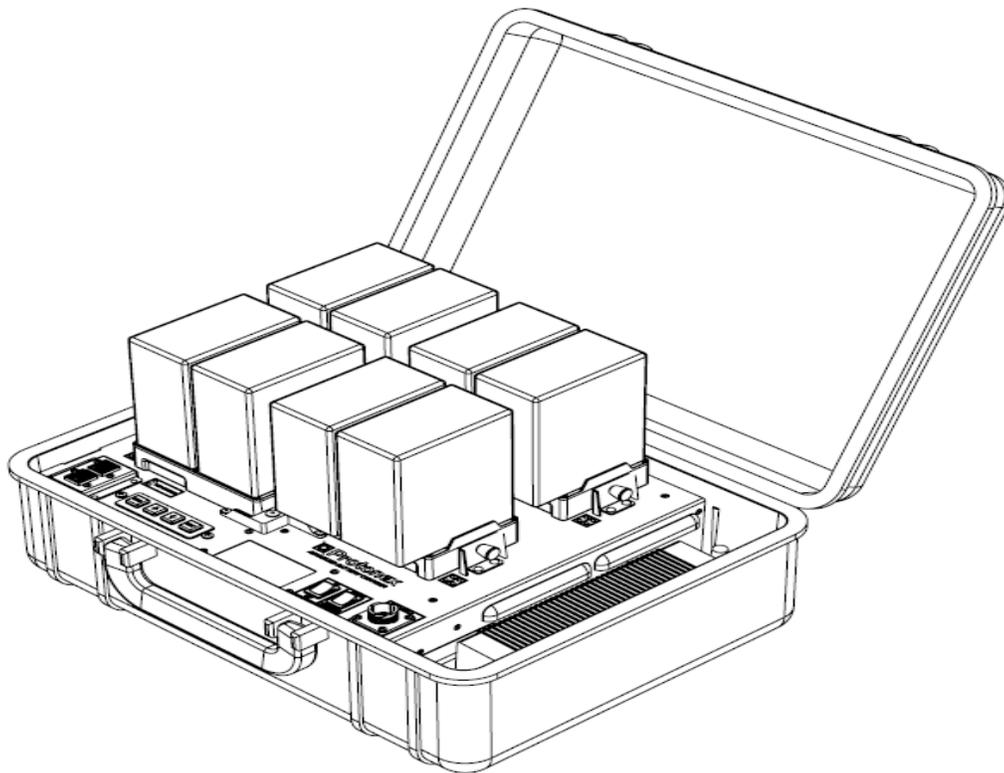




ABC-812 Adaptive Battery Charger

User Guide

Rev. 7



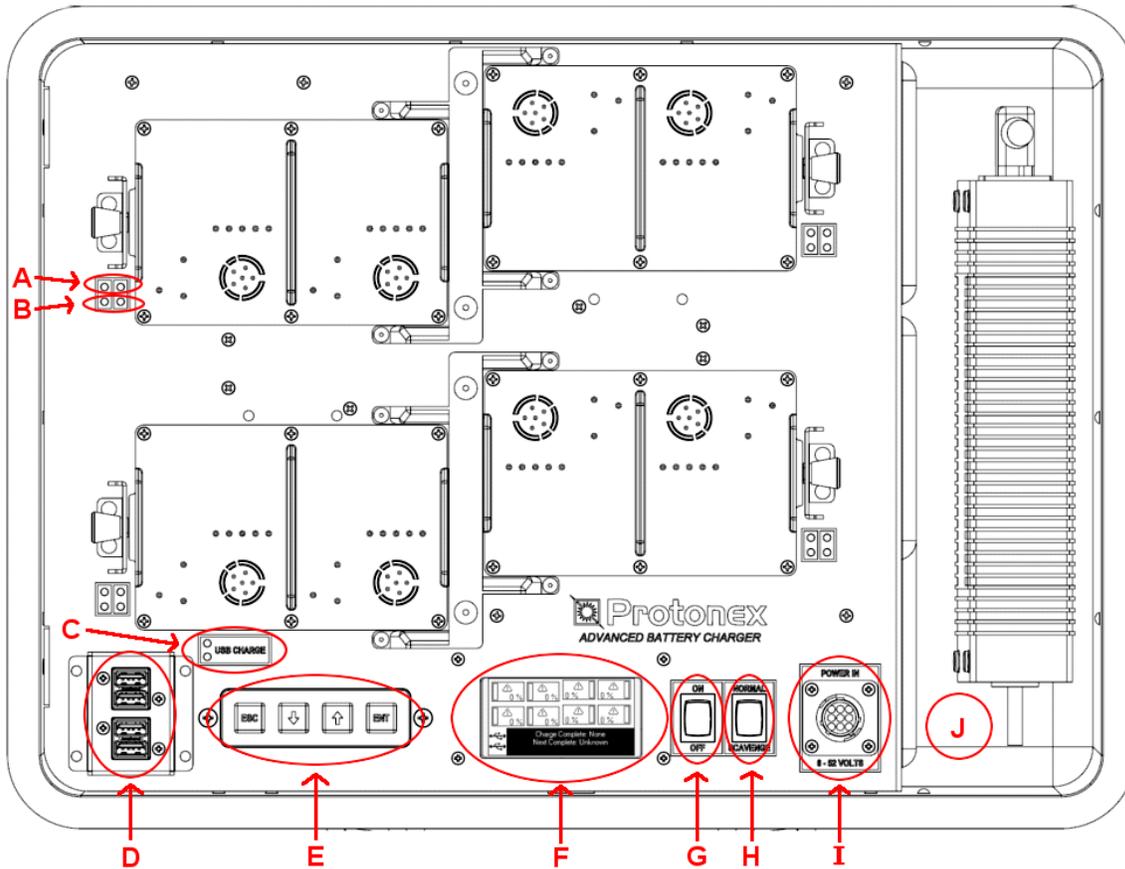
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1 Controls and Indicators



- **Top Indicator Light (for each port):**
 - Red = Battery Fault Detected
 - Off = No Fault Detected
- **Bottom Indicator Light (for each port)**
 - Blinking Green = Charging in Progress
 - Solid Green = Charge Complete
 - Off = No Battery Installed/Not Charging
- **USB Charge indicators:**

The “USB Charge” status lights will be green when each set of USB Ports have charging enabled. The top LED is lit when the top two ports are enabled, the bottom LED is lit when the bottom two ports are enabled. These ports are turned on and off depending on the power available in the system.
- **USB Charging Ports (x4):**

There are four USB Charging Ports capable of charging 5V at 1A out each port – this is enough to charge larger devices including tablets and cameras.
- **Buttons:**

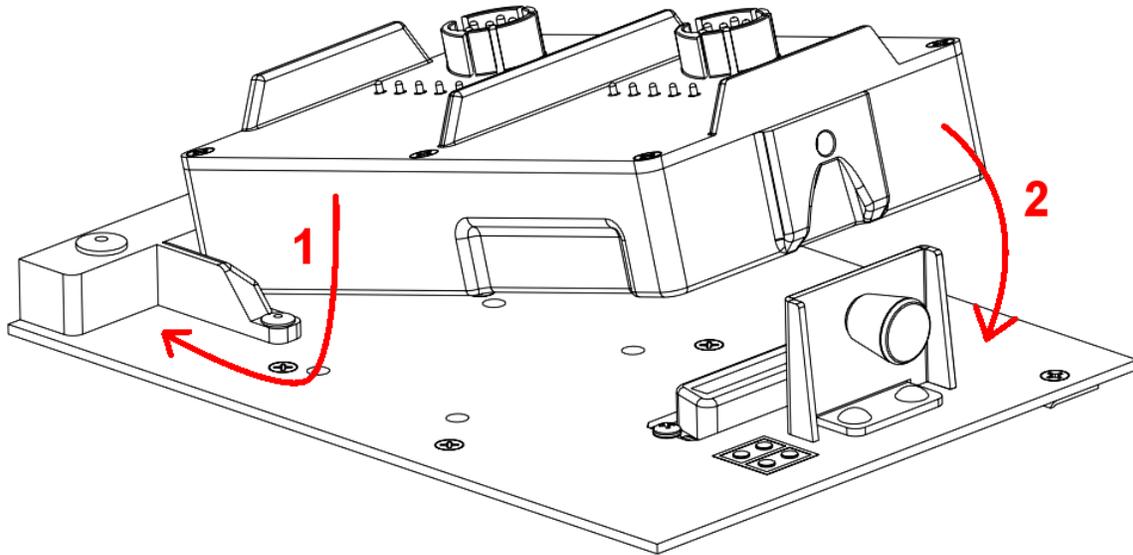
There are four buttons to navigate the user interface: Escape, Down, Up, Enter (from left to right).

- **Graphical Display:**
This displays charging and status details, and features a backlight to increase visibility in lower light environments. The brightness of the backlight and the contrast of the screen are both adjustable in the User Interface option of the main menu (see Section 6 below).
- **On-Off Switch**
This switch enables the power to the system. If the switch is in the “On” position the system will run. If the switch is in the “Off” position the system is disabled.
- **Normal-Scavenge Mode Switch**
This switch changes the mode that determines how the system handles the input voltage. To use the ABC in Normal mode, the switch must be in the top position. This enables the 22V under voltage lockout, which shuts the system when the input voltage gets below 22V. Use the Normal mode when powering the ABC from a vehicle to prevent running the battery down too low. To operate in Scavenge mode, put the switch in the bottom position. This allows the ABC to operate down to 6V.
- **Input Power Connector**
This 9-pin connector provides the input power to the system and has a quarter-turn fastener to prevent unwanted disconnection. Use only supplied cables to connect power to the system.
- **Power Supply Bay**
This storage bay is used to store the AC and DC cords. It also contains the fan inlet and outlet vents.

2 Installing and Removing Adapters

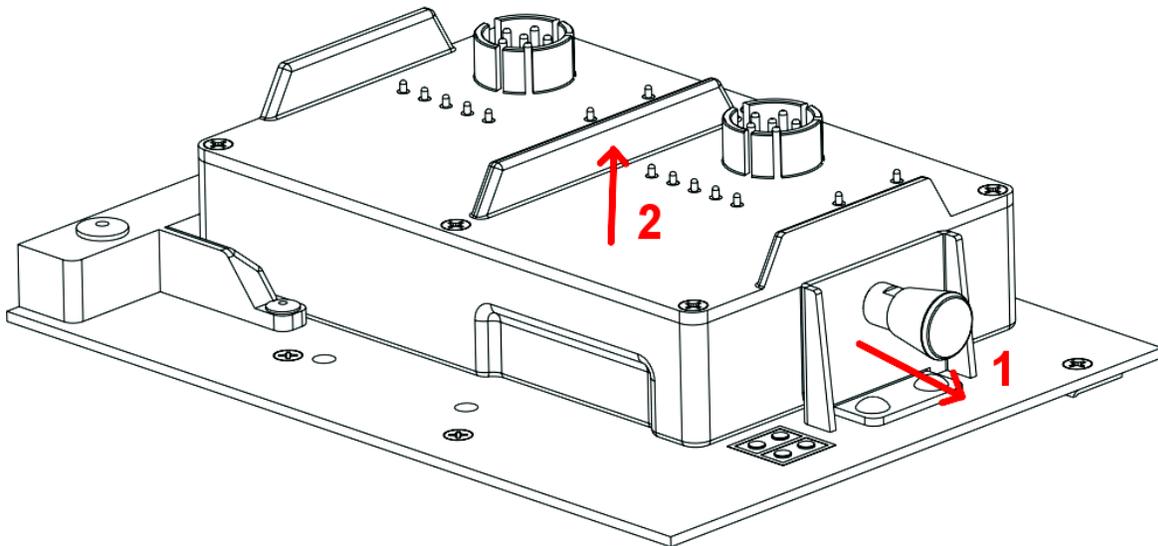
To install adapters into the Adaptive Battery Charger refer to the steps and figure below.

- Push the locking tab down and slide the adapter back until it fits snug within the locking cavity, towards the center of the top of the ABC.
- Put the opposite side (connector side) of the adapter down until the plunger locks in place.



To remove adapters from the Adaptive Battery Charger refer to the steps and figure below.

- Pull plunger out towards the outside edge of the ABC unit.
- Using the slots on each side of the adapter, pull the connector side of the adapter up and slide locking tab out from the cavity.



3 Charging Batteries from AC Power

The following instructions are a guide describing how to correctly charge batteries using the Adaptive Battery Charger. **Below is a suggested order for using the Adaptive Battery Charger, however if these instructions are done out of order, no damage will result to the Adaptive Battery Charger unit or the batteries. The Adaptive Battery Charger will still charge the batteries.**

- Select the appropriate adapter for the selected the battery by referring to the table in the **Accessories** section (Page 14).
- Remove any unused adapters from the top of the unit. Install the selected adapter(s). If necessary, refer to the previous section: **Installing and Removing Adapters** (Page 5).
- Install the batteries into the corresponding adapter with the correct orientation (batteries should only fit one way).
- Screw in the AC Power Supply cable to the Input Power connector and lock it in.
- Turn the Normal-Scavenge switch to the “Normal” position.
- Make sure the On-Off switch is in the “On” position.
- Plug the AC cable into a standard AC outlet.
- Ensure that the installed batteries are charging properly by checking if the **Bottom LEDs** are blinking green for each of the installed batteries. For the location of the **Bottom LEDs**, refer to the diagram in the **Controls and Indicators** section (Page 3).

4 Charging Batteries from DC Power

The following instructions are a guide describing how to correctly charge batteries from DC power using the Adaptive Battery Charger. **Below is a suggested order for using the Adaptive Battery Charger, however if these instructions are done out of order, no damage will result to the Adaptive Battery Charger unit or the batteries. The Adaptive Battery Charger will still charge the batteries.**

- Select the appropriate adapter for the selected the battery by referring to the table in the **Accessories** section (Page 14).
- Remove any unused adapters from the top of the unit. Install the selected adapter(s). If necessary, refer to the previous section: **Installing and Removing Adapters** (Page 5).
- Install the batteries into the corresponding adapter with the correct orientation (batteries should only fit one way).
- Screw in the DC Power cable to the Input Power connector and lock it in.
- Attach the DC power cable to a DC power source (to avoid danger, attach the return/neutral ring terminal first).

- Turn the Normal-Scavenge switch to the “Normal” position.
- Make sure the On-Off switch is in the “On” position.
- Ensure that the installed batteries are charging properly by checking if the **Bottom LEDs** are blinking green for each of the installed batteries. For the location of the **Bottom LEDs**, refer to the diagram in the **Controls and Indicators** section (Page 3).

When operating in Normal Mode there is a 22V under voltage threshold that prevents the Adaptive Battery Charger from draining a 28V battery system used in a military vehicle. The Adaptive Battery Charger will stop charging batteries when the 28V vehicle battery reaches 22V.

Caution: Moving the Normal-Scavenge switch to Scavenge Mode may cause the vehicle battery to be completely drained.

5 Scavenging

The following instructions are a guide describing how to correctly charge batteries using the Adaptive Battery Charger scavenging mode. Scavenging mode allows the Adaptive Battery Charger to pull power from unstable sources such as solar, wind and other renewable sources. Scavenging can also be used to completely empty batteries such as those used in a vehicle. **Below is a suggested order for using the Adaptive Battery Charger, however if these instructions are done out of order, no damage will result to the Adaptive Battery Charger unit or the batteries. The Adaptive Battery Charger will still charge the batteries.**

- Select the appropriate adapter for the selected the battery by referring to the table in the **Accessories** section (Page 14).
- Remove any unused adapters from the top of the unit. Install the selected adapter(s). If necessary, refer to the previous section: **Installing and Removing Adapters** (Page 5).
- Install the batteries into the corresponding adapter with the correct orientation (batteries should only fit one way).
- Screw in the DC Power cable to the Input Power connector and lock it in.
- Attach the DC power cable to a DC power source (to avoid danger, attach the return/neutral ring terminal first).
- Turn the scavenge-normal switch to scavenge
- Make sure the On-Off switch is in the On position

- Ensure that the installed batteries are charging properly by checking if the **Bottom LEDs** are blinking green for each of the installed batteries. For the location of the **Bottom LEDs**, refer to the diagram in the **Controls and Indicators** section (Page 3).

Caution: Moving the Normal-Scavenge switch to Normal Mode may result in less than optimal charge times.

Solar Operation

The Adaptive Battery Charger can scavenge from solar blankets and solar panels automatically. The user should follow the instructions for scavenging but pay special attention to the orientation of the solar panel. The following instructions will assist in optimizing solar performance:

- Orient the solar panel so that it is directly facing the sun. If possible, use something to prop the solar panel to get the best tilt. Laying the panel flat on the ground is rarely optimal.
- Obstructing the sunlight reaching the solar cells will result in a lower than optimal power output. Avoid casting shadows over the solar panel and be sure to keep it clear of dust and other debris.
- Keep the ABC unit out of the direct sunlight. The batteries or the ABC may become too hot to charge. The ABC will slow down or shut off if this is the case.
- Re-orient the solar panel as the sun moves throughout the day.

Note: If there is not enough sunlight to operate the ABC, it will automatically shut down. The ABC will automatically restart itself when there is enough power. The ABC may start and stop under low light conditions until the light improves.

Vehicle Battery Drain

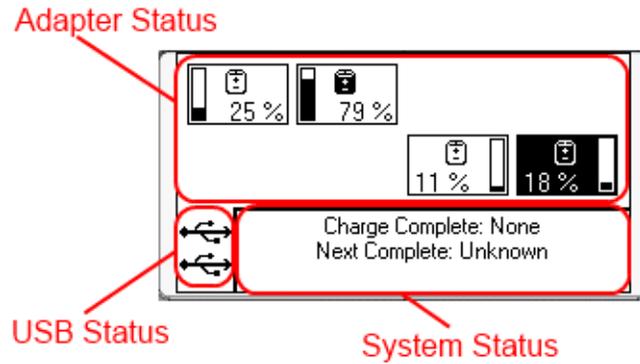
The Adaptive Battery Charger can completely drain any battery to transfer the energy to the batteries being charged. Follow the instructions for scavenging but pay attention to the following notes:

Note: Completely draining a lead acid or other battery may be detrimental to the battery life.

Note: The ABC will automatically shut off when a battery is drained. The ABC may attempt to restart and retry.

6 User Interface

Status Screen



The Status Screen is the heart of the User Interface for the Adaptive Battery Charger. It consists of three major parts and is organized in much the same way as the system itself. The top half is taken up by the Adapter Status region, which has a 1:1 representation of attached adapters. The bottom left is the USB Status region and the bottom right is the System Status region.

Adapter Status:

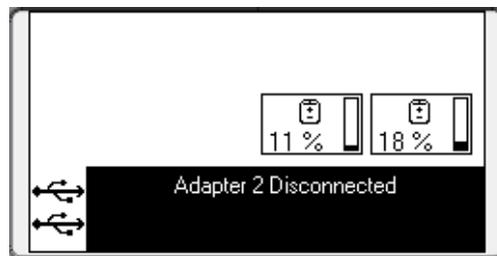
This region shows the state of all attached batteries and adapters. If an adapter is not attached, then it will not appear on the screen.

USB Status:

This region shows whether or not the USB chargers are enabled. If the chargers are enabled, the USB icons will appear. If there is insufficient power to run USB, the icons will disappear from the screen.

System Status:

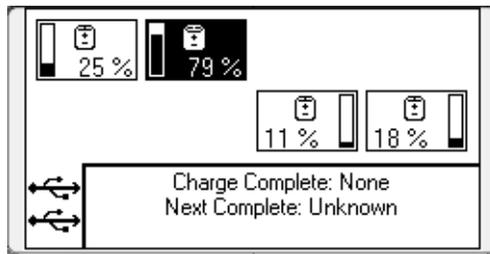
This region shows general system information. By default, it shows which batteries have been fully charged and which battery is next to be completed (if it is able to determine it). This region will also update and display system messages, such as adapter connections, disconnections and errors.



Navigation

All User Interface navigation is done using the buttons shown in the **Controls and Indicators** section (Page 3). Up and Down are used to navigate around a single screen, while Escape and Enter are used to 'enter into' and 'exit from' screens. Enter is also used to confirm variable changes.

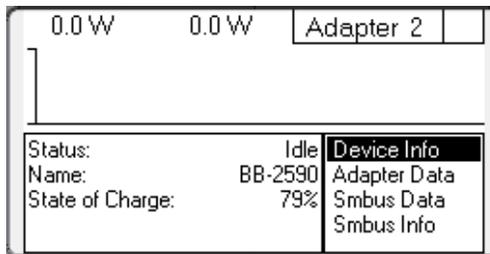
As an example, look at the previous **Status Screen** section. In the first image, the adapter in the bottom right with 18% is selected (its colors are inverted). In the next image, the System Status region is selected. The Down arrow was used to move the selected region (or alternatively, the Up arrows could be used many times).



In this image, the selected box has moved yet again to another adapter. All of these moves are done using the Up and Down arrow keys.

Adapter Info Screen

If you have an adapter selected and press the Enter key, you will enter into the Adapter Info Screen.

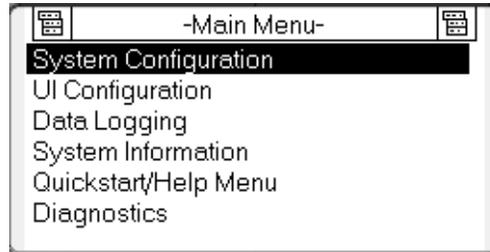


This screen has some basic information about the attached battery, the attached adapter and, if available, some Smbus information. By pressing the Up and Down keys, the selected field can be moved to Device Info, Adapter Data, Smbus Data and Smbus Info, thus changing the information displayed on the left half of the screen.

The top half of the screen is a power graph that will display the power going into the adapter (if any).

Main Menu Screen

If you have the System Status region selected when you press enter, it will bring you to the Main Menu screen.



System Configuration contains options for changing how the system behaves. Currently, the only configurable behavior is the charging method, **Sequential** and **First to Full**.

UI Configuration contains options for changing how the backlight functions, how bright the backlight is and adjusting display contrast.

Data Logging allows the user to view how much information is currently logged, change the logging interval and to erase the log. Erasing the log is non-reversible.

System Information displays some basic system data such as run time, firmware version, etc.

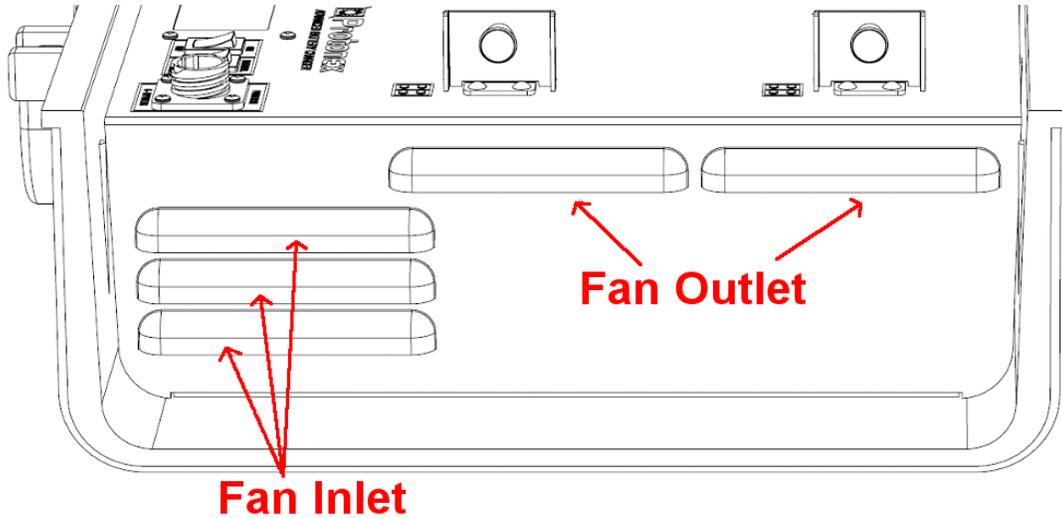
Quickstart/Help contains some basic help information.

Diagnostics brings you to a more detailed information page that displays voltage and current for each adapter slot. Pressing enter on that page will bring you to a **Diagnostic Menu** screen that contains very detailed information about each adapter. Detailed **Smbus Information** is also available from this menu.

7 Precautions

There are some precautions that should be followed while operating the Adaptive Battery Charger.

- The user should only charge batteries with the lid open to allow proper ventilation.
- The unit is only waterproof with the lid closed, so caution should be used with the lid open while charging batteries.
- There are fan inlet and outlet vents located on the side of the ABC (facing into the **Power Supply Bay**), shown below. Do not cover these vents as it will affect the thermal performance of the unit.



- Do not put non-rechargeable batteries in the Adaptive Battery Charger
- If powering the Adaptive Battery Charger from 28V vehicle battery and Scavenge Mode is selected the unit can drain the battery of the 28V vehicle. It is advised to select the Normal Mode when powering from 28V vehicle battery.
- Only install the designated batteries in the proper orientation for each adapter.

8 Accessories

- **DC Cable**

A DC cable is supplied with two ring terminals. The red ring terminal is the positive terminal and the black is the return/neutral ring terminal. Do not let the terminals touch each other with power connected. Connect the power to the ring terminals with the cable disconnected from the ABC, then connect the live cable to the ABC. Never connect power before ground when hot plugging power supplies.

- **AC Power Supply and Cable**

An AC/DC power supply is provided with an AC cable to plug into a North American AC outlet.

- **Battery Adapters**

There are many adapters for different battery types with new ones coming out all the time. You can also visit www.Protonex.com for an up-to-date list.

9 Maintenance

The Adaptive Battery Charger requires no scheduled maintenance. The unit can be operated continually if needed.

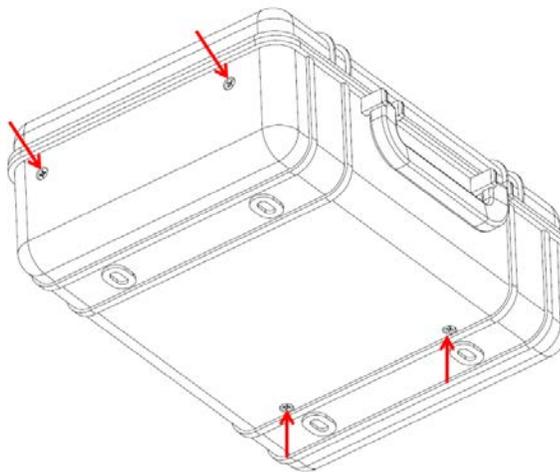
Care should be taken to avoid exposure to dust and water while the Adaptive Battery Charger is operating. Prolonged exposure to dust and moisture will degrade the life of the system. If sand, dust or water gets inside the unit, it can be opened to be cleaned.

CAUTION: Electrostatic Discharge (ESD) can damage the unit. Only ESD trained technician should open the unit in an ESD safe environment. Take appropriate ESD precautions when opening the unit: ground the technician with a static strap, provide an ESD safe area for the electronics.

CAUTION: Do not open the unit with power applied. Remove all power and batteries.

The following steps are used to clean the unit:

- Turn the off switch to the “off” position.
- Unplug the Adaptive Battery Charger from the power source.
- Remove the batteries and adapters
- Unscrew the 4 screws on the outside of case as shown in the following illustration.



- Lift the tray assembly straight up.
- Dump debris from unit, remove lint from fan, allow unit to air dry.

The unit can be reassembled by following the steps in the reverse order.

After assembly, use compress air to blow out any dust in the connectors for the Adapters and Power.

CAUTION: Do not use water to clean any of the connectors. Do not insert anything into the connectors. Pin damage can occur if anything other than air is used to clean the connectors.

Upgrading Firmware

WARNING – During the upgrading, **DO NOT** unplug the USB cable. Bad things will happen to the ABC.

Protonex issues one to two firmware releases each year for the ABC. Most of these releases add some new capabilities – usually for fairly unusual or specific missions. It's highly recommended to update the firmware when new firmware is made available. Here's how to upgrade the firmware in your ABC:

- 1) Before you start, you'll need three things (besides the ABC):
 - a. A standard type A plug to type B plug cable. This cable connects to USB type B receptacle of the ABC to a USB port on a laptop or desktop Windows computer, and is how the ABC gets the firmware.
 - b. The ABC "System Loader" Windows application. You'll need to install this software on the computer that you'll be using to do the upgrade. You can request this application on the Protonex website.
 - c. The hex image of the firmware you want to put on the ABC. You can request this image on the Protonex website if it was not given to you.
- 2) Install the Protonex "System Loader" application software.
 - d. Double click on the "System Loader.exe" file
 - e. The user Account control menu will pop up, click yes.
 - f. The Welcome to Protonex System Loader Setup Wizard will appears, click on next.
 - g. Click on "I agree" on the Welcome to Protonex. System Loader setup wizard.
 - h. When the "Check the components you want to install and uncheck the components" window appears, uncheck the M300 FTDI-USB-to-Serial and Start menu Shortcuts and click on Next.
 - i. The Destination Folder window appears next, click on "Install" if you accept the directory location.
 - j. Click the "Finish" button when you see the "Completing the Protonex System Loader Setup Wizard".
 - k. You should see the "System Loader" icon on your desktop.
- 3) Get access to the ABC USB Receptacle B connector by following the instruction of Maintenance section.
- 4) Connect the USB type B plug into the ABC and the Type A plug to your computer.
- 5) Run the "System Loader" application on the PC.
- 6) Using the pull-down, select the COM port that your ABC is connected to – the application should tell you which one (COM4 below):
- 7) Now select the firmware image you want to load to your ABC, using the ". . ." button at the right. If you are given both an "App" and a "Boot" image, use the "App" one:
- 8) Click the "Upgrade" button. You should see the progress bar at the top of the System Loader move to the right, and status messages scroll across the bottom. At the end of the upgrade process, which should take about 45 seconds, the SPM-622 will reset, and will come up using the new firmware.
- 9)

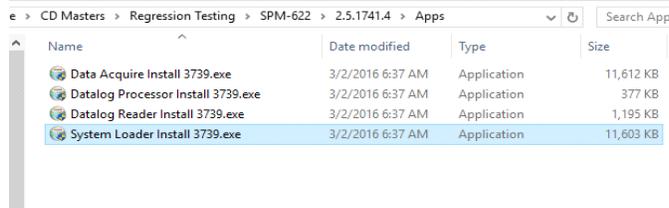
WARNING – During the upgrading, **DO NOT** unplug the USB cable. Bad things will happen to the ABC.

That's it! Unplug your stuff and try out your new capabilities!

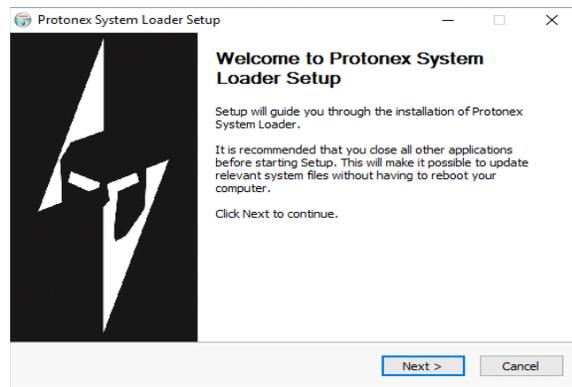
Firmware upgrading procedure pictures:

Step 2d.

Apps



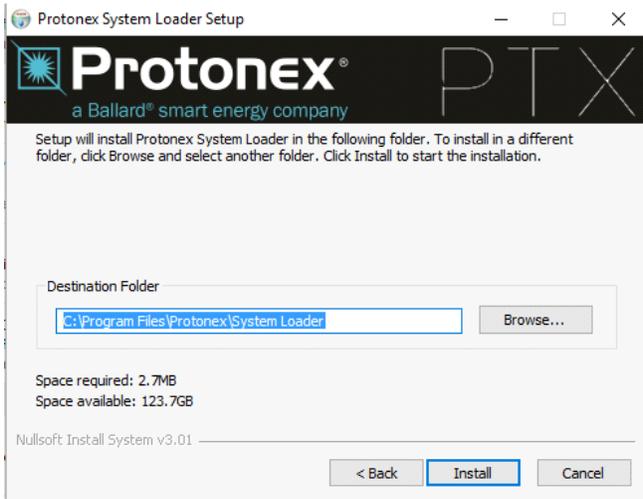
Step 2f.



Step 2h.



Step 2i.



Step 4.



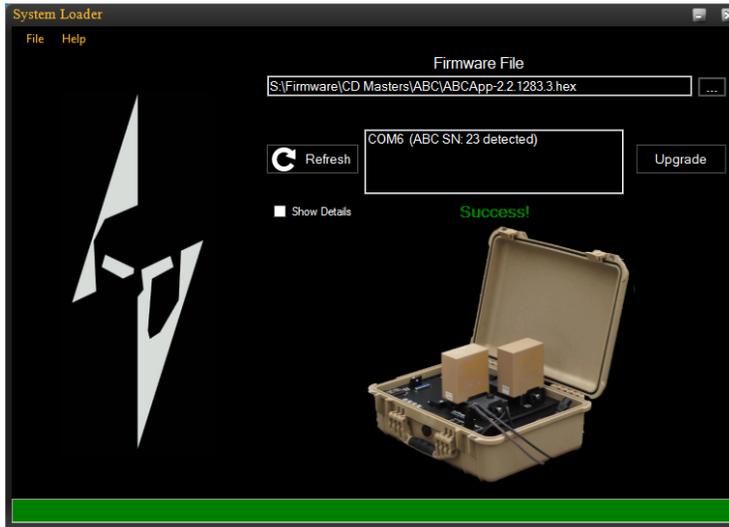
Step 6.



Step 7.

ABCApp-2.2.1283.3.hex	7/28/2016 12:01 PM	HEX File
ABCBoot-2.1.1458.hex	3/3/2017 12:58 PM	HEX File

Step 8.



10 Troubleshooting

Look up the symptom and check possible causes from the list below.

- No lights on unit, unit does not power up from AC
 - Check on/off switch in “on” position
 - Check power connection at unit
 - Check power connection at AC adapter
 - Check power source
- No lights on unit, unit does not power up from DC
 - Check on/off switch in “on” position
 - Check power connection at unit
 - Check DC positive and negative terminals reversed
- Unit running, batteries do not charge
 - Check battery already charged

- Check adapter battery contact pins clean and unbent
- Check adapter to unit connectors contact pins clean and unbent
- Check temperature, if too hot or too cold batteries will not charge
- Adapter not recognized
 - Check adapter battery contact pins clean and unbent
- Fan noise is loud
 - Check temperature, heat may cause fan to run faster
 - Check for debris in fan
- Adaptive Battery Charger runs down military vehicle battery
 - Check Normal-Scavenge switch is in “Normal” position
- Solar can’t charge batteries in low light
 - Check solar panel orientation
 - Check Normal-Scavenge switch is in “Scavenge” position

11 Frequently Asked Questions

Q: I only have one battery plugged in, why isn't it charging?

A: If you have just plugged in a battery and it doesn't appear to be charging, there are a few things to check. Proceed down the following list until the battery starts charging.

- Confirm that the adapter is installed correctly. Refer to **Installing and Removing Adapters** (Page 3) to see how to properly install them.
- Check to make sure that the On-Off switch is in the On position
- Make sure a power cable is screwed all the way into the Input Power connector. You must press it on and then screw until it stops.
- Make sure the power cable is connected to a power source. If the User Interface turns on, you know that you are connected to power.
 - If it is the AC Power Supply cable, it must be plugged into a standard AC outlet.
 - If it is a HMMWV cable, make sure it is plugged into the vehicle.
 - If it is a solar cable, make sure the solar panel is in sunlight.

Q: I have multiple batteries on the system, why is it charging some of them but not others?

A: The ABC only has so much power available to it which depends on which power cable is connected to it. Depending on how many batteries are connected, it may not be able to charge all of them all of them

at the same time. The system will also limit its output to protect itself from overheating if it is hot outside, in direct sunlight or the air vents have been blocked.

Q: How do I know which order batteries will be charged in?

A: The system has two different modes in which it can operate: **Sequential** and **First to Full**.

First to Full means that the system will search out the fullest battery and start charging it, regardless of position on the ABC. It will then find the next fullest battery, and so on. This method guarantees the user the shortest amount of time to having a fully charged battery.

Sequential means that it will charge batteries starting in the top left and ending in the bottom right (the same way you would read a book). If a slot is empty, it is skipped and the next available slot will be charged.

By default the system uses the **First to Full** method, but it can be changed using the User Interface. Highlight the system status box (the one in the bottom right) and press enter. Scroll down to **System Configuration**. From there you can change the charging method.

Q: How do I know a battery is charged?

A: The easiest way to tell is to look at the LEDs next to the adapter. If the LED is solid green, then it's fully charged and ready to be used. The next way to tell which battery is charged is to look at the User Interface. The system status box will contain a list of all the charged batteries (if there are any) as well the next battery the system thinks will be fully charged (if it is able to determine it).

Q: Can I remove a battery before it is charged?

A: Yes. This will not damage the system or the battery.

Q: Can I add a new battery why the system is running?

A: Yes. This will not damage the system or the battery.

Q: Can I change adapters while the system is running?

A: Yes. This will not damage the system or any batteries.

Q: How do I change adapters while the system is running?

A: To change an adapter, refer to the [Installing and Removing Adapters](#) section (Page 3). No special care has to be taken even though the system is running. You can even be ambitious and remove an adapter that has batteries on it that are actively being charged. No harm will come to the system, the adapter or the batteries.

Q: The red LED came on, now what?

A: The red LED means that a fault was detected, either with the battery, the adapter or the ABC itself. Try removing the battery, if the red LED disappears then we detected something erroneous with the battery. Set it aside and do not try to charge it. If the red LED stays lit, then there is a fault with either the adapter or the ABC. Contact support@protonex.com. While the red LED is lit, no battery will charge in that port.