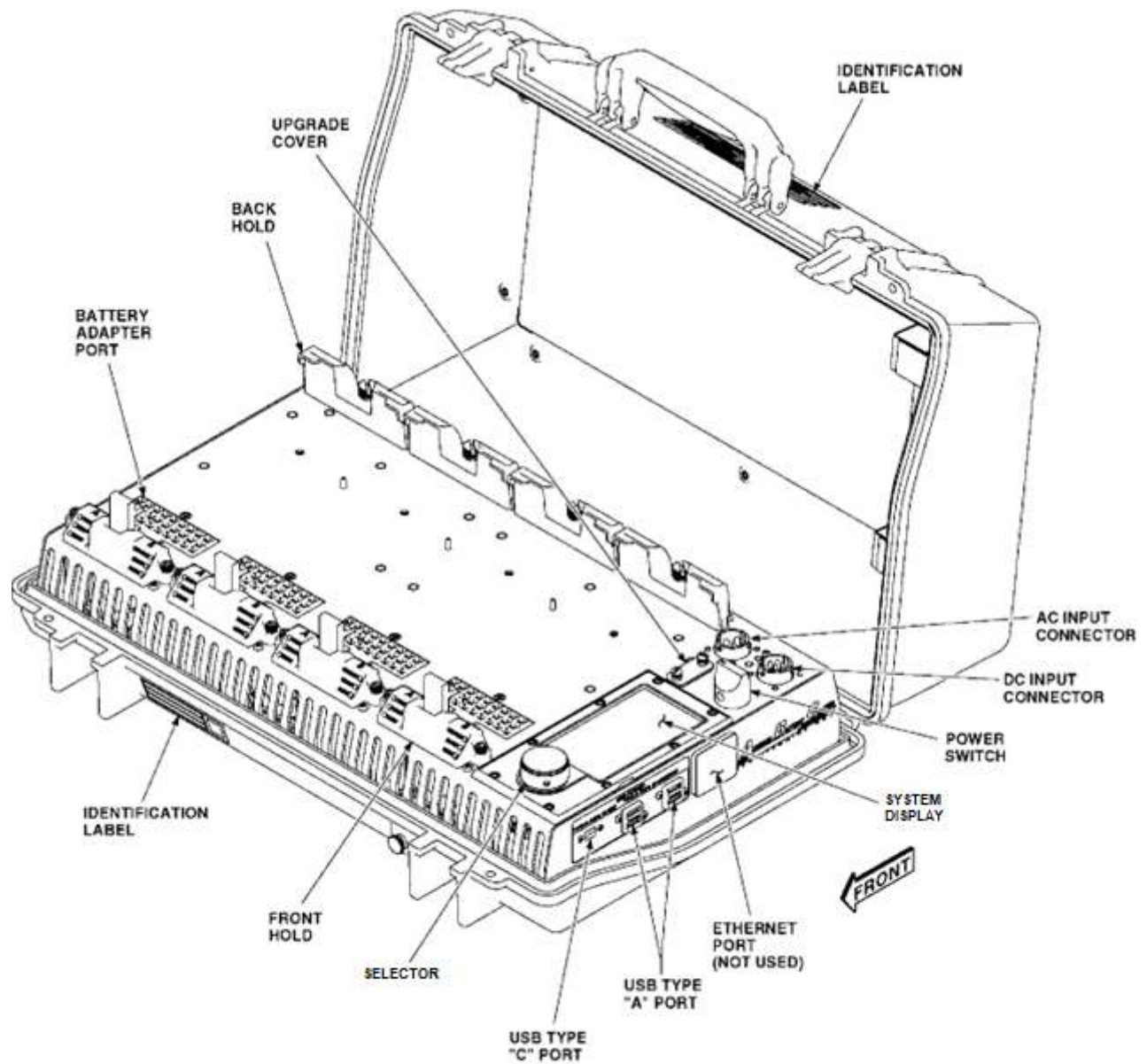


Figure 2-1.1 Controls, Indications and Power Connections

2-2 PRELIMINARY SETUP PROCEDURES

INSPECT BATTERIES FOR SERVICEABILITY

Before beginning charging operations, check batteries for serviceability. Check batteries for visual defects (swelling, leaks, and cracks).

Inspect the battery connector pins, thermal/signal contacts, and communications pins.

OPERATING THE ABC

Pre-Power On

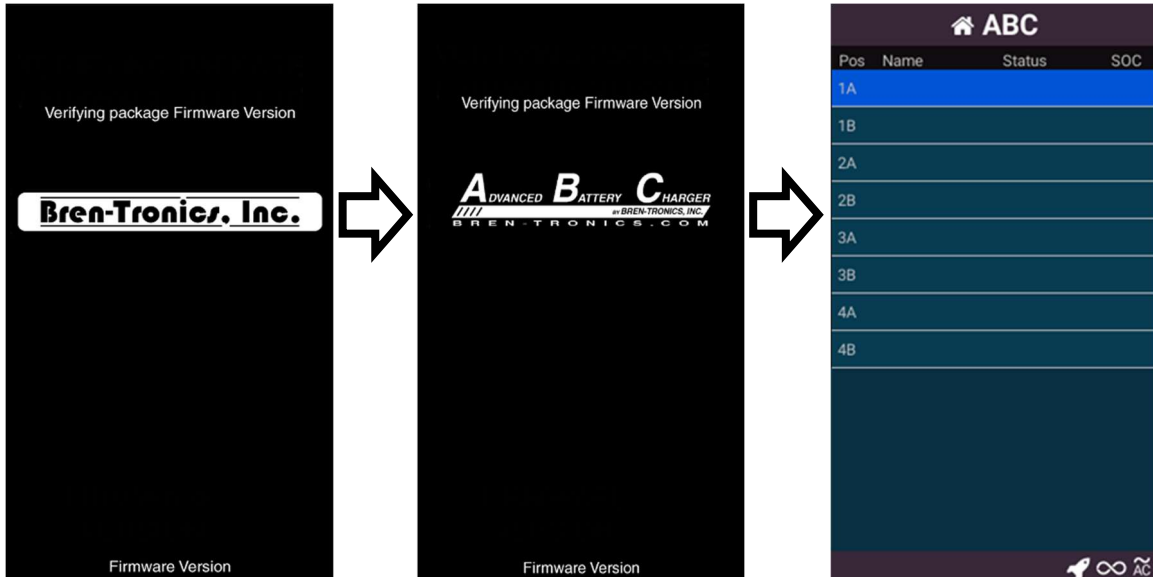
1. Prior to opening the ABC top case, rotate the pressure equalization valve 2-3 turns counterclockwise to open valve and relieve any internal pressure within the inside of the ABC.
2. Release top case latches and open top case.
3. Close pressure equalization valve by rotating valve clockwise until secured. Damage may occur to valve if Switch is overtightened.
4. Inspect ABC for damage
5. With the Power Switch set to OFF, connect the ABC to an input-power source.
6. Rotate the Power Switch to either BLACKOUT, or ON.

If the Power Switch is turned to BLACKOUT, the ABC will go through the self-test sequence, but with no visual indications.

If the Power Switch is turned to ON – the normal mode for operation - the ABC will go through the self-test sequence with visual indications, as described below.

Self-Test Sequence

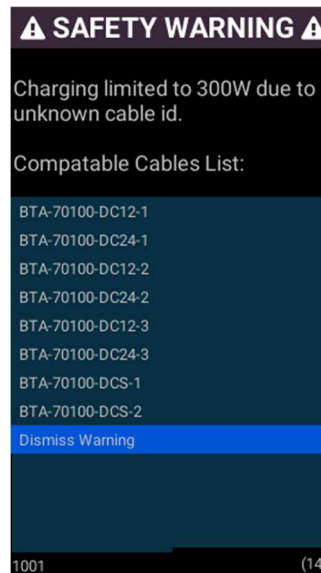
- Upon start up, the LEDs will begin their start-up sequence and the Manufacturer Splash Screen will appear on the LCD. If the ABC passes its self-test, the Product Splash Screen will appear briefly, followed by the Home Screen, as shown below.



Once the startup sequence is complete, if an adapter has been installed, the amber (CHARGE) LEDs at that adapter port will flash, indicating the ABC is waiting for a battery to be installed. If no adapter is installed, no LEDs will be displayed following the initial startup sequence. If all LEDs remain illuminated after the adapter is installed then the installed adapter is not recognized or supported by the ABC.

- During startup, the ABC does a self-check and verifies that it is connected to input power via a compatible cable, and that each PCB contains compatible programming. Should an error be found, an error or warning update request will be displayed.

The ABC also searches, during self-test, to detect if an update file (USB-C flash drive) is connected to the upgrade port.



The Home Screen will appear once the ABC has completed its self-test. If no adapters are installed, the operator will see the screen as shown below, at left. Depending on the mode of operation, various symbols will appear on the lower right corner of the ABC Home Screen. The symbols are depicted in **Table 3**.

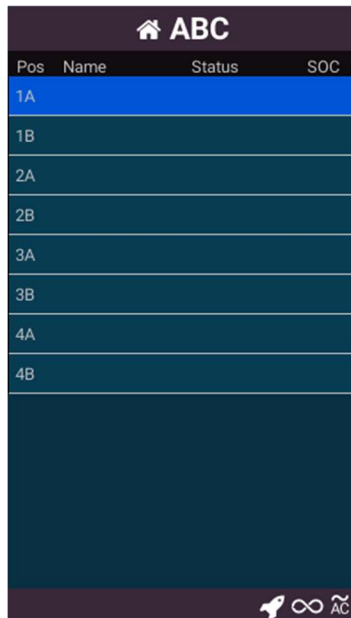


Table 3 Screen Symbols

Symbol	Name	Explanation
	DC	Identifies ABC input power source as DC
	AC	Identifies ABC input power source as AC
	Leaf	Identifies the charging mode is set for Charge for Life
	Rocket	Identifies the charging mode is set for Charge for Speed
	Infinity	Identifies the power limit is set to Unrestricted Power < 1000W
	Power Limiter	Identifies the power limit is set to Restricted Power < 300W
	USB	Identifies a device is connected to one of the USB charging ports
	MPPT	Identifies MPPT as active
	Thermometer	Indicates a battery has reached a temperature limit

3. Visually confirm the operation of the center fan. Following completion of the self-test, the center fan will continue to run until the unit is powered off. If the center fan is not operating, battery charge times will be extended as the ABC internal temperatures increase.

Basic Operating Procedures

1. There are several factory settings that can be changed depending on user requirements. Refer to **Table 4** to review factory and optional settings. These settings can be changed via the various configuration screens described in Section 2.6.

Table 4 Factory Default Settings

Title	Factory Setting	Optional Setting
Power Limit	< 1000W	< 300W to < 900W
Charge Mode	Charge for Speed	Charge for Life
Brightness	8	1 - 10
Dimming Mode: Factory - Dimming function is disabled Optional - Dimming function is enabled		

2. Select the appropriate adapter for the battery you wish to charge. The Back Hold can be re-positioned forward on the charging port to accommodate the smaller SPC adapters. Adapters can be installed in any or all four charging ports.

Slide the adapter under the top tabs on the Back Hold. Align the pins with the electrical receptacle and gently push down on the adapter until it is fully seated. A flashing amber (CHARGE) LED indicates adapter recognition, and the ABC is searching for a battery to be charged. Refer to **Table 5** (or the Instruction Label located on the inside of the ABC cover) for the Charging Status LED Indicators table.

Table 5: Charging Status LED Indicators

S = STEADY F = FLASHING RF = RAPID FLASHING			CHARGING STATUS LED INDICATORS	
AMBER	GREEN	RED	DEFINITION	REMARKS
F	F	F	CHARGER START UP	LIGHTS SCROLL MOMENTARILY
			NO ADAPTER PRESENT/ BLACKOUT	ADAPTER MUST BE INSTALLED AND FULLY SEATED
F			NO BATTERY PRESENT	AWAITING BATTERY TO BE INSTALLED
RF		*	CHARGE PREQUALIFICATION	CHECK OF BATTERY INTEGRITY/ PRE-CHARGE
S		*	FAST CHARGE IN PROGRESS	MULTIPLE BATTERIES CAN CHARGE SIMULTANEOUSLY
	F	*	TRICKLE CHARGE IN PROGRESS	BATTERY IS READY TO USE; REMOVE WHEN READY
	S	*	CHARGE IS COMPLETE	BATTERY IS READY TO USE; REMOVE WHEN READY
		S	FAULTY BATTERY: DO NOT USE	CONSULT STANDARD OPERATING PROCEDURES.
		F	CONTACT PINS ARE DIRTY OR DAMAGED	CLEAN BATTERY CONTACTS; CHECK ADAPTER PINS
S	S	S	INCOMPATIBLE BATTERY OR ADAPTER	UNSUPPORTED OR SOFTWARE UPDATE REQUIRED
RF		RF	CHARGING SUSPENDED	LEDs ALTERNATE; BATTERY AT TEMPERATURE LIMIT

* When a “Smart” battery is connected, but not communicating with the charger, the Red LED will flash and the battery is charged at a lower rate than normal to assure safe charging.

- In the photo shown at right, one BB-2590/U battery has been inserted into adapter BTA-70100-1.

The amber Front Hold LED will rapid flash indicating that battery is in pre-charge.

If the battery fails pre-charge, the red (FAULT) LED will turn on signifying a fault. The fault will remain until the removal of the failed battery.



4. Once a battery is installed, the ABC Home Page will update automatically, displaying the battery type, charging port position, charging status, and SOC as shown at right.
5. At the completion of pre-charge, the ABC will enter the battery into a fast charge. This is indicated by the Front Hold amber LED turning a steady amber (no flashing). When a “Smart” battery is connected, but not communicating with the charger, the red LED will flash and the battery is charged at a lower rate than normal to assure safe charging.

When the battery is charged above 90% capacity, it will enter the Trickle charge mode. This is indicated by the Front Hold green LED flashing and the Front Hold amber LED turning off. The ABC remains in this mode until the battery is fully charged and the Front Hold green LED turns a steady green signifying the charging is complete.

NOTE: When charging operational batteries for THHR (AN/PRC-148, AN/PRC-152, AN/PRC-153, AN/PRC-154, AN/PRQ-7), the operational battery can remain attached to the radio but the radio should be powered off to prevent possible Electromagnetic Interference (EMI).

Pos	Name	Status	SOC
1A			
1B			
2A			
2B	BB-2590	Precharge	23%
3A			
3B			
4A			
4B			

USER INTERFACE INTERACTIONS
(unless otherwise noted):

- HIGHLIGHT** choices by rotating the Selector.
- SELECT** choices by momentarily pressing and releasing the Selector.
- RETURN** (to the Home Screen, from a Battery Info Screen) by momentarily pressing and releasing the Selector.
- ENTER MENU** Screen (Section 2-6) by pressing the Selector down until the screen changes, then releasing the Selector.

6. When one or more batteries are installed, the user can view detailed battery information for any individual battery being charged. To navigate between batteries, **HIGHLIGHT** the battery of interest, as shown at right, then **SELECT** the battery to view its status.

Pos	Name	Status	SOC
1A			
1B			
2A	BB-2590	Charge	1%
2B	BB-2590	Charge	93%
3A			
3B			
4A			
4B			

The display for smart batteries (those with the ability to communicate with the ABC) and non-smart batteries differs as shown at right, for a BB-2590 smart battery and a Ni single-cell non-smart battery.

With smart batteries, State of Charge (SOC), State of Health (SOH) and Cycle Count are reported by the battery via communications.

Non-smart batteries display a SOC value that is estimated by the ABC, based upon observed voltage and delivered charge; this is indicated by a “~” symbol next to the SOC value. SOH and Cycle Count are left blank.

BATTERY INFO		
Name	BB-2590	7-10-2025
Position	2B1	
Status	Charge	
SOC	94%	
SOH	103%	
Cycle Count	10	
Power	29.96 W	
16.51 V	1.815 A	

BATTERY INFO	
Name	NiMH Cell
Position	2C3
Status	Ready
SOC	~100%
SOH	
Cycle Count	
Power	0.00 W
1.39 V	0.000 A

RETURN (to the Home Screen) when done, if desired.

The word “Fault” appearing on a Home Screen or Battery Info status line, indicates a bad battery at that adapter position.

Remove the battery to clear the fault, inspect the adapter contacts for dirt/damage and re-insert the battery into the adapter. If the fault appears a second time, the battery is defective.

ABC			
Pos	Name	Status	SOC
1A			
1B			
2A	BB-2590 NC	FAULT	~0%
2B	BB-2590	Charge	14%
3A			
3B			
4A			
4B			

BATTERY INFO	
Name	BB-2590 NC
Position	2A1
Status	FAULT
SOC	~0%
SOH	
Cycle Count	
Power	0.00 W
11.99 V	0.000 A

6. When the ABC detects that a smart battery has exceeded a cycle count of 500, or the SOH is below 80%, the Home Screen font for that battery name will change to yellow, as shown at right. **HIGHLIGHT** the battery of interest, then **SELECT** the battery to view its status on the Battery Info Screen.

The Battery Info Screen will display the yellow-triangle “attention” symbol, as shown at right, if the cycle count and/or SOH threshold has been exceeded, Warning messages at the bottom of the Battery Info Screen will also appear to call attention to these conditions.

NOTE: One cycle count is equal to one complete discharge and one complete charge of a battery. The battery SOH is a measure of the ratio of the battery’s present-day full charge capacity compared to its original full charge capacity. The units of SOH are displayed as percentage points. Typically, a battery’s SOH will be 100% at the time of manufacture and will diminish over time depending on the battery type, amount of usage, storage temperature, and age.

Pos	Name	Status	SOC
1A			
1B			
2A			
2B			
3A	BB-2590	Charge	7%
3B			
4A			
4B			

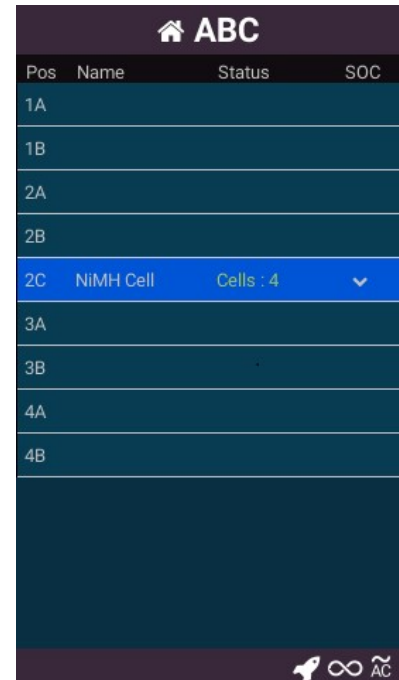
BATTERY INFO		
Name	BB-2590	4-5-2023
Position	2B1	
Status	Charge	
SOC	41%	
SOH	▲ 76%	
Cycle Count	▲ 501	
Power	107.48 W	
15.00 V	7.166 A	
▲ Cycle Count exceeds the warning threshold		

2-3 CHARGING SINGLE-CELL COMMERCIAL BATTERIES


Certain ABC adapters are designed to support both common batteries and additional single-cell commercial batteries. These adapters use a third channel, position C, to manage single-cell commercial battery charging. The display at right shows the 2C position display.

When using these adapters, the LED indicators for channel A and B (on the Front Hold) operate as previously described.

The LED indicators for position C also operate in accordance with the LED Indicators table (*Table 5 above, and on the Instruction Label located on the inside of the ABC cover*), but are located on the adapter itself.



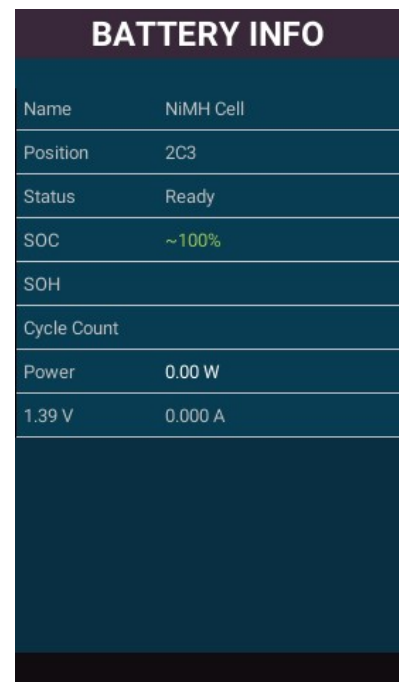
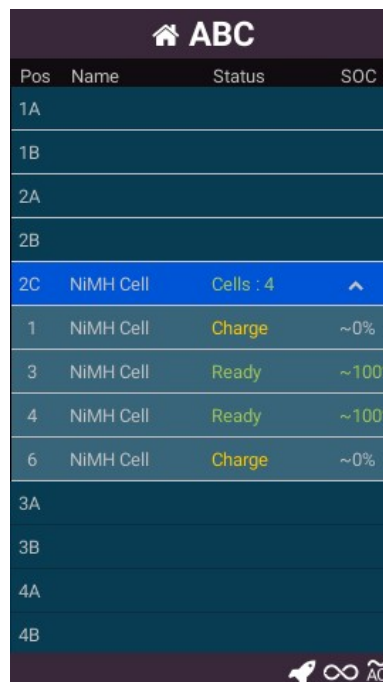
As single-cell batteries are inserted, the chemistry and number of cells inserted in the adapter are displayed. In the example above, at far right, 4 cells have been inserted at position 2C.

NOTE: The  symbol indicates that more information is available via a sub menu.

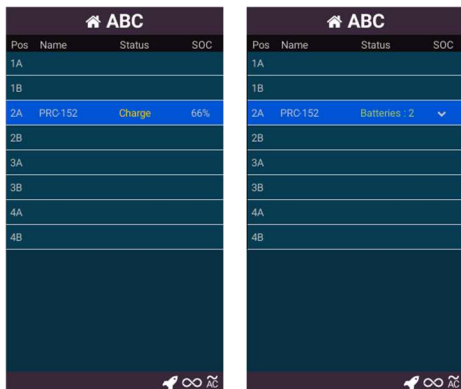
HIGHLIGHT the position, and then **SELECT** to expand the sub menu. That sub menu is shown at right in expanded form, displaying the status and estimated SOC of each of the four cells.

To view charging information for an individual cell, **HIGHLIGHT** and **SELECT** the individual cell in the sub-menu to display the Battery Info Screen for that cell, as shown at the far right.

(Note the “~” that is added as a prefix to the SOC values, indicating that the values are estimated for these “non-smart” cells.)



2-4 CHARGING WITH QUAD ADAPTERS

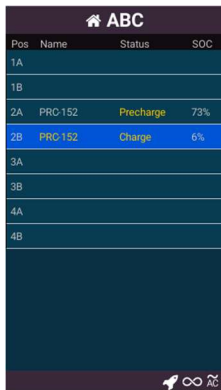


When using a quad adapter, placing a single battery in a position will provide the same display indications as a standard adapter, as shown at far left. **HIGHLIGHT** the battery of interest, then **SELECT** the battery to view its status on the Battery Info Screen as described earlier for standard adapters.



However, when more than one battery is placed on the “A” or “B” channel, the Home screen shows the number of batteries and the sub menu arrow, as shown at above-left with the batteries in positions A1 and A2.

HIGHLIGHT the position of interest, then **SELECT** to expand the sub menu and view the status of each battery at the position (as shown at far left).



To view charging information for an individual cell, **HIGHLIGHT** and **SELECT** the individual cell in the sub-menu to display the Battery Info screen for that cell, as shown at far right.

NOTE: When charging two batteries in a quad adapter, using A1 and B1 (as shown in the photo at far left) is faster than using A1 and A2, or B1 and B2. They will also be displayed on separate lines on the display.

On quad adapters, the charging of those batteries in each channel is done with the same voltage source. Therefore, similar batteries will be charged in parallel and dissimilar batteries will be time managed to charge separately

Because the batteries are being charged together, if the number of batteries changes during a charge, the charge cycle for that voltage source “#Ax” or “#Bx” will start over.

2-5 SHUTDOWN PROCEDURES

Shutdown

1. Turn Power Switch off.
2. Turn AC or DC power source off.
3. Disconnect AC or DC input cables. Secure AC input cables inside of top case and stow DC input cables accordingly.

CAUTION

Do not attempt to remove the adapter by pulling upward from the rear. Doing so will cause damage to the equipment.

4. To avoid damage to the adapter or ABC front panel connectors, always remove the adapter by grasping the front section finger-grips firmly with one hand while moving the front hold ejector lever with the other. Lift the front of the adapter straight up from the ABC.
5. Perform general cleaning with wiping rag and glass cleaner, if needed.
6. Reinstall the top case if previously removed.
7. Close top case.
8. Secure latches.

2-6 INFORMATION AND CONFIGURATION

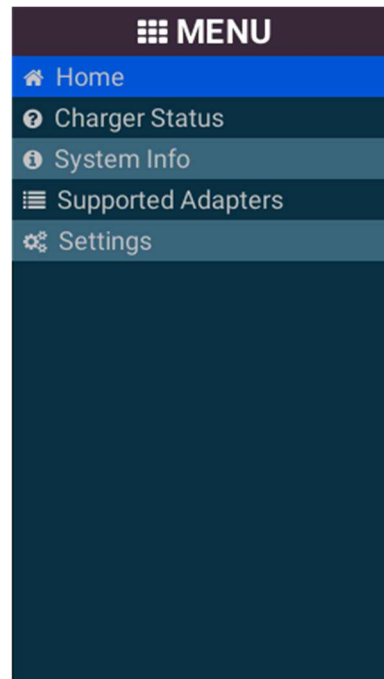
Menu Screen

Additional system-level information, and configuration settings, can be accessed by entering the Menu Screen. From the Menu Screen the user can return to the Home Screen, view Charger Status, System Information, Supported Adapters, and Settings. At any time from the Home Screen, its sub menus, or Battery Info Screen, the user may **ENTER MENU** by pressing the Selector down until the screen changes, then releasing the Selector.

To move past the Menu Screen, either back to the Home Screen or to one of the other screens listed, **HIGHLIGHT** and **SELECT** one of the choices.

To return to the Menu Screen from any of the screens below, **HIGHLIGHT** and **SELECT** Previous Screen, or press and hold the Selector to **ENTER MENU**.

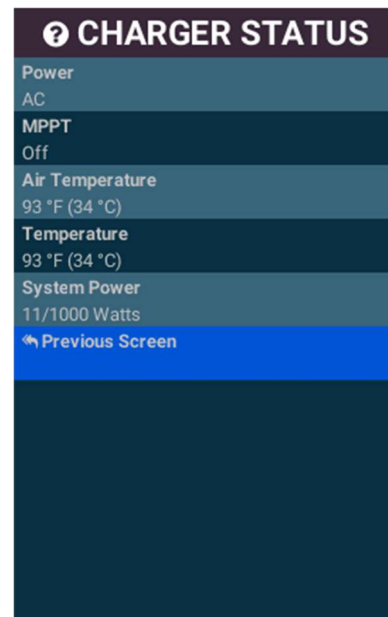
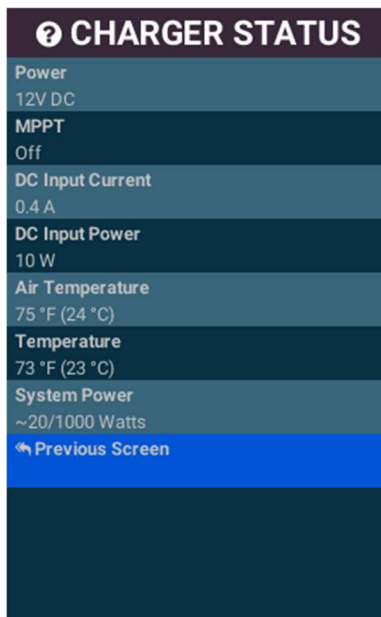
NOTE: in the following screens, the greater-than (>) symbol indicates that a sub menu is available for viewing. **HIGHLIGHT** and **SELECT** the line with the > symbol to expand the sub menu for access.



Charger Status

The Charger Status Screen identifies to the user:

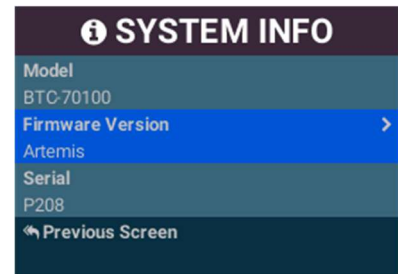
- Power source (AC / DC) in use.
- MPPT (Maximum Power Point Tracking) status.
- DC input current (if operating on DC).
- DC input power (if operating on DC).
- The internal ambient-air temperature of the ABC.
- PCB temperature.
- Current system power consumption / available power.



System Info

From the Menu Screen, **HIGHLIGHT** and **SELECT** System Info.

The System Info Screen displays the ABC model number, system firmware version, and ABC's serial number



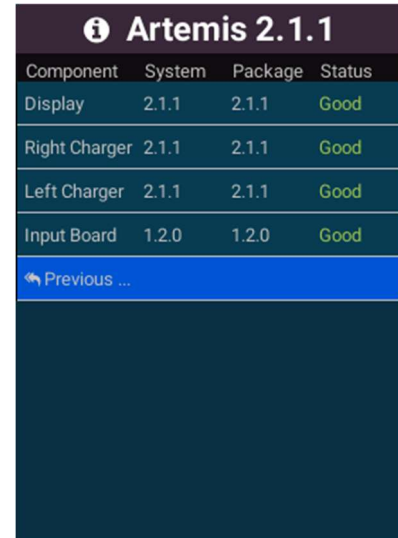
Firmware Version Sub Menu

From the System Info Screen, **HIGHLIGHT** and **SELECT** Firmware Version to enter the Firmware Version sub menu.

This sub menu displays the name and revision of the currently-downloaded unit firmware package at the top, the version number of each individual firmware element in the package, and the version numbers of each firmware element installed in the processors of the ABC.

This information is used during firmware upgrades, to verify a proper installation of the upgrade. Name and version numbers change with succeeding upgrades.

NOTE: When the user is within a sub menu, the user can directly return to the Menu Screen via **ENTER MENU**. **HIGHLIGHT** and **SELECT** Previous Screen to move back to the screen last accessed (in this example, System Info).



Supported Adapters

From the Menu Screen, **HIGHLIGHT** and **SELECT** Supported Adapters. The available adapters that are compatible with the ABC will be displayed.

Rotate the selector to scroll up and down the list, to check if a particular adapter is supported by the ABC. Scrolling is used to accommodate the entire, extensive list of adapters supported by the ABC.

Consult Bren-Tronics if that adapter is not found on the list, to check if there are firmware upgrades that will enable support of that adapter on the ABC, or if there is another, compatible adapter available.

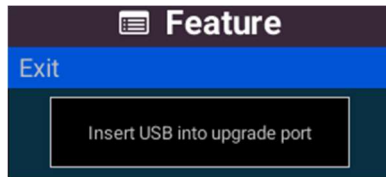


Settings Screen

From the Menu Screen, **HIGHLIGHT** and **SELECT** Settings. The Settings Screen provides access to the various configuration settings of the ABC. To choose within each option, **HIGHLIGHT** and **SELECT** the option to access its sub menus.

Feature Update

From the Settings Screen, **HIGHLIGHT** and **SELECT** Feature Update. The Feature Update screen below will appear. This screen is used to enable any charger features authorized for upgrade by Bren-Tronics. Follow the screen prompts.



LED Warnings Sub Menu Screen

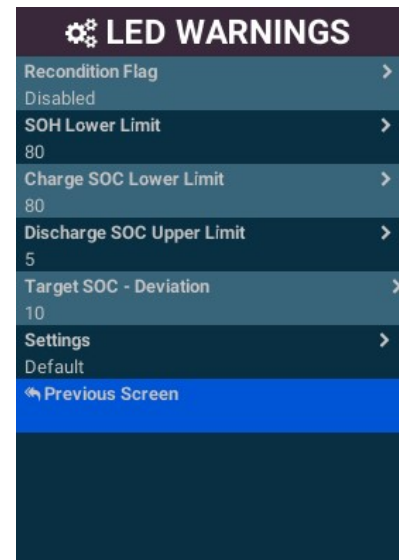
The ABC can be configured – with or without the Discharge Adapter installed – so that the red (FAULT) front-panel LED associated with any adapter position where a “smart” (BMS/communication equipped) battery is present will indicate the presence of a problem condition in that battery.

When a warning is initiated (at the end of a Charge, Discharge* or Target SOC* process), the red (FAULT) front-panel LED at the adapter position where the problem battery is located will fade in and out. In addition, the condition that initiated the warning is displayed at the bottom of the Battery Info screen. (If there are multiple warnings, the display will display each warning at two-second intervals on the screen.)

The conditions/levels that produce a warning are user-configurable. First, from the Settings Screen, **HIGHLIGHT** and **SELECT** the LED Warnings sub menu.

Then, **HIGHLIGHT** and **SELECT** the particular parameter to open its sub menu and access the available choices. **HIGHLIGHT** and **SELECT** your choice; this will update the parameter and return the ABC to the LED Warnings sub menu.

(ENTER MENU from any parameter-choice screen will return the ABC to the Menu Screen, without changing the parameter.)



The warnings are based upon the SOH, SOC, and Cycle Count transmitted by the battery at the end of the above processes, and/or when a battery requests a reconditioning cycle be applied to it. (Warnings will not be generated for batteries that do not have communications capability.)

The following configuration settings are available from this screen:

- **Recondition Flag** – warning is generated if the battery’s recondition flag is set.
- **SOH Lower Limit** – warning is generated if SOH is less than this value.
- **Charge SOC Lower Limit** – warning is generated if SOC is less than this value at end-of-charge.
- **Discharge* SOC Upper Limit** – only used when a BTF-70100-2 Discharge Adapter is connected to the ABC; see the 850240 user guide for details.
- **Target SOC* +/- Deviation** – only used when a BTF-70100-2 Discharge Adapter is connected to the ABC; see the 850240 user guide for details.
- **Settings** – Displays DEFAULT when all LED Warnings settings are at their factory-default values. Displays CUSTOM if any settings differ from factory-default.

(* This operating mode is only active when a BTF-70100-2 Discharge Adapter is installed.)

Network

Feature not enabled at present time; reserved for future use with Ethernet port.

Discharger

This selection is used when a BTF-70100-2 Discharge Adapter is installed; refer to the BTF-70100-2 User Guide (Bren-Tronics document number 850240) for guidance on installation, configuration, and use.

Power Limit Sub Menu Screen

From the Settings Screen, **HIGHLIGHT** and **SELECT** Power Limit. This screen allows the user (in increments of 100W) to set the ABC total output-power limit.

HIGHLIGHT and **SELECT** your choice; this will update the setting and automatically return the ABC to the Settings Screen.

This setting is useful to prevent overloading portable generators, DC vehicle power buses, or other limited-output-power sources. The trade-off with limiting power is longer charge times, since there is less charging power available.

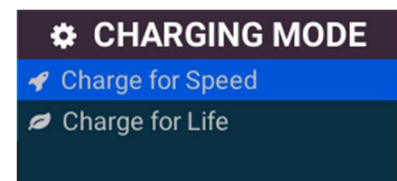


Charging Mode Sub Menu Screen

From the Settings Screen, **HIGHLIGHT** and **SELECT** Charging Mode.

There are two charging modes, Charge for Speed (fastest charge) and Charge for Life (to maximize battery lifetime). Charging modes are described in Section 1-1.

HIGHLIGHT and **SELECT** your choice; this will automatically update the setting and return the ABC to the Settings Screen.



(ENTER MENU from any parameter-choice screen will return the ABC to the Menu Screen, without changing the parameter.)

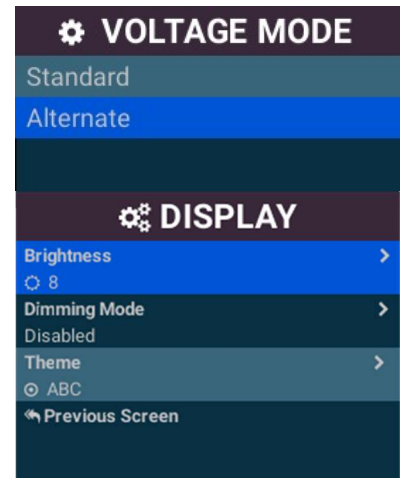
Default Voltage Mode Sub Menu Screen

From the Settings Screen, **HIGHLIGHT** and **SELECT** Default Voltage Mode. There are two choices: Standard and Alternate.

This function is not supported at this time on the ABC. *(it is supported on the higher-power ABC+ charger, to accommodate the alternative charge-voltage choices for vehicle batteries).* Selecting either choice does not affect ABC operation and returns to the Settings Screen.

Display Sub Menu Screen

From the Settings Screen, **HIGHLIGHT** and **SELECT** Display. This selection accesses three sub-menus – Brightness, Dimming Mode, and Theme, as shown at right.



Brightness Sub Menu Screen

From the Display sub menu, **HIGHLIGHT** and **SELECT** Brightness to adjust the ABC screen intensity from 1 (Lowest) to 10 (Brightest). The default setting is 8. Selection will automatically update the setting and return the ABC to the Display sub menu.



Dimming Mode Sub Menu Screen

From the Display sub menu, **HIGHLIGHT** and **SELECT** Dimming Mode to enable or disable the dimming function of the ABC LCD. Selection will automatically update the setting and return the ABC to the Display sub menu.

This operates like a computer screensaver. If no user interaction – moving the Selector, installing a battery - occurs for more than one minute while in Dimming Mode, the System Display will dim and then blackout. The LEDs stay active. The System Display will be restored if the Selector is moved or a battery is installed.



Theme Sub Menu Screen

From the Display sub menu, **HIGHLIGHT** and **SELECT** Theme, to select the theme (color scheme) preferred by the user. Selection will automatically update the setting and return the ABC to the Display sub menu.

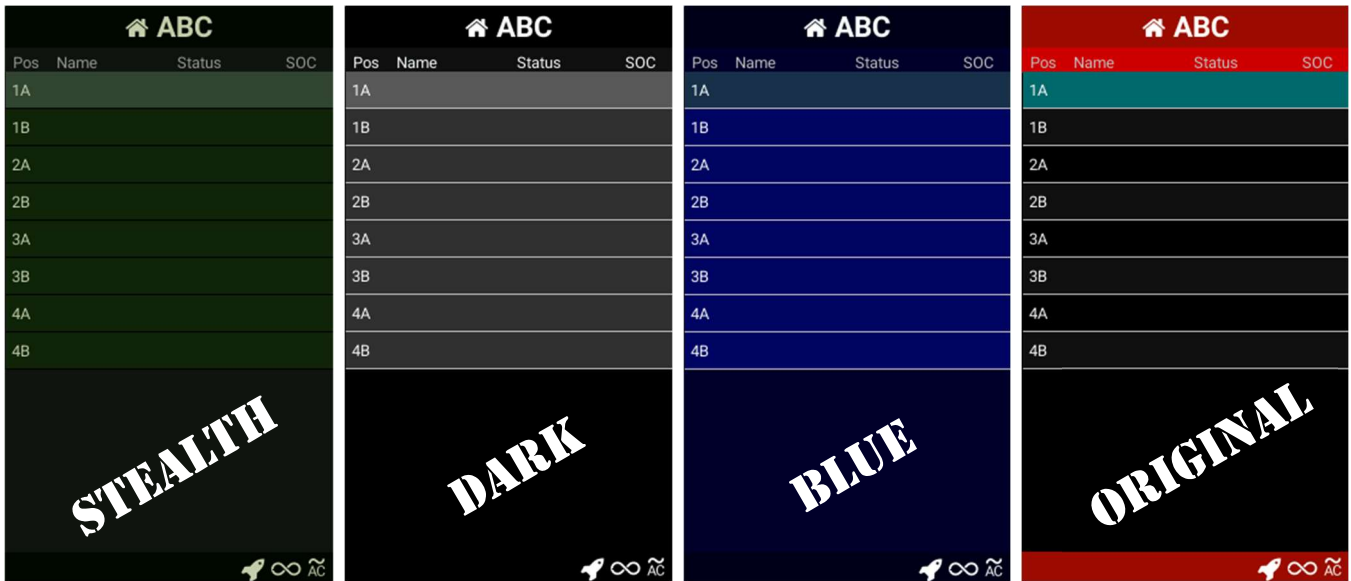
NOTE: changing the theme will initiate a system restart, as though the power was just turned on. The display will cycle through the splash screens, back to the Home Screen (in the new theme).



The theme choices are shown on the next page.

(ENTER MENU from any parameter-choice screen will return the ABC to the Menu Screen, without changing the parameter.)

ABC Display Themes.



Settings (Factory Default) Sub Menu Screen

From the Settings Screen, **HIGHLIGHT** and **SELECT** Settings.

Then, **HIGHLIGHT** and **SELECT** YES to restore the factory-default settings listed in Table 4 (in Section 2.2 of this user guide), or **NO** to keep the current settings.

Selection will automatically update the setting and return the ABC to the Settings Screen.

NOTE: Any changes to factory setting will remain regardless of updates, unless the user makes the change.



2-7 SOLID RED LED TROUBLE SHOOTING

1. Remove battery and inspect all contacts. Clean if necessary. Then, reinstall at same location for another charge cycle. Note battery and adapter location for later review.
2. If charge indications go "red" again at the same location remove battery and do the following:
 - a. If the battery was in storage see para 2-13.
 - b. Check battery: older than 3 yrs? Maybe ready for disposal. Discharge & recharge.
 - c. IF RED AGAIN check warranty instructions on battery. If not covered or no instructions, dispose of.
 - d. Note success/failure of future battery charges at this location. More "RED" lights? Change adapter.

2-8 FLASHING RED LED TROUBLE SHOOTING

1. This condition is telling you that some of the battery contacts are not connecting to the charger.
 - a. For BB-390B/U and other nickel-chemistry batteries the thermal contacts are not making contact with the charger.
 - b. For BB-2590/U and other smart batteries the communication pin(s) are not making contact with the charger.
2. To minimize this issue before you first start using the charger, ensure that
 - a. The contacts are clean on the battery.
 - b. Adapter pins are in place and retain their spring action: Check by pushing down the pins and releasing.
3. You can still charge batteries with thermal/communication pins missing or damaged, it will just take longer, and the battery may not fully charge in one cycle.
4. If flashing "red" condition persists after this check, mark location of condition and battery affected.
 - a. You can pull batteries and clean thermal contacts on the battery.
 - b. Check adapters again. Mark for future review, if a continuing problem at this location: change adapter.

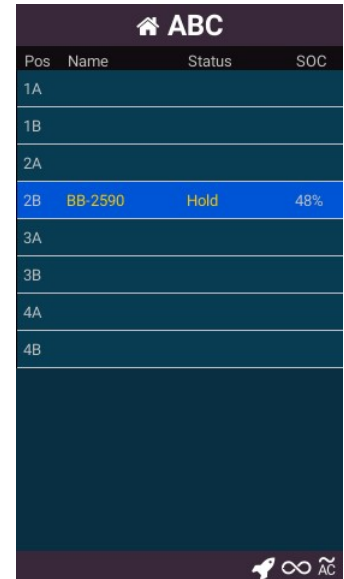
2-9 OPERATION IN EXTREME ENVIRONMENTAL CONDITIONS

Operation in Extreme Heat and Cold

The ABC is designed for operation in ambient temperatures between -25°F (-32°C) and 131°F (55°C).

If operating at extreme temperatures, the ABC may experience shut down, restarts, or other faults due to icing, heavy condensation, or temperature fault in the described condition. If such faults are experienced, the ABC must be turned off, all input power must be disconnected, and the ABC must be moved to a more suitable temperate environment, allowing all parts to reach normal operating temperature before attempting to power on again.

If a battery is outside of its charging temperature threshold, the battery name will change to yellow with a Hold indication for its charger status on the Home Screen, as shown at right.

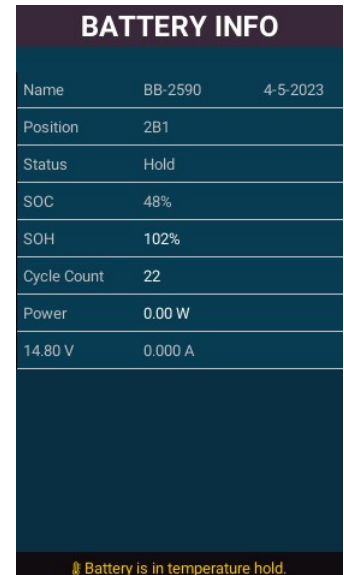


The screenshot shows the Home Screen of the ABC system. At the top, there is a header with a home icon and the text 'ABC'. Below this is a table with four columns: 'Pos', 'Name', 'Status', and 'SOC'. The table lists several battery positions: 1A, 1B, 2A, 2B, 3A, 3B, 4A, and 4B. The row for position 2B is highlighted in blue and shows the name 'BB-2590', the status 'Hold', and the SOC '48%'. At the bottom of the screen, there are icons for a signal strength indicator, a Wi-Fi icon, and an AC power icon.

Pos	Name	Status	SOC
1A			
1B			
2A			
2B	BB-2590	Hold	48%
3A			
3B			
4A			
4B			

Accessing the Battery Info Screen will show the thermometer symbol and an indication that the battery is in temperature hold.

NOTE: optimal battery charging temperatures are between 40°F (4°C) and 80°F (27°C). Charging at lower temperatures is permitted, but may result in longer charge times.



The screenshot shows the Battery Info screen. At the top, there is a header with the text 'BATTERY INFO'. Below this is a table with two columns: 'Name' and 'Value'. The table lists various battery parameters: Name (BB-2590, 4-5-2023), Position (2B1), Status (Hold), SOC (48%), SOH (102%), Cycle Count (22), Power (0.00 W), and 14.80 V (0.000 A). At the bottom of the screen, there is a yellow warning message: 'Battery is in temperature hold.'

Name	Value
Name	BB-2590 4-5-2023
Position	2B1
Status	Hold
SOC	48%
SOH	102%
Cycle Count	22
Power	0.00 W
14.80 V	0.000 A

Moisture and Humidity

The ABC is designed to run without damage when operated in an environment up to 95% non-condensing relative humidity at 120°F (49°C).

In high moisture and humidity conditions, the ABC may experience shut downs, restarts, or other faults related to moisture coming in contact with sensitive electronics.

If any conditions described in the prior paragraph are experienced, the ABC must be turned off, all input power must be immediately disconnected, and the ABC must be fully dried. Prior to resuming normal operation, the ABC must successfully pass the appropriate basic functional test (AC or DC) in Section 3.2.

Salt Environment

The ABC is designed to be corrosion resistant in its transportation configuration. If exposed to a salty environment, all traces of salt must be removed from all affected components of the ABC. Clean all affected components with a bristle brush and distilled water. After cleaning, the affected components may be wiped with a clean dry rag and must be allowed to fully dry. Prior to resuming normal operation, the ABC must successfully pass the appropriate basic functional test (AC or DC) in Section 3.2.

Sand and Dust

The system is designed to operate in sandy and dusty environments. However, in extreme cases, the ABC may experience shut down, restarts or other faults related to sand and dust. If such faults occur, the ABC must be turned off and all input power must be immediately disconnected. The ABC must be cleaned so all signs of sand and dust have been removed using dry low pressure shop air. Prior to resuming normal operation, the ABC must successfully pass the appropriate basic functional test (AC or DC) in Section 3.2.

High Altitudes

The ABC is designed to operate at temperatures from -4°F (-20°C) to 95°F (35°C) up to 10,000 feet above sea level.

2-10 PREPARATION FOR MOVEMENT

PRE-TRANSPORTATION

Table 6 Pre-Transportation Inspection

Item	Inspection
Equipment Exterior	Visually inspect equipment exterior for scratches, cracks, loose and/or missing hardware.
Chassis	Ensure that chassis is free from scratches and that switch and/or control placarding is legible. Also inspect for damage to LED display. Check for loose or missing screws.
Controls	Check all switches and controls for proper mechanical actuation/operation. In addition, ensure that all switches and controls are secure. Check that the Front Hold ejector tabs function correctly.
Cables	Inspect cables for any signs of cracked, worn, or deteriorated insulation and/or damaged, frayed, or bare wiring.
Electrical Connectors	Inspect electrical connectors for loose or bent, recessed, or missing contacts. Also inspect for damaged insulation and/or frayed wiring.
Identification Plate	Ensure that identification plate is secure and legible.

PREPARATION FOR MOVEMENT

1. Ensure Power Switch is off.
2. Remove battery(s) from adapter(s).
3. Turn off AC or DC power source.
4. Remove AC or DC Input cable.
5. Secure AC input cable in Top Case Hook and Loop straps, if applicable.
6. If Top Case was removed, install Hinge Pins.
7. Wipe down ABC with soft rag and glass cleaner, if necessary.
8. Close Top Case.
9. Secure Top Case latches.
10. Ensure Pressure Equalization Valve is closed.

2-11 BATTERY STATE-OF-CHARGE DISPLAYS

Batteries equipped with state-of-charge (SOC) displays typically indicate battery charge status on a five-segment LCD bar graph readout. The number of LCD segments activated corresponds to the battery state-of-charge as follows:

<u>Segments</u>	<u>State-of-Charge</u>
0	0% (fully discharged)
1	1 to 20%
2	21 to 40%
3	41 to 60%
4	61 to 80%
5	81 to 100% (fully charged)

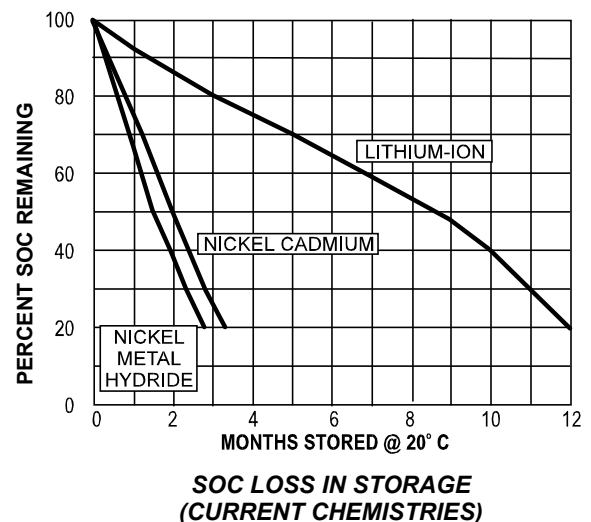
NOTE: The BB-390A/U, BB-390B/U and BB-2590/U batteries have two SOC indicators. Each SOC indicator provides state-of-charge indication for each of the two 12V sections. Both SOC's must display 100% for the battery to be fully charged.

2-12 BATTERY STATE-OF-CHARGE (SOC) RETENTION

As shown in the adjoining graph, fully charged batteries that are stored inherently lose a portion of their charge over time. This is normal and should not be interpreted as battery failure.

Storage at higher temperatures increases the rate of SOC loss, while storage at lower temperatures decrease the rate.

The graph shows that Nickel based batteries like the BB-390B/U lose over 30% charge/month (1%/day) on the shelf waiting to be used. The BB-2590/U (a Li-Ion based battery) loses less than 10% a month on the shelf.



2-13 BATTERY STORAGE

Nickel based batteries may require one or more charge/discharge cycles after a long period of storage. They may not charge fully on the first charge cycle. Repeat the charge if necessary. If the battery does not fully charge after three cycles it may no longer be serviceable.

Lithium based batteries must be charged yearly if held in storage. Long term storage of fully discharged Lithium based batteries can permanently damage the battery. They do not require charge/discharge cycling after storage. If the battery does not charge (no SOC Bars), place it back on the charger for an additional charge cycle. It is not necessary to discharge it first. If the battery does not fully charge it may no longer be serviceable.

Type-specific maintenance-charge specifications for any particular battery, if they exist, supersede the above guidelines.

3 OPERATOR MAINTENANCE INSTRUCTIONS

3-1 INTRODUCTION

Routine Checks

Routine maintenance like cleaning, dusting, washing, checking for loose and/or chipped paint, storing items not in use and checking for loose nuts, bolts, and screws are not listed as Preventive Maintenance Checks and Services. They are tasks that should be performed anytime they are needed.

Continuous Operation

If the ABC must be kept in continuous operation, check and service those items that can be checked and serviced without disturbing operation. Make all other checks and services when the ABC can be shut down.

Care and Handling

Every effort should be made to protect the equipment from weather elements, oil, grease and acid. When available, an environmentally controlled building should be used to store equipment. Equipment shall be stored in a dry, well-ventilated location and protected from pilferage, dampness, fire, dirt, insects, rodents, and direct sunlight.

Cleaning

Step 1 - Use bristle brush to loosen dirt and dust from the ABC. Low-pressure air may be used to remove heavy dust from the case, connectors, and user interface. Avoid blowing dust into the ABC. Low- pressure air may be blown into the front and rear air vents to help remove internal dust.

Step 2 - Wipe all surfaces, including the window display, with a damp (not wet) wiping rag. Glass cleaner may be used.

Step 3 - The adapter port receptacles may be cleaned with isopropyl alcohol and an acid swab brush. Allow the cleaner to dry before installing the adapters or applying power to the charger.

3-2 BASIC FUNCTIONAL TEST

AC Operation

- Step 1: Connect the AC Input cable to the ABC Input connector. No adapters should be installed at this time.
- Step 2: Connect AC Input Power cable to a known power source.
- Step 3: Turn the Power Switch to the ON position.
- Step 4: Visually confirm the LEDs go through their start up sequence.
- Step 5: Visually confirm that no “mismatch” warning appears on the LCD screen. This may appear if a PCB was installed that contained a different firmware revision level. If the warning appears, update the ABC to test the latest revision and continue.
- Step 6: **ENTER MENU**, then **HIGHLIGHT** and **SELECT** Settings.
- Step 7: From the Settings Menu, **HIGHLIGHT** and **SELECT** Settings, then **HIGHLIGHT** and **SELECT** YES to restore the factory-default settings (per Table 4 of Section 2.2).
- Step 8: **ENTER MENU**, then **HIGHLIGHT** and **SELECT** Home.
- Step 9: At the bottom right-hand corner of the Home Screen, confirm that the following symbols appear:
- Rocket (Charge for Speed)
 - Infinity (Unrestricted Power)
 - AC
- Step 10: Install adapter BTA-70100-1 in all four charging ports.
- Step 11: Visually confirm that the amber (CHARGE) LEDs are flashing in all adapter positions.
- Step 12: Turn the Power Switch to the Blackout position.
- Step 13: Visually confirm that the LCD screen and all LEDs are no longer illuminated.
- Step 14: Turn the Power Switch back to the ON position.
- Step 15: Visually confirm that the flashing (CHARGE) LEDs and LCD screen are again illuminated.
- Step 16: Insert two fully discharged BB-2590/U batteries into the adapter on charging port 1.
- Step 17: Visually confirm that the amber CHARGE LEDs for charging port 1 positions A and B go from flashing to rapid flashing.
- Step 18: Visually confirm that the center fan is running.
- Step 19: Insert six additional BB-2590/U batteries into the adapters on charging ports 2, 3, 4.
- Step 20: All amber (CHARGE) LEDs should be rapidly flashing.
- Step 21: Visually confirm that the three front fans are running.
- Step 22: From the Home Screen, **HIGHLIGHT** and **SELECT** each adapter position, to view the Battery Info screen for each battery and confirm that SOC and SOH are displayed.
- Step 23: Turn off the ABC and remove the AC power cable. Adapters can be removed or remain stored in the ABC.

DC Operation

- Step 1: Connect a 24V DC power cable to the ABC.
- Step 2: Connect the DC Power Cable to a 24V, 50A DC power source.
- Step 3: Turn the Power Switch to the ON position.
- Step 4: Visually confirm the LEDs go through their start up sequence.
- Step 5: Visually confirm that no “mismatch” warning appears on the LCD screen. This may appear if a PCB was installed that contained a different firmware revision level. If the warning appears, update the ABC to test the latest revision and continue.
- Step 6: **ENTER MENU**, then **HIGHLIGHT** and **SELECT** Settings.
- Step 7: From the Settings Menu, **HIGHLIGHT** and **SELECT** Settings, then **HIGHLIGHT** and **SELECT** YES to restore the factory-default settings (per Table 4 of Section 2.2).
- Step 8: **ENTER MENU**, then **HIGHLIGHT** and **SELECT** Home
- Step 9: At the bottom right-hand corner of the Home Screen, confirm that the following symbols appear:
 - Rocket (Charge for Speed)
 - Infinity (Unrestricted Power)
 - DC
- Step 10: Install adapter BTA-70100-1 in all four charging ports.
- Step 11: Visually confirm that the amber (CHARGE) LEDs are flashing in all adapter positions.
- Step 12: Turn the Power Switch to the Blackout position.
- Step 13: Visually confirm that the LCD screen and all LEDs are no longer illuminated.
- Step 14: Turn the Power Switch back to the ON position.
- Step 15: Visually confirm that the flashing (CHARGE) LEDs and LCD screen are again illuminated.
- Step 16: Insert two fully discharged BB-2590/U batteries into the adapter on charging port 1.
- Step 17: Visually confirm that the amber (CHARGE) LEDs for charging port 1 positions A and B go from flashing to rapid flashing.
- Step 18: Visually confirm that the center fan is running.
- Step 19: Insert six additional BB-2590/U batteries into the adapters on charging ports 2, 3, 4.
- Step 20: All amber (CHARGE) LEDs should be rapidly flashing.
- Step 21: Visually confirm that the left and right side front fans alternate on and off. The center front fan will always be running.
- Step 22: From the Home Screen, **HIGHLIGHT** and **SELECT** each adapter position, to view the Battery Info screen for each battery and confirm that SOC and SOH are displayed.
- Step 23: Turn off the ABC and remove the DC power cable. Adapters can be removed or remain stored in the ABC.

3-3 SIMPLIFIED OPERATOR TROUBLESHOOTING PROCEDURES

Table 7 provides a troubleshooting guide to the Organizational level.

Table 7 Operator Troubleshooting

ITEM	MALFUNCTION	POSSIBLE CORRECTIVE ACTION	Yes:	No:
1	With Power Switch set to ON, ABC does not power up when connected to an AC power source.	1.1. Ensure AC power source is powered on. Is AC source voltage available at output (110 or 220 Vac)?	Go to Step 1.3.	Go to Step 1.2.
		1.2. Locate serviceable AC power source. Check for AC power at source outlet.	Troubleshooting complete. Return ABC to service.	-
		1.3. Disconnect AC input cable from ABC. Plug AC input cable into AC power source outlet. Measure voltage at AC input cable connector end, pins 1 (line) and 2 (neutral). Is source voltage measured at connector, 110 or 220Vac?	Turn AC power source off and connect AC input cable to ABC. Go to Step 1.4.	Replace AC input cable or input adapter cable (for 220 Vac use) with a known serviceable cable. Go to Step 1.4.
		1.4. Turn AC power source on. Turn ABC on. Does ABC turn on?	Troubleshooting complete.	Turn ABC off and disconnect AC power source. Contact Bren-Tronics Customer Service for return procedure.

ITEM	MALFUNCTION	POSSIBLE CORRECTIVE ACTION	Yes:	No:
2	ABC does not power up when connected to external DC power.	2.1. Turn on external DC power source. Is DC source voltage at a level compatible with the DC cable being used (12V, 24V) available at outlet?	Go to Step 2.3.	Go to Step 2.2.
		2.2. Locate serviceable DC power source. Check for DC power at source outlet.	Troubleshooting complete. Return ABC to service.	-
		2.3. Plug DC input cable into DC power source outlet. Turn on DC power source. Measure for source voltage at DC input cable connector end. Pins 1 and 2 are positive, Pins 3 and 4 are negative.	Turn DC power source off and connect DC input cable to ABC. Go to Step 2.4.	Turn ABC off and disconnect DC power. Replace DC input power cable. Go to Step 2.4.
		2.4. Turn DC power source on. Turn ABC on. Does ABC turn on?	Troubleshooting complete.	Turn ABC off and disconnect DC power source. Contact Bren-Tronics Customer Service for return procedure.

ITEM	MALFUNCTION	POSSIBLE CORRECTIVE ACTION	Yes:	No:
3	One or more of the LED charging status displays do not light during self-test sequence.	3.1. Is Power Switch in the BLACKOUT position?	Turn Power Switch to OFF. Go to Step 3.2.	Go to Step 3.3.
		3.2. Connect ABC to power source, if applicable. Turn ABC on. Does ABC go through self-test sequence?	Troubleshooting complete. Return to service.	Go to Step 3.3.
		3.3. Turn ABC off and disconnect power source. Remove affected front hold. Remove, inspect and reseat electrical connection. Connect ABC to power source. Turn ABC on. Does ABC go through self-test sequence?	Troubleshooting complete. Secure ABC and return to service.	Go to Step 3.4.
		3.4. Turn ABC off and disconnect power source. Replace all affected front holds with known serviceable front holds. Connect ABC to power source. Turn ABC on. Does ABC go through self-test sequence?	Troubleshooting complete. Secure ABC and return to service.	Turn ABC off and disconnect power source. Contact Bren-Tronics Customer Service for return procedure.
4	All LEDs light and stay lit after the ABC is turned on.	This is an indication that the ABC has lost programming. Perform the firmware update procedure (Section 3.5). Turn ABC on. Do all LEDs go through self-test sequence?	Troubleshooting complete. Perform basic operational test, this WP.	Contact Bren-Tronics Customer Service for return procedure.

ITEM	MALFUNCTION	POSSIBLE CORRECTIVE ACTION	Yes:	No:
5	The LEDs do not flash in sequence at start up.	This is an indication that the ABC has lost its program. Perform the firmware update procedure (Section 3.5). Turn ABC on. Do all LEDs go through self-test sequence?	Troubleshooting complete. Perform basic operational test.	Contact Bren-Tronics Customer Service for return procedure.
6	All 3 LEDs are lit on a front hold when an adapter is installed.	6.1. Connect ABC to power source. Turn ABC on. Insert an adapter. Do LEDs sequence correctly with an adapter inserted?	Troubleshooting complete. Secure ABC and return to service.	Go to Step 6.2.
		6.2. Check for a poor connection between adapter and charging port receptacle. Inspect, clean, and reseat adapter. Do LEDs sequence correctly with adapter inserted?	Troubleshooting complete. Secure ABC and return to service.	Go to Step 6.3.
		6.3. Replace adapter with a known serviceable adapter. Do LEDs sequence correctly when adapter is inserted?	Troubleshooting complete. Secure ABC and return to service.	Go to Step 6.4.
		6.4. Use a known serviceable charging port receptacle. Do LEDs sequence correctly when adapter is inserted in another charging port?	Charging port is at fault. Turn ABC off and disconnect power source. Contact Bren-Tronics Customer Service for return procedure.	ABC may not be recognizing the adapter. Update firmware to the latest version.

ITEM	MALFUNCTION	POSSIBLE CORRECTIVE ACTION	Yes:	No:
7	LCD screen has no display.	7.1. Ensure that Power Switch is not in BLACKOUT mode.	Connect ABC to power source. Turn Power Switch to On. Go to Step 7.2.	Go to Step 7.3.
		7.2. Is LCD display visible?	Troubleshooting complete. Return ABC to service.	Go to Step 7.3.
		7.3. Rotate Selector to verify LCD display is not in sleep mode. Is LCD display visible?	Troubleshooting complete. Return ABC to service.	Turn ABC off and disconnect power source. Contact Bren-Tronics Customer Service for return procedure.
8	Unable to navigate or access screens.	Connect ABC to power source. Turn ABC on. Rotate Selector to verify LCD display is not in sleep mode. Can screens be accessed and navigated?	Troubleshooting complete. Return ABC to service.	Turn ABC off and disconnect power source. Contact Bren-Tronics Customer Service for return procedure.

ITEM	MALFUNCTION	POSSIBLE CORRECTIVE ACTION	Yes:	No:
9	Adapter is not recognized and amber LEDs do not flash on adapter insertion.	9.1. Ensure the ABC is not in BLACKOUT mode.	Turn ABC off. Go to Step 9.2.	Go to Step 9.3.
		9.2. Turn ABC Power Switch to On. Do amber LEDs flash?	Troubleshooting complete. Return ABC to service.	Go to Step 9.3.
		9.3. Unplug the adapter, inspect contact pins, reinsert adapter and push down completely. Do amber LEDs flash?	Troubleshooting complete. Perform basic operational test.	Go to Step 9.4.
		9.4. Use known working adapter. Insert and push down completely. Do amber LEDs flash?	Troubleshooting complete. Perform basic operational test. If known working adapter corrects the fault, dispose of faulty adapter.	Go to Step 9.5.
	Adapter is not recognized and amber LEDs do not flash on adapter insertion. (Continued)	9.5. Turn ABC off and disconnect power source. Remove Front Hold. Remove, inspect and reseat electrical connection to front hold. Connect ABC to power source. Turn ABC on. Do amber LEDs flash?	Troubleshooting complete. Perform basic operational test.	Turn ABC off and disconnect power source. Go to Step 9.6.
		9.6. Replace front hold with a known serviceable front hold. Connect ABC to power source. Turn ABC on. Do amber LEDs flash?	Troubleshooting complete. Perform basic operational test.	Turn ABC off and disconnect power source. Contact Bren-Tronics Customer Service for return procedure.

ITEM	MALFUNCTION	POSSIBLE CORRECTIVE ACTION	Yes:	No:
10	Adapter is not charging a battery.	10.1 Replace adapter with a known serviceable adapter. Does ABC indicate charge?	Troubleshooting complete. Return ABC to service. Dispose of faulty adapter as a consumable item.	Reinstall adapter. Go to Step 10.2.
		10.2. Replace battery with a known serviceable battery. Does ABC indicate charge?	Troubleshooting complete. Return ABC to service. Dispose of faulty battery per local environmental SOP.	Turn ABC off and disconnect power source. Contact Bren-Tronics Customer Service for return procedure.
11	Battery is charging, but is not recognized on the LCD display.	Contact Bren-Tronics Customer Service for return procedure.	-	-

ITEM	MALFUNCTION	POSSIBLE CORRECTIVE ACTION	Yes:	No:
12	Battery is taking longer than expected to charge. Power limit set to “unrestricted” and ambient temperature is within charging specifications.	12.1. Replace adapter with a known serviceable adapter. Does charge cycle improve?	Troubleshooting complete. Return ABC to service. Dispose of faulty adapter	Reinstall adapter. Go to Step 12.2.
		12.2. Replace with a known serviceable battery. Does charge cycle improve?	Troubleshooting complete. Return ABC to service. Dispose of faulty battery per local environmental SOP.	Reinstall battery. Go to Step 12.3.
		12.3. In settings window, is power limit set to unrestricted?	Go to Step 12.5.	Change power limit to unrestricted. Go to Step 12.4.
		12.4. Does charge cycle improve?	Troubleshooting complete. Return ABC to service.	Go to Step 12.5.
		12.5. If a SMBus battery type is installed, are LEDs flashing red?	Check battery contacts and remove any debris. Go to Step 12.6.	Go to Step 12.7.
		12.6. Does red LED flashing stop and charge cycle improve?	Troubleshooting complete. Return ABC to service.	Turn ABC off and disconnect power source. Contact Bren-Tronics Customer Service for return procedure.
		12.7. Is airflow obstructed through the ABC?	Turn ABC off and disconnect power source. Clear obstructions, if possible or Contact Bren-Tronics Customer Service for return procedure.	Go to Step 12.8.

ITEM	MALFUNCTION	POSSIBLE CORRECTIVE ACTION	Yes:	No:
12 (cont)		12.8. Are fans operating in the correct sequence?	Turn ABC off and disconnect power source. Contact Bren-Tronics Customer Service for return procedure.	Turn ABC off and disconnect power source. Contact Bren-Tronics Customer Service for return procedure.
13	USB port is not charging.	13.1. Do both the USB cable and the device being charged operate correctly on a known serviceable charging source?	Turn ABC off and disconnect power source. Go to Step 13.2.	Replace the USB cable or device, as required.
		13.2. Is any debris inside or on the contacts?	Remove debris and clean contacts. Go to Step 13.3.	Contact Bren-Tronics Customer Service for return procedure.
		13.3. Connect ABC to a power source. Turn on ABC. Does USB port function correctly?	Troubleshooting complete. Return ABC to service.	Turn ABC off and disconnect power source. Contact Bren-Tronics Customer Service for return procedure.

3-4 WARRANTY / REPAIR INFORMATION

If the Charger or Adapters fail to function they must be returned to Bren-Tronics for repair. Contact Bren-Tronics for a Return Material Authorization (RMA) number before returning any hardware to Bren-Tronics. The part numbers, serial numbers and failure descriptions must be included for Bren-Tronics to issue an RMA number. Chargers that have been damaged by abuse or that are no longer under warranty may be returned for a repair quotation. There are no user repairable parts in the charger. Opening the charger will void the warranty.

For return authorization call (631) 499-5155 or email sales@Bren-Tronics.com

3-5 UPGRADING CHARGER FIRMWARE

Bren-Tronics is continuously adding new battery/adaptor types and other functional capabilities to the ABC via revisions to the ABC firmware. Users and maintenance personnel should periodically check <http://bren-tronics.com/software-updates/> to stay informed about the latest firmware revisions.

FLASH DRIVE REQUIREMENTS

The upgrades are performed by inserting a USB-C flash drive that contains all the files necessary for the upgrade into the Upgrade Port (located next to the Power Switch).

If the user downloads the upgrade package (set of files) into their own flash drive, ***the flash drive must be USB 2.0 compliant, must be formatted as a fat32 drive, and no other files except for the files required for the firmware upgrade can be present - or the upgrade process may fail.***

When Bren-Tronics provides a firmware upgrade on a flash drive, it already meets these requirements and should be used only for the ABC firmware upgrade.

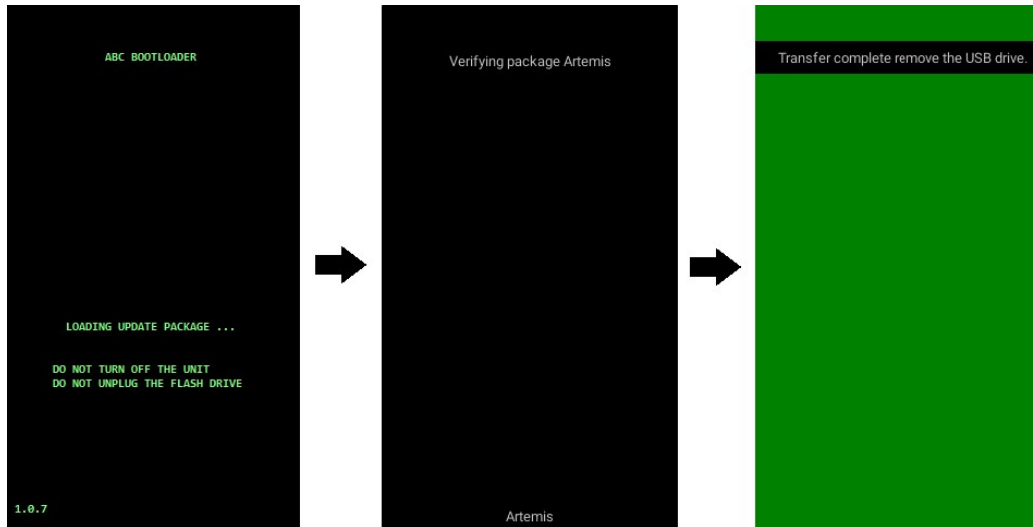
UPGRADE INSTALLATION PROCEDURE

Firmware upgrades are installed using the procedure below; it should take about seven minutes to complete.

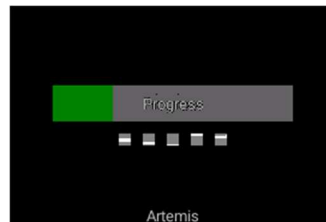
NOTE: Firmware version names and numbers will change with each firmware upgrade; information shown is an example of what is seen during the process.

- Step 1: Start with the Power Switch in the OFF position.
- Step 2: Remove all adapters.
- Step 3: Remove Upgrade Cover.
- Step 4: Insert the USB-C flash drive into the upgrade port. ***DO NOT REMOVE THE FLASH DRIVE UNTIL PROMPTED IN STEP 6; DO NOT TURN POWER OFF UNTIL STEP 8 IS COMPLETED WITH THE APPEARANCE OF THE HOME SCREEN!***
- Step 5: Turn the Power Switch to the ON position.

Step 6: The firmware upgrade will automatically start, displaying screens in the sequence shown below. When prompted, remove the USB-C flash drive.



Step 7: Once the USB-C flash drive is removed, the Progress Screen (Figure 3.5.2) will appear as shown below.

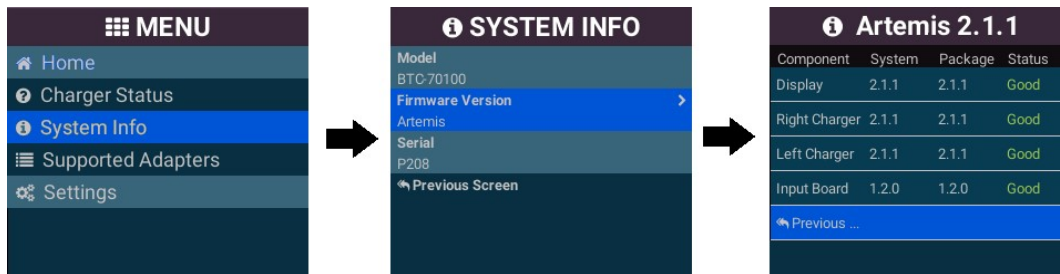


When the progress bar is fully green, the ABC will automatically restart. The LED startup sequence and the splash screens will appear, followed by the Home Screen as the charger starts normal operation.

IF THE ENTIRE STARTUP SEQUENCE, ALL THE WAY TO THE HOME SCREEN, DOES NOT OCCUR, OR IF ANY ERROR MESSAGE APPEARS, THE FIRMWARE UPGRADE PROCESS HAS FAILED. CONSULT BREN-TRONICS IF THIS HAPPENS.

Step 8: To further verify that the firmware has been properly loaded into all subsystems of the charger, **ENTER MENU**, then **HIGHLIGHT** and **SELECT** System Info.

Then, **HIGHLIGHT** and **SELECT** Firmware Version, to display the firmware “package” version (at the top of the screen) and the various version numbers of the system components. See below.



Verify that:

- The version name and number at the top matches the firmware package version name and number of the upgrade.
- The “System” and “Package” firmware version numbers match for each component listed.
- The status for each component listed is “Good”.

IF THE INFORMATION ON THE FIRMWARE SUB-MENU SCREEN DOES NOT CONFORM TO THE ABOVE CRITERIA, THE FIRMWARE UPGRADE PROCESS HAS FAILED. CONSULT BREN-TRONICS IF THIS HAPPENS.

Step 9: If steps 7 and 8 were successfully completed, the upgrade is complete. Replace and secure the Upgrade Cover.