

Operator's Instructions & Reference Guide

BatteryMINDER® Model DS24041-AA-S5 Aviation-Specific 24V Battery Charger and Continuous-Duty Maintainer, Conditioner, Desulfator



This manual pertains ONLY to Audio Authority specific configurations of the 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 meet regulatory requirements for use with FAA certified aircraft.

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

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Introduction and Background Information

The Model DS24041-AA-S5 is a special configuration of the BatteryMINDER 3-stage battery charger specifically calibrated for lead-acid aircraft batteries only. Audio Authority, in collaboration with VDC Electronics, has incorporated this award-winning technology as an option into the 2800 Series Ground Power Units for general aviation aircraft.

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 sulfates that naturally form on the battery plates. This sulfation process reduces battery capacity and is made worse by extended periods of inactivity, high heat, and poor maintenance. Aviation batteries must maintain a minimum of 80 or 85% of their rated capacity to be airworthy, or legal for flight.

The BatteryMINDER's continuous desulfation can actually reverse the battery aging process, which will restore 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 the special 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 to access the battery on a certified aircraft. This harness provides a mating polarized plug for quick connect and disconnect of the BatteryMINDER from the aircraft. An airframe log entry is all that is required to document this minor alteration and return the aircraft to service.

The BatteryMINDER's "plug-n-run" design requires no input from the operator, or if line power is lost. Make just one connection to the aircraft, turn it on, and leave. Operation is completely automatic.

Faithful use of the BatteryMINDER will provide maximum starting power every time, important for all aircraft, but especially for turbine starts.

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 possibly 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 123°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 an arc. **NOTE:** according to the manufacturer, Concorde sealed AGM batteries do not need to be removed from aircraft for 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 aviation-grade parts kit to install a fuse-protected battery charger harness on FAA certified aircraft to connect your BatteryMINDER. 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.



Controls, Indicators, and Connections

An overview of the indicators is provided here. See page 6 for details.



Power-Status indicator
GREEN = Charger ON, ready
RED = Battery error or short

Battery Condition indicator
GREEN = Good, OK to charge
YELLOW = Weak, sulfated
OFF = Dead battery, not charging

Charge Mode indicator
GREEN = Charging
FLASHING GREEN = Desulfate-Condition
OFF = not charging

Output Receptacle

Connect twist-on, 4-pin charger output cable here.

Quick-Start Summary Operating Instructions

- 1) Install Model BM-AIK1 Airframe Interface Kit

Provide the kit to your FAA licensed aircraft mechanic for installation and return-to-service airframe maintenance log entry as a minor alteration. An FAA Form 337 is NOT required.

- 2) Attach GPU line cord and connect to AC power receptacle. A heavy-duty extension cord may be used, the shorter the better.
- 3) Attach charger output cable to twist-on receptacle on GPU.
- 4) Verify Power Switch is OFF.
- 5) Connect output cable to mating plug installed on aircraft.

Verify **Battery Condition** indicator lights **GREEN**.

If indicator does not light, battery is dead, and must be serviced in accordance with the battery manufacturer's instructions. NOTE: BatteryMINDER will NOT recharge a dead battery.

If indicator lights **YELLOW**, battery is weak and/or badly sulfated. Charging and desulfation may be attempted, but battery may not be recoverable.

- 6) Turn on BatteryMINDER by moving power switch to **CHARGER** position.

Verify **Power-Status** indicator lights **GREEN** within 30 seconds. The charger will begin by checking the battery voltage and ability to charge. If indicator lights **RED**, disconnect BatteryMINDER from aircraft battery. Check for short circuit or reverse battery polarity. Resolve problem before continuing.

Verify **Charge-Float** indicator lights **GREEN**. If indicator is not illuminated, charger is not engaged. If charger is **FLASHING GREEN**, then battery is fully charged and charger has automatically entered its maintenance or float mode. Battery will be maintained at its optimum state of charge and full-time conditioning desulfation will occur in this mode.

- 7) Leave charger connected continuously when aircraft is in hangar storage to maintain optimum charge and desulfate to recover lost battery capacity and lengthen 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. Be patient and you will be rewarded with a "sulfate-free" battery.

- 8) Before next flight, turn off the GPU/Charger and disconnect the BatteryMINDER output cable from the aircraft. Store the GPU and all cords, accessories, extension cords, etc. where they will not interfere with aircraft preflight inspection or operations.

LED Indicator Functions

POWER-STATUS	
CONDITION / DESCRIPTION	INDICATION
Power OFF	OFF
Power ON, battery connected correctly	ON GREEN
Power ON, battery fully charged, float or maintenance mode, de-sulfating in process, leave charger connected	FLASHING
Power ON, battery polarity reversed, shorted, or < 6V, battery rejected, charging cannot begin	ON RED
Power ON, battery fault, battery not fully charged, charger is in the float-maintenance mode.	FLASHING

BATTERY CONDITION	
CONDITION / DESCRIPTION	INDICATION
Before or during charge, battery voltage less than 22V	ON YELLOW
Before or during charge, battery voltage greater than 22V	ON GREEN
Power ON, after full charge, battery less than 25.8V	ON YELLOW
Power ON, after full charge, battery greater than 25.8V	ON GREEN

CHARGE-FLOAT	
CONDITION / DESCRIPTION	INDICATION
Power OFF	OFF
Power ON, battery connected, normal charging	ON GREEN
Power ON, battery fully charged, float or maintenance mode, de-sulfating in process	FLASHING

Detailed Operating Instructions

- 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, Model BM-AIK1 Airframe Interface Kit. 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 337 required, or should 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. The **Battery Condition** indicator should light **GREEN** if the open circuit voltage is greater than 22 volts and battery is acceptable to charge. If battery voltage is less than 22 volts (fully discharged) the **Battery Condition** indicator will light **YELLOW**. If the **Battery Condition** indicator does not light at all, check for

reverse battery polarity, defective harness, blown harness fuse, severely discharged battery, or other problem and resolve before proceeding.

- 6) Turn on BatteryMINDER by moving the power switch to the CHARGER position. Verify **Power-Status** indicator lights **GREEN** within 30 seconds or less. The charger will begin by checking the battery voltage and ability to charge. If indicator lights **RED**, disconnect BatteryMINDER from aircraft battery. Check for short circuit or reverse battery polarity. Resolve problem before continuing.
- 7) If the battery does not have at least a normal fully discharged voltage (21 volts minimum) the unit will begin charging in the “Soft-Start” mode to determine if the battery can be safely charged. If it cannot, the **Power-Status** indicator will **FLASH RED** and charging will be stopped. Battery should be carefully checked under a load by a qualified aviation technician before attempting to charge it again.

Note: If the battery does not have a minimum no load 6 volts, the Power-Status will light RED and charger will reject battery for charging.

No further effort should be made to charge this battery with this charger or any charger. Discard this battery, unless it has just been subjected to a long period of continuous discharge under a load such as can occur with leaving lights on or cranking an engine excessively. Remove battery from aircraft for servicing per manufacturer’s maintenance manual. Allow such a battery to “Rest” for several hours (overnight if possible) before determining if it is defective. Be very suspicious of any 24-volt battery that does not have at least 22 volts before it is recharged. It may well be seriously damaged and unsafe for any type of use or recharge. The unit’s **Battery Condition** indicator will show whether battery is less than 22-Volts (**YELLOW**) or greater than 22-Volts (**GREEN**)

- 8) Verify **Charge-Float** indicator lights **GREEN**. If indicator is not illuminated, charger is not engaged. If charger is **FLASHING GREEN**, then battery is already fully charged and charger has automatically entered its maintenance or float mode. Battery will be maintained at its optimum state of charge. Full-time conditioning and long-term desulfation will occur in this mode.
- 9) After battery has been fully charged, the **GREEN Charge-Float** indicator will begin blinking. It will continue to blink indefinitely, unless unit is disconnected from battery or Stop/Restart button is pressed. If the battery cannot be fully charged, the **Charge-Float** indicator will not flash and the **RED Power-Status** indicator will flash. Battery may not be able to be fully charged, may be too large or too deeply discharged to be fully charged in the normal time allowed by charger. If you are certain battery is not defective, having read and understood completely all of the above concerns and conditions, proceed to restart the charging sequence by turning the power switch to the OFF position for 10 seconds, then back ON again to reboot / reset the charger.
- 10) If battery is not defective, it should fully charge after being restarted. After sufficient time has lapsed the **Charge-Float** indicator will **FLASH GREEN** confirming battery is now fully charged.

Special Note for Aircraft with Dual Battery Systems:

If attempting to charge more than one battery at a time, it is very likely the charger will need to be restarted as described 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.

A better solution is to charge each battery separately and then connect them together for long term maintenance-float charging. See section on Maintaining Multiple Batteries.

Temperature Sensor

The charger output cable features a built-in temperature sensor near the red SB50 plug to provide an indication of ambient temperature to the BatteryMINDER's control circuitry. The chart below 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	26.8	25.8
115	46	27.2	26.0
105	41	27.4	26.2
95	35	27.6	26.4
85	29	27.8	26.6
75	24	28.2	27.0
65	18	28.5	27.5
55	13	28.5	27.9
45	7	29.2	28.3
> 40	> 4	29.8	28.8

The values shown in **RED** are based on data supplied by Concorde Battery Co., Sept 2010. Values for batteries from other aviation battery manufacturers may vary slightly, but are believed to 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. For example, at an average annual battery temperature of 35°C (95°F) the life of the battery will be reduced by 50%.

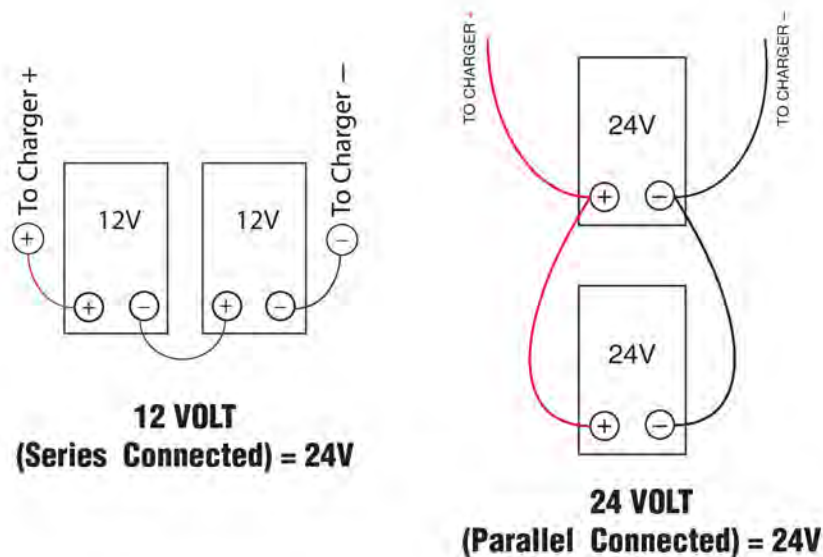
MAINTAINING MULTIPLE BATTERIES

BatteryMINDER DS24041-AA-S5 maintenance charger-desulfator can maintain 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 2.13volts / cell, 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 2.13volts / cell after fully charging battery and letting it “rest” for 12 hours minimum, before testing. If battery voltage is less than 2.13/ cell you must first desulfate it until you reach a “rested” of 2.13 volts / cell.

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 individual batteries for the purpose of charging them in groups, due to the many battery terminal sizes and configurations that exist. See diagram below for the most common multiple battery configurations.



Troubleshooting Guide

Problem / Condition	Solution
Power ON, indicator does not light	Check electrical outlet. If controlled by a wall switch be sure switch is on and avoid accidentally shutting it off while charger is working.
Power-Status indicator lights RED	<ol style="list-style-type: none"> 1. Polarity of wiring harness to aircraft battery is reversed. Verify correct polarity. 2. If still remains RED check battery voltage. If 6-Volts or less battery may be damaged and should not be recharged. If battery was just recently removed from a load (lights, electronic equipment) or not used for extended time without a charger-maintainer, allow battery to “recover” by letting it “rest” without a load. If battery is healthy and just deeply discharged it should recover its voltage (rise above 6 volts) sufficiently to allow charger to begin an attempt to fully recharge it. If battery cannot be recovered or recharged, it should be recycled.
Power-Status indicator lights FLASHING RED .	<ol style="list-style-type: none"> 1. Battery(s) may be weak, heavily sulfated, or too large to fully charge before charger times out. Allow battery to remain in Maintenance-Float mode for 72 hours or more, then attempt to charge again. 2. Battery may be so large it requires a second full recharge. Repeat charge cycle by switching the power OFF for 10 seconds, then back ON to reboot / reset the charger. 3. If recharging multiple batteries, 2 or more complete recharge cycles may be needed. Repeat full recharge by switching the power OFF for 10 seconds, then back ON to reboot / reset the charger. <p>If still FLASHING RED, you may need to charge each battery separately.</p>
After battery has been completely charged, Battery Condition indicator lights YELLOW	Battery still has an unacceptable level of sulfation and must remain in Maintenance-Float mode (FLASHING GREEN indicator) for 72 hours or longer. Then stop charger by switching the power OFF for 10 seconds, then back ON to reboot / reset the charger. If still YELLOW repeat (up to 3 full cycles) or until indicator lights GREEN .
Before battery is completely charged, Battery Condition indicator lights YELLOW	Battery may be weak due to sulfation, self discharge, or was very deeply discharged. Attempt a full recharge and recheck after completion. If still YELLOW follow procedure above.
Power-Status and Charge-Float indicators both FLASHING simultaneously	Charger has timed out before battery has completely charged. Switch the power OFF for 10 seconds, then back ON to reboot / restart the charging cycle.

DETAILED SPECIFICATIONS - VDC Model No. DS24041-AA-S5

28.2V – 4A Microcontroller Based Charger for 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: 90 - 140Vac

Input frequency: 50/60 Hz

Unloaded input current: 80 mA ac

Input current consumption at 120VAC input, output 26V 4A loading (UL1236) approx: 1A AC

Charging Output Control Characteristics:

Soft start charging Activity conditions: Battery voltage is over 6 VDC and less than 21VDC

Soft start charging output current control: (4A mode) 4 ± 0.25 A DC

Soft start charging Timeout: 6 ± 0.25 Hours (Stops charge if battery cannot be charged over 21 volts after 6 hours, **Power-Status** indicator flash indicated)

Bulk charging activity conditions: Battery voltage is over 21VDC

Bulk charging current control at 4A mode: $4 + 0.22 / - 0$ amps DC

Max. rated output voltage and current: 26.0V at 4A DC 27.2V at 3.25A DC

Bulk charging time limited: (stops charge if battery cannot be fully charged [28.2V @ 24°C] after 20 hrs, error LED flash indicated) 20 ± 1 hours

Maintenance-Float Operations:

Mode: 1) Charging current

2) 5 hours time-out: after 5 hours unit switches to Float Charge mode

Absorption mode thermal runaway protection: Stops charging when the second current sample is larger than the first current sample (positive dI/dt)

Charge-Float indicator will **FLASH GREEN**

Float charge output voltage control 27.0 ± 0.25 VDC

Float charge current control (4A Rate) 2A DC ± 0.25

Float charge transitions to PWM* Float Charge mode after 1 hour

Float pulse charge voltage control 27.0 @ 24°C ± 0.25 VDC

Float pulse charge current control: (4A rate) 2A DC ± 0.25

Battery sulfation check period (after absorption charge is finished): 10 minutes

Unloaded output voltage when battery is disconnected: 0.5 VDC (max.)

Output short-circuit current when battery disconnected: 5mA DC (max.)

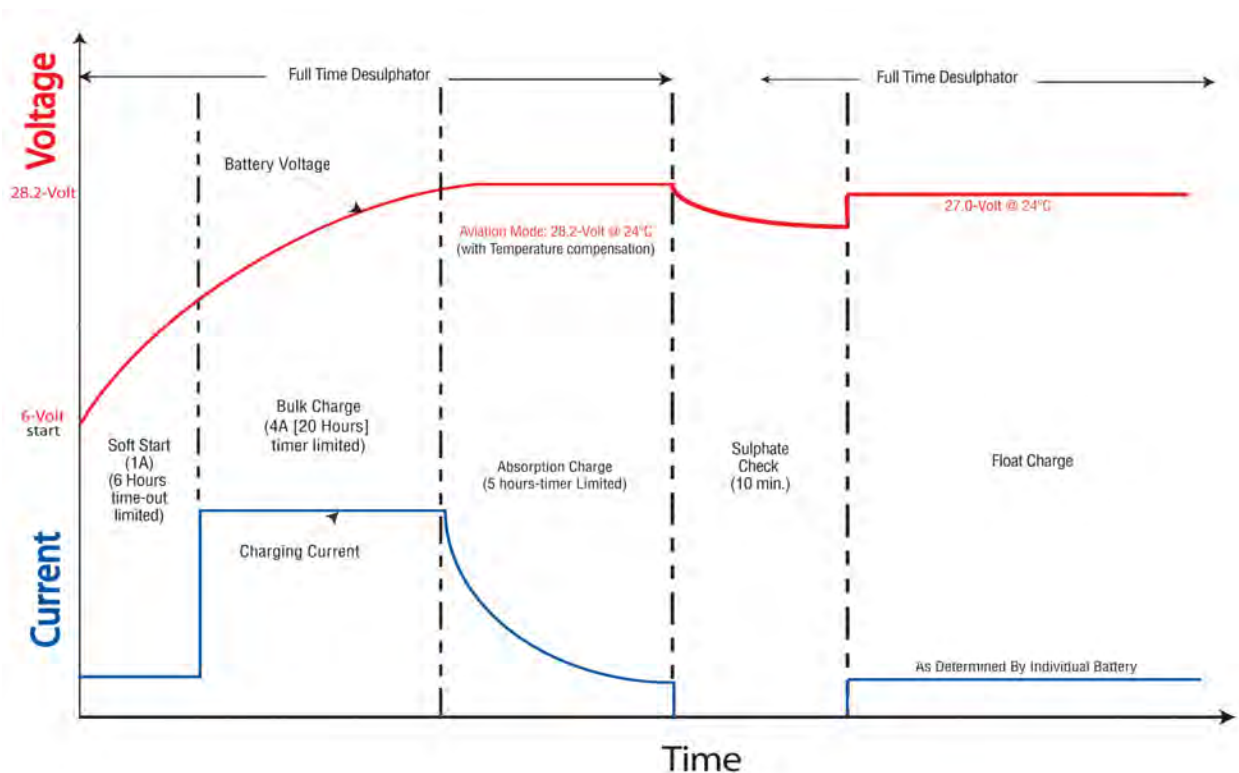
Battery flow back current (to the charger) when connected to 24V battery, AC power disconnected: 30 (max.) mA DC

All indicators shut off if AC power is disconnected for 5 minutes

Full time de-sulfation output pulse current control $I_{p-p} \pm 3ADC$

Full time de-sulfation output PWM* frequency 100 ±10Hz
Full time de-sulfation duty 0.3%

* Pulse Width Modulated



Physical Parameters

Weight: 2 lbs. added to weight of GPU
Operating temperature : -10° to 40°C
Storage temperature : -10° to 80°C
Operating humidity range: 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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