Enhanced Flight™
by Audio Authority Corporation

Operator's Instructions & Reference Guide

GPU-Integrated BatteryMINDer® 244CEC1-AA
Aviation-Calibrated 24V Maintenance Charger-Desulfator

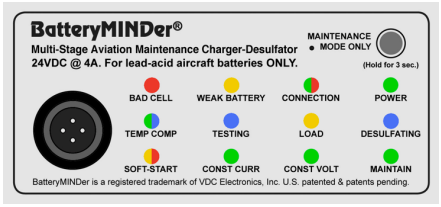
BM-AIK1 Harness Kit

Charger Output Cable

2800 Series Ground Power Unit

28VDC Output Power Cable

120VAC Input Line Cord



Built-in BatteryMINDer (Optional)

This manual pertains ONLY to Audio Authority specific configurations of the 244CEC1-AA type BatteryMINDer, a product of VDC Electronics, integrated into our Ground Power Units (GPUs). Its circuitry, operation, and warranty are unchanged; but the packaging, implementation, and wiring connections have been redesigned to comply with regulatory requirements for use with FAA certified aircraft.

PLEASE READ AND SAVE THESE INSTRUCTIONS.
FOR LEAD-ACID 24V AVIATION BATTERIES ONLY!

Introduction and Background Information

The 244CEC1-AA is a special configuration of the BatteryMINDer multi-stage battery charger specifically calibrated only for lead-acid aircraft batteries. Audio Authority, in collaboration with VDC Electronics, has incorporated this award-winning technology as a convenient option into the 2800 Series Ground Power Units for general aviation aircraft.

Do not confuse the BatteryMINDer with trickle chargers or battery “tenders.” It is completely different. It is designed to gently charge aircraft batteries as completely as possible and then continuously maintain them at their maximum charge. While in this maintenance or float mode, the BatteryMINDer employs patented technology to modulate high-frequency pulses to the battery to break up and dissolve the lead sulfate crystals that naturally form on the battery plates. Sulfation build-up reduces battery capacity and is made worse by extended periods of inactivity, high heat, and poor maintenance. Aviation batteries must maintain a minimum of 85% of their rated capacity to be airworthy, or legal for flight.

The BatteryMINDer’s continuous desulfation can actually reverse the normal battery aging process. It will restore lost capacity and significantly extend the useful life of aircraft batteries. The BatteryMINDer is designed and intended for full-time continuous-duty use. It is recommended that it be kept connected whenever the aircraft is in hangar storage to maintain and condition the battery.

To prevent over or undercharging, the aviation BatteryMINDer automatically adjusts its output in response to an ambient temperature sensor, incorporated into our special charger output cable.

A Model BM-AIK1 Airframe Interface Kit is supplied and contains the aviation-grade parts and instructions necessary for a FAA-licensed mechanic to install a simple wiring harness as a minor alteration to conveniently access the battery on a certified aircraft. This harness provides a mating polarized plug for quick connect of the BatteryMINDer to the aircraft. An airframe log entry is all that is required to return the aircraft to service – no STC, Form 337, or field approval required.

The BatteryMINDer’s “plug-n-run” design requires no input from the operator and automatically resumes operations following power failure. Make just one connection to the aircraft, turn it on, and walk away. Operation is completely automatic.

Faithful use of the BatteryMINDer will provide maximum starting power, important for all aircraft but especially for cool turbine engine starts, and full reserve emergency power for every flight.

IMPORTANT SAFETY PRECAUTIONS

WARNING

TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR PERSONAL INJURY, OBSERVE THE FOLLOWING:

1) Do not expose charger to moisture or precipitation. It is designed to operate ONLY INDOORS.
2) USE of any attachment not specifically recommended by the battery charger manufacturer for use with this exact model of charger may result in additional risk of fire & electric shock or personal injury.
3) Do not use charger if it receives a sharp blow, is dropped, or damaged.
4) Charger contains no serviceable parts. If it fails for any reason, return it to Audio Authority Corp for repair or replacement.
5) **WARNING - RISK OF EXPLOSIVE GASES**. Whenever you work near a lead-acid battery, there are inherent risks and dangers that must be managed and mitigated. Batteries generate explosive gases during normal operation, therefore it is of utmost importance that the operator be familiar with, refer to, and follow the instructions in this manual exactly to reduce the risk of battery explosion. Additionally, follow the instructions published by the battery and aircraft manufacturer. Review and abide by all safety & cautionary product markings.

6) **PERSONAL PRECAUTIONS** when working with or near a lead acid battery:

   a) Do not work in seclusion. Someone should be able to hear you or be close enough to aid you when working near a lead acid battery.

   b) Have fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes. Wear complete eye protection and cover clothing. Avoid touching eyes while working near battery.

   c) If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters the eye, immediately flood the eye with running water for at least 10 minutes and get medical treatment immediately.

   d) NEVER smoke or allow a spark or flame near battery, fuel or engine.

   e) Be careful not to drop a metal tool onto the battery, as it might create a spark that could ignite explosive gases.

   f) Remove all personal metal items such as rings, bracelets, necklaces, and watches that could possible come in contact with a lead acid battery or related wiring. A lead acid battery can produce a short-circuit current sufficient to weld a ring or the like to metal, causing a severe burn.

   g) This charger is designed for and restricted to recharging general **aviation lead acid batteries ONLY**. Never use it for any other purpose, including powering a low voltage electrical system. Do not use to recharge common dry cell household batteries, as they may explode and cause injury and damage property.

Preparing Your Battery for Charging

1) Ambient air and battery temperature must be 40° to 115° F. **NEVER CHARGE A FROZEN BATTERY OR ONE ABOVE 115°F.**

2) If the battery manufacturer requires battery to be removed from aircraft before charging, always remove ground terminal first. Turn off the aircraft Battery Master Switch and disconnect external power to avoid causing a spark. **NOTE:** according to the manufacturer, Concorde sealed AGM batteries do not need to be removed from aircraft for maintenance charging purposes.

3) Be sure area around battery is well ventilated while battery is being charged to dissipate and avoid any concentration of explosive gases.

4) Battery terminals should be kept clean. Avoid any battery terminal corrosion from contacting eyes.

5) Add distilled water to each cell until battery acid reaches level specified by the manufacturer. This helps purge excessive gas from cells. Do not overfill. For a battery without caps, follow manufacturer's recharging instructions.

6) Study all battery manufacturer's specific instructions such as removing cell caps while charging and recommended charge rates.

7) Determine condition of battery, by referring to instructions herein, before ever attempting to charge or de-sulfate any / all batteries.

Included Items with GPU BatteryMINDer Option

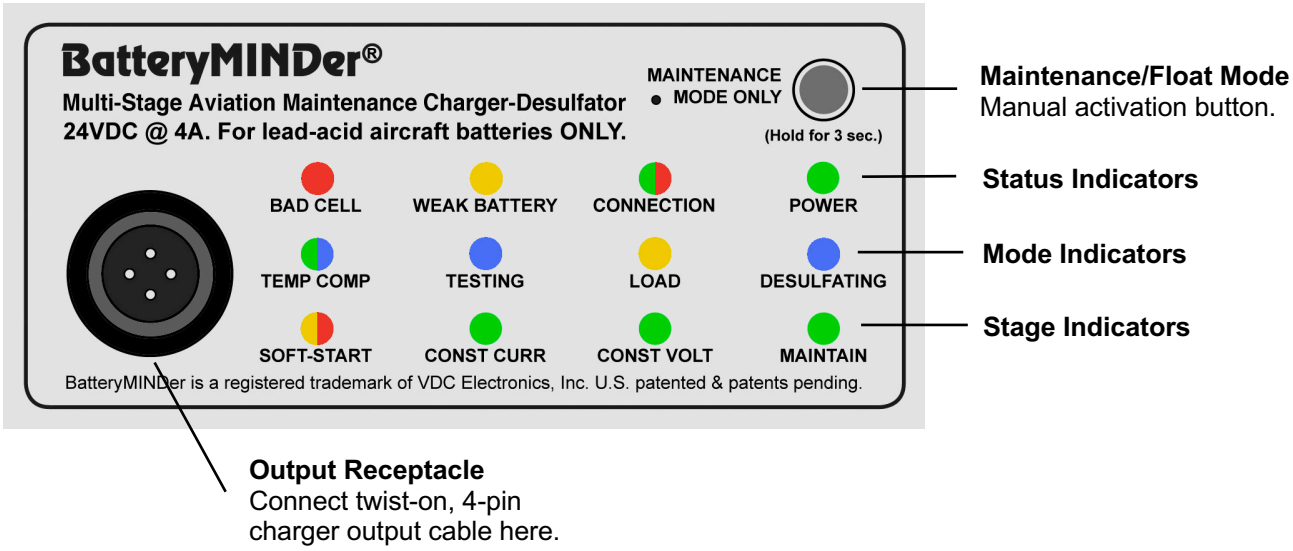
The following additional items are included with your GPU when equipped with the BatteryMINDer option:

- This instruction manual.
- 8 ft. output cable, 4-pin circular connector to red SB50 with imbedded ambient temp sensor – Connects to mating plug on Model BM-AIK1 airframe battery harness below.

- Airframe Interface Kit (Model BM-AIK1) – Provides kit of aviation-grade parts to fabricate and install a fuse-protected battery maintenance charger harness on FAA certified aircraft. Just hand the kit to your licensed mechanic to install as a minor alteration, and return your aircraft to service with a simple log entry – no STC, field approval, or Form 337 required.

Controls, Indicators, and Connections

GPUs with the BatteryMINDer option feature the control & indicator panel below. Colors represent possible LED indications. Note some LEDs use 2 colors to indicate more than one state or function.



Quick-Start Summary Operating Instructions

1) Install the included Model BM-AIK1 Airframe Interface Kit on your aircraft.

   Your FAA licensed aircraft mechanic can install the kit and make a return-to-service airframe maintenance log entry as a minor alteration. An FAA Form 337 is NOT required for minor alterations. See examples: www.audioauthority.com/bmaik

2) Attach GPU line cord and connect to AC power receptacle. A heavy-gauge (12-3) extension cord may be used, the shorter the better.

3) Attach charger output cable to twist-on receptacle on GPU.

   Verify 3-position POWER switch is OFF.

4) Connect output cable to mating SB50 plug installed on aircraft.

   Verify CONNECTION indicator lights **GREEN**.

   If CONNECTION indicator lights **RED**, disconnect BatteryMINDer from aircraft battery. Check for short circuit or reverse battery polarity. Resolve problem before continuing.

   Turn on BatteryMINDer by moving power switch to **CHARGER** position.

   As the BatteryMINDer initializes and begins analyzing the battery, all the first and second row of LED indicators will illuminate, and the third row will sequence.

   After successful initialization and battery analysis, the POWER and BATTERY CONDITION indicators should be **GREEN**, the DESULFATING indicator flashing **BLUE**, and one of the charging stage indicators (3rd row LEDs) should be illuminated.

   For other LED indications, see the following table on page 6.

5) Leave charger connected continuously when aircraft is in hangar storage to maintain optimum charge and continuously desulfate to recover lost battery capacity and extend battery life. BatteryMINDer will not overcharge or damage battery.

   The BatteryMINDer features “Plug-N-Run” design. If AC power to charger is interrupted, once restored the BatteryMINDer will automatically resume its normal charging cycle without any user input or adjustment.

   Note: Do not expect to completely eliminate sulfate in a few days. Long established sulfate will require several weeks or longer to be fully dissolved and battery recovered. Be patient and you will be rewarded with a “sulfate-free” battery.

6) Before next flight, turn off the GPU/Charger and disconnect the GPU & BatteryMINDer output cables from the aircraft. Store the GPU and all cords, accessories, extension cords, etc. where they will not interfere with aircraft flight operations.

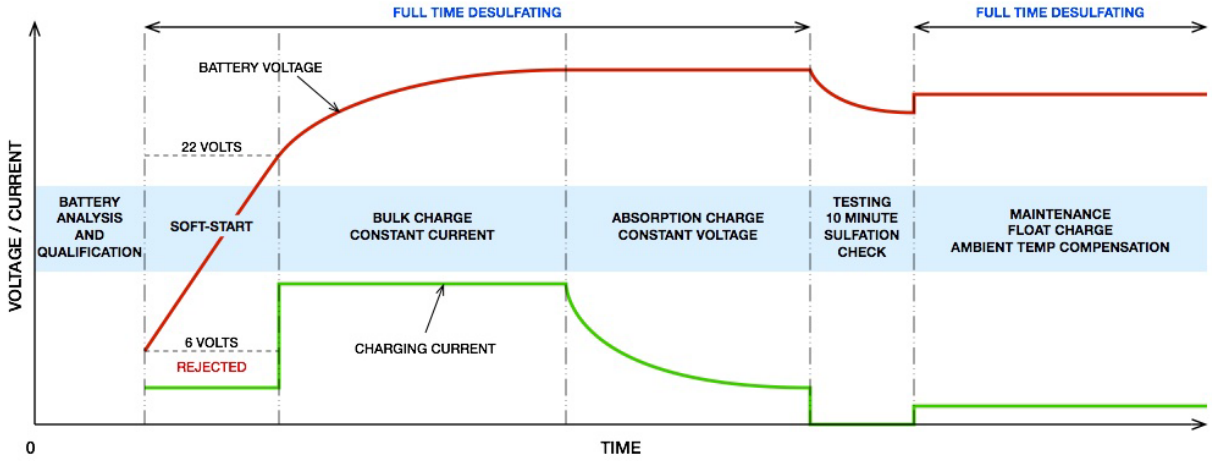
Indicators and Functions

First Row, Status Indicators – Left to Right		
Indicator	**Meaning**	**Action**
BAD CELL	FLASHING **RED** = one or more cells of the battery are dead, voltage less than 23V after analysis stage.	Battery must be replaced. Cannot charge.
WEAK BATTERY	**AMBER** = battery voltage low, less than 25.0V after analysis stage.	If low at start up, allow BatteryMINDer to attempt to restore battery. If voltage is low after charging and testing stage, replace battery.
CONNECTION	**GREEN** = good connection to battery. **RED** = incorrect polarity or short circuit in connection.	OK. Reverse positive and negative leads, or troubleshoot short circuit.
POWER	**GREEN** = AC power connected. FLASHING **GREEN** = ECO mode (no battery connected, very low standby power mode).	None required.

Second Row, Mode Indicators – Left to Right		
Indicator	**Meaning**	**Action**
TEMP COMP	**GREEN** = ambient temperature above 27C/80F, compensation engaged. **BLUE** = ambient temperature colder than 21C/70F, compensation engaged.	Automatic, none required.
TESTING	**BLUE** = battery testing in process, charging paused. (Tests to verify battery will hold charge.)	None possible. Wait for testing to complete, about 10 minutes.
LOAD	**AMBER** = parasitic load detected. BatteryMINDer is putting out maximum current in maintenance stage.	Turn off external device loading aircraft electrical system.
DESULFATING	FLASHING **BLUE** = battery is being desulfated.	Automatic, none required.

Third Row, Stage Indicators – Left to Right		
Indicator	**Meaning**	**Action**
SOFT-START	**AMBER** = battery fully discharged. Voltage 6-21V. FLASHING **RED** = battery voltage less than 6V.	Allow BatteryMINDer to attempt to restore battery. Use conventional charger to bring up voltage.
CONST CURR	**GREEN** = battery being charged at constant current up to about 80%.	Allow BatteryMINDer to charge battery.
CONST VOLT	**GREEN** = battery being charged at constant voltage to about 95%.	Allow BatteryMINDer to charge battery.
MAINTAIN	**GREEN** = battery is being topped off to 100%.	Allow BatteryMINDer to maintain battery continuously and indefinitely.

BatteryMINDer Charging Stages



- **Soft-Start** is used if a battery's voltage is under 21V when charging begins. It uses a low constant current to slowly bring up voltage. This prepares a weak or neglected battery for the Constant Current stage.
- **Constant Current** (sometimes called Bulk) is the main charging stage. The charger outputs a constant current of 4 amps, its full power. Battery voltage rises until the battery reaches the optimal charging voltage.
- **Constant Voltage** (sometimes called Absorption) is the second charging stage. The charger regulates the current given to the battery to maintain a constant voltage. As the battery nears a full charge, the current needed to maintain this voltage decreases. Once the current falls below a 0.10A change per hour, the stage is complete. It will be in this stage for a minimum of one hour.
- **Battery Test** is administered by reading your battery voltage while resting the battery for 10 minutes. A voltage of under 25.0V indicates a weak battery, under 23.0V indicates a shorted cell. The battery is tested at completion of the Constant Voltage stage, and every 12 hours during the Maintain stage**.**
- **Maintain** (sometimes called Float) is the charger's long-term stage. The charger can and should be left connected indefinitely. This will keep the battery fully charged ensuring no sulfate can form. The charger maintains float voltage using very little power as it actively monitors the battery and adjusts its output several times a second.

Detailed Operating Instructions

Used properly, your charger is set to provide your battery with exactly what it needs to out-live and out-perform any similar battery used in the same application conditions by a factor of two (2).

1) To use your BatteryMINDer with FAA certified aircraft, a wiring harness must be installed to provide a convenient electrical connection between the aircraft's lead acid battery and the charger. Your GPU/Charger includes a kit of aviation-grade components for this purpose, the Model BM-AIK1 Airframe Interface Kit. This kit is equally appropriate for Experimental category aircraft. Provide this kit to your FAA licensed aircraft mechanic for installation. It contains the parts to fabricate and install a fused wire harness from your aircraft battery to a polarized plug with insulating dust cover. The plug should be mounted in a convenient location for connecting the BatteryMINDer's output cable. The kit also includes regulatory references to assure your mechanic that this qualifies as a minor alteration and is within his/her authority to install and return-to-service with a simple airframe maintenance log entry. No FAA Form 337 is required, and should not be filed.

2) Attach the GPU line cord and connect to a 120VAC receptacle. A heavy-duty extension cord may be used if necessary, but the shorter the better.

3) Attach the charger output cable to the twist-on receptacle on the GPU front panel.

4) Verify GPU power switch is in the OFF position.

5) Attach output cord of charger to the mating airframe connector.

6) Turn on BatteryMINDer by moving the power switch to the CHARGER position. The POWER indicator will light **GREEN**. Within 30 seconds, if it does not light **GREEN** check the outlet to be sure it is functioning. In addition, be sure if outlet is controlled by a switch, no one will accidentally shut off the power to the outlet. Verify CONNECTION indicator is **GREEN**. If indicator is **RED**, shut down, check for short, or reverse the charger's output connections to the battery. Once connection problem to battery is resolved, restart.

7) Charging will automatically start within 15 - 30 seconds. The CONST CURR (constant current or bulk charge) indicator will light **GREEN**. The charger will now begin charging by first checking the battery to determine its voltage and ability to accept a charge. Should the battery not have a normal fully discharged voltage (22.0V minimum) the unit will begin charging in the SOFT-START stage, indicated by **AMBER**, to determine if the battery can be safely charged. If it cannot, the SOFT-START indicator will light **RED** and charging will be stopped. Battery should be carefully checked under a load by a qualified technician before further attempting to charge it.

   Note: If the battery does not have a minimum no-load open-circuit-voltage (OCV) of 6 volts, the SOFT-START indicator will flash red and charger will reject the battery.

Fully-Rested, No Load, Open Circuit Voltage for 24-Volt Battery	
Measured Voltage	**Capacity**
25.8 – 26.2	100%
25.2 – 25.8	75%
24.8 – 25.2	50%
24.4 – 24.8	25%
24.0 – 24.4	0%
< 22.0	Shorted

   No further effort should be made to charge this battery with this or any charger. Discard this battery, unless it has just been subjected to a recent period of continuous discharge under a load such as can occur with leaving lights on or cranking an engine excessively. Allow such a battery to "Rest" for several hours (overnight if possible) before determining if it is defective. Be very suspicious of any 24V battery that does not have at least 22V (OCV) before it is recharged. It may well be seriously damaged and unsafe for any type of use or recharge. The charger's SOFT-START **AMBER** indication will help you determine if battery is less than 22V.

8) After battery has been fully charged, MAINTAIN stage indicator will light. Some batteries may be too large or too deeply discharged to be fully charged in the normal time allowed by charger. If you are certain the battery is not defective, having read and understood completely all of the above concerns and conditions, proceed to reboot the charger by turning the POWER switch OFF and disconnecting from the battery (DC) and waiting 10 seconds before reconnecting the battery and then powering back ON. This allows charger to begin charging battery again. If battery is not defective it should be able to be fully charged after being restarted. After sufficient time has lapsed the MAINTAIN indicator will illuminate confirming if / when battery is fully charged.

Special Note for Aircraft with Dual Battery Systems:

If attempting to charge more than one battery at a time, the charger will need to be restarted in order to completely charge multiple batteries. We do not recommend charging more than one battery at a time without confirming the individual condition of each battery and monitoring the charging and batteries closely.

It's better to charge each battery separately, then together for maintenance-float charging. It's best to use a separate BatteryMINDer for each battery. See Maintaining Multiple Batteries.

Temperature Sensor and Compensation

The charger output cable features a built-in temperature sensor to provide an indication of ambient temperature to the BatteryMINDer's control circuitry. For full-time continuous, indefinite, maintenance charging, the exact charging / maintenance voltage is critical for maximum battery life. The following chart shows the need to regulate the voltage of the charger to ensure against over or under charging over a wide range of temperatures.

Ambient Temperature		Optimum Output Voltage	
°F	°C	Charge	Maintain
> 120	> 49	26.7	25.9
115	46	27.0	25.9
105	41	27.3	25.9
95	35	27.6	25.9
85	29	27.9	25.9
75	24	28.2	26.1
65	18	28.5	26.4
55	13	28.8	26.7
45	7	29.1	27.0
> 40	> 4	29.4	27.3

The values above show a common aviation battery with BatteryMINDer "S2" charging profile. Values for batteries from other aviation battery manufacturers may vary slightly, but should be comparable. We strongly recommend checking with the appropriate dealer or battery manufacturer to be certain.

Temperature also has a direct effect on the life of a battery. The design life of the battery is based on an average annual temperature of 25°C (77°F). As the temperature increases, the life of the battery decreases. Example: if average temperature is 35°C (95°F), life of battery is reduced 50%.

Aviation Battery Charging Profiles

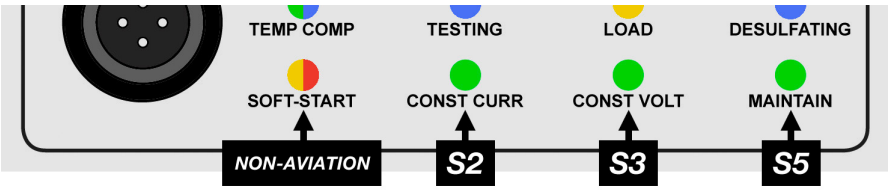
The 244CEC1-AA BatteryMINDer within the GPU has 3 charging profiles that are designed to precisely match the long-term charging requirements of the most popular aviation lead acid battery types:

BATTERY TYPE	RECOMMENDED CHARGING PROFILE
Concorde Flooded Cell	S2 or S5
Gill Flooded	S2
Concorde Sealed RG	S5
Hawker Odyssey	S3
Gill LT/7000	S3

The default charging profile is S2. To change the desired profile:

1) Locate the pin-hole on the BatteryMINDer panel, above the CONNECTION indicator. Use a straightened paper clip to access the micro-switch located behind the panel.

2) During programming, the bottom row of LEDs indicates 1 of 4 charging profiles that can be selected. (Do not use the NON-AVIATION profile for aircraft batteries.)



3) Disconnect charger output cable from battery, if connected.

4) Turn power switch to CHARGER position to power ON. After the initial start-up routine of LEDs being illuminated, there will be one indicator in the bottom row that will flash 4 times. This indicates the current profile. Next, the first indicator (SOFT-START) will flash RED about 10 times. While it is still flashing, press and hold the switch until current profile indicator is flashing.

5) Release the switch, and press repeatedly to change profiles until the desired profile is indicated. After a few seconds, the charger will reboot with the new charging profile and is ready to use.

NOTE: If you want to change the profile again or missed the RED flashing mode, turn charger off and wait 30 seconds to try again.

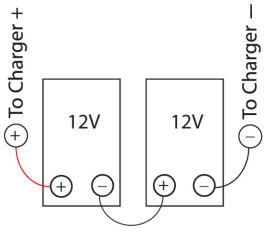
Maintaining Multiple Batteries

BatteryMINDer 244CEC1-AA maintenance charger-desulfator can maintain (not charge) two 24-volt batteries simultaneously, providing each battery is fully operational (no dead/dying cells), free of sulfate and meeting the minimum full charge “rested” voltage of 25.5V, after being fully desulfated. **ALL batteries MUST be properly tested to ensure they are in good condition (no dead/dying cells or excessive sulfation) before maintaining them in multiples.** Only healthy, fully desulfated batteries should ever be MAINTAINED in sets of 2. Attempting to desulfate more than one (1) battery at a time will yield very poor results, as the strongest (healthiest) and not the weakest (most sulfated) battery will receive the majority of the desulfation pulse energy.

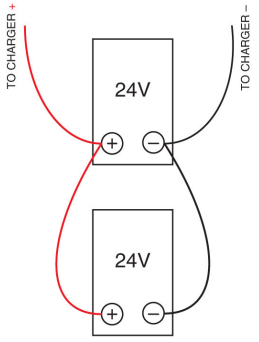
Test each cell of filler cap batteries using an accurate, temperature compensated hydrometer. Test sealed (no filler caps) batteries using an accurate, DIGITAL type ONLY, voltmeter. The minimum voltage must not be less than 25.5V after fully charging battery and letting it “rest” for 12 hours minimum, before testing. If battery voltage is less than 25.5V you must first desulfate it until you reach a “rested” 25.5V.

ALWAYS test each individual battery to be certain it is healthy and free of sulfate before attempting to charge or maintain them, either as a single battery or in sets.

Audio Authority and VDC Electronics, Inc. do not make, supply, or recommend any type of wire harness to connect multiple batteries for the purpose of charging them in groups, due to the many battery terminal sizes and configurations that exist. The most common multiple battery configurations are illustrated here.



12 VOLT (Series Connected) = 24V



24 VOLT (Parallel Connected) = 24V

Troubleshooting Guide

PROBLEM	POSSIBLE CAUSE	SOLUTION
POWER indicator does not illuminate **GREEN** after charger turned on for 30 seconds	AC outlet is dead. No AC to GPU.	Check AC receptacle for 120VAC, check for blown circuit breaker, make sure outlet is not remotely switched to prevent accidental shutdown while charger is working. Make sure AC input cord to GPU is fully engaged. Check extension cord.
CONNECTION indicator **RED** or OFF	DC output connections to battery reversed or shorted. DC output connection to battery is open circuit.	Reverse positive and negative leads to battery. Check for short circuit. Troubleshoot battery connection. Check for blown fuse.
WEAK BATTERY indicator **AMBER** at initial connection	Battery can be weak due to sulfation, self-discharge or was very deeply discharged.	Attempt a full recharge and recheck afterwards. If still AMBER, follow procedure below.
SOFT-START indicator **AMBER**	Low-voltage, 6 – 21V. Battery may be weak, heavily sulfated, or too large to fully charge before unit times out. Battery may be so large it may require a second full recharge.	Reboot charger by moving power switch to OFF position, disconnect from battery so there will be no electrical power going to the unit from either direction. Wait 30 seconds, reconnect to battery, then turn power switch to CHARGER position to restart the charging process.
SOFT-START indicator FLASHING **RED**	Battery voltage below 6V. Battery just removed from continuous load (lights or equipment left on) or not used for extended time without a charger-maintainer. Battery has charged and “rested” and still cannot be recovered or recharged.	Use conventional charger to bring up voltage.
WEAK BATTERY indicator **AMBER** after battery has been completely charged	Battery still has an unacceptable level of sulfation.	Reboot unit by moving power switch to OFF position, disconnect from battery so there will be no electrical power going to the unit from either direction. Wait 30 seconds, reconnect to battery, then turn power switch to CHARGER position to restart the charging process.

SPECIFICATIONS:

VDC Model No. 244CEC1-AA
Microcontroller-Based Maintenance Charger for 24V General Aviation Lead-Acid Battery

FCC Part 15 Certification: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.

Electrical Parameters:

Input voltage:	120VAC
Input frequency:	50/60 Hz
Unloaded input current:	0.50 W
Loaded Input current:	approximately 1.8 Amp 120VAC consumption full output (UL1236)
Output:	approximately 26-28VDC, max 4 amps, varies with charging stage

Physical Parameters

Weight:	approximately 2 lbs. added to weight of GPU
Operating temperature:	-20° to 40°C
Storage temperature:	-40° to 85°C
Operating Humidity:	0 to 95% RH

BatteryMINDer® Five-Year Limited Warranty

Audio Authority Corp and VDC Electronics, Inc. warrant this product for FIVE years from date of retail purchase against defective material or workmanship and will be repaired or replaced at no charge. We make no warranty other than this limited warranty and expressly exclude any implied warranty including any warranty for consequential damages. This limited warranty is not transferable. To obtain warranty repair service, *unit must be returned freight prepaid together with Proof of Purchase directly to Audio Authority Corp,* ***NOT TO THE DEALER FROM WHICH IT WAS PURCHASED****.*

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