

# INSTALLATION & OPERATION MANUAL

**BCA310 SERIES  
AC SOURCE  
BATTERY CHARGER**



# AC SOURCE BATTERY CHARGER

## IMPORTANT SAFETY INSTRUCTIONS

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**SAVE THESE INSTRUCTIONS** — This manual contains important safety and operating instructions for the battery charger.

### BATTERY CHARGER PRECAUTIONS

1. Do not expose the battery charger to rain or snow unless it is a sealed model.
2. Use of an attachment not recommended or sold by the battery charger manufacturer may result in a risk of fire, electric shock, or injury to persons.
3. Do not disassemble the battery charger; return it to the manufacturer or an authorized service center when service or repair is required. Incorrect reassembly may result in a risk of electric shock or fire. Voltages in excess of 350 volts are present inside the charger anytime it is plugged into an AC outlet, even if it is switched off.
4. To reduce risk of electric shock, unplug the battery charger from the AC outlet before attempting any maintenance or cleaning. Turning off controls will not reduce this risk.
5. Never place battery charger directly above battery; gases from battery will corrode and damage battery charger.
6. Never allow battery acid to drip on the battery charger.

### BATTERY SAFETY

1. WARNING — RISK OF EXPLOSIVE GASES
    - i. WORKING IN VICINITY OF A LEAD-ACID BATTERY IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL BATTERY OPERATION. FOR THIS REASON, IT IS OF UTMOST IMPORTANCE THAT EACH TIME BEFORE SERVICING EQUIPMENT IN THE VICINITY OF THE BATTERY, YOU READ THIS USER GUIDE AND FOLLOW THE INSTRUCTIONS EXACTLY.
    - ii. To reduce risk of battery explosion, follow these instructions and those published by the battery manufacturer and manufacturer of any equipment you intend to use in vicinity of battery. Review the cautionary marking on these products.
  2. PERSONAL PRECAUTIONS
    - i. Someone should be within range of your voice or close enough to come to your aid when you work near a battery.
    - ii. Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
    - iii. Wear complete eye protection and clothing protection. Avoid touching eyes while working near battery.
    - iv. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cold water for at least 10 minutes and get medical attention immediately
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- v. NEVER smoke or allow a spark or flame in the vicinity of a battery.
  - vi. Be extra cautious to reduce risk of dropping a metal tool onto battery. It might spark or short-circuit the battery or other electrical part that may cause a fire or explosion.
  - vii. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a lead-acid battery. A lead-acid battery can produce a short-circuit current high enough to melt metal, causing a severe burn.
  - viii. NEVER charge a frozen battery.
  - ix. If it is necessary to remove a battery from service, always remove grounded terminal from battery first. Make sure all accessories connected to the battery are off, to prevent an arc when reconnecting the new battery.
  - x. Be sure area around battery is well ventilated.
  - xi. Clean the battery terminals. Be careful to keep corrosion from coming in contact with eyes.
  - xii. Study all the battery manufacturer's specific precautions such as removing or not removing cell caps while charging and recommended rates of charge

## **GROUNDING AND AC POWER CORD CONNECTION INSTRUCTIONS**

The plug must be plugged into an outlet that is properly installed and grounded in accordance with all local codes and ordinances.

**DANGER:** Never alter the AC power cord or plug provided. If it will not fit the output, use an approved adapter or have the proper AC power cord installed by a qualified electrician. Improper connection can result in the risk of electric shock.

## **MEDICAL EQUIPMENT NOTICE**

Analytic Systems does not recommend the use of their products in life support applications where failure or malfunction of this product can be reasonably expected to cause failure of the life support device or to significantly affect its safety or effectiveness. Analytic Systems does not recommend the use of any of its products in direct patient care. Examples of devices considered to be life support devices are neonatal oxygen analyzers, nerve stimulators (whether used for anesthesia, pain relief, or other purposes), auto-transfusion devices, blood pumps, defibrillators, arrhythmia detectors and alarms, pacemakers, hemodialysis systems, peritoneal dialysis systems, neonatal ventilator incubators, ventilators for both adults and infants, anesthesia ventilators, and infusion pumps as well as any other devices designated as "critical" by the U.S. FDA

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# Introduction

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The BCA310 AC source battery charger provides up to 300 watts of precision charging power to charge your one or two bank battery system. The batteries must share a common ground.

This unit can be built to operate from any conventional AC mains power of 110 or 220 VAC .In the absence of a battery, the BCA310 can also function as a power supply up to its continuous current rating. See Specifications for the output current rating of your unit.

This unit can be configured all your battery charging needs. The charger can deliver output voltages of 12, 24, 32,48 or 72 VDC for battery capacities of all types. An output voltage adjust, user-selected charging profiles, and temperature compensation allow for precise and gentle charging of your expensive battery banks. The user-initiated equalize cycle function can help maintain your battery banks, prolonging their lifespan.

Internally, the recently updated single board design incorporates time-tested switch mode technology for unmatched efficiency and ultra-quiet operation. Additional stages of filter on the outputs reduce conducted and radiated noise to very low levels.

Designed with safety in mind, this unit features reverse input connection, over temperature shutdown, short circuit protection, input/output under voltage shutdown, reverse battery connection and output overvoltage crowbar.

# Box Contents

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The box you've received should contain the following:

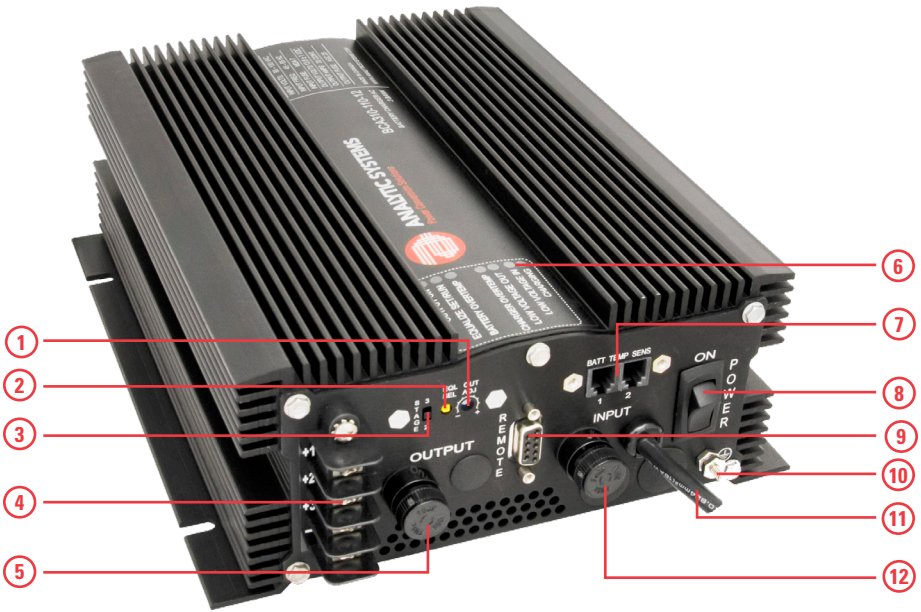
- One BCA310 Battery Charger
- One Battery Temperature Sensor (B-Temp)
- This manual
- One warranty card

*If anything is damaged or missing from your box, please contact your dealer or Analytic Systems for a replacement.*

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# Main Parts

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## Front Panel

1. Output Voltage Adjust
  2. Equalize Start Button
  3. Stage Select Switch
  4. **DC Output Connection:** Molex BEAU 4-pin Terminal Strip
  5. **Output Fuse:** AGC-25
  6. Indicator LEDs
  7. Battery Temperature Sensor Port
  8. Power Switch
  9. Remote Control Port
  10. Chassis Grounding Screw
  11. **AC Input Connection:** 5-foot (2.5m) power cable ending in a NEMA 5-20 Connector
  12. **Input Fuse:** AGC-7
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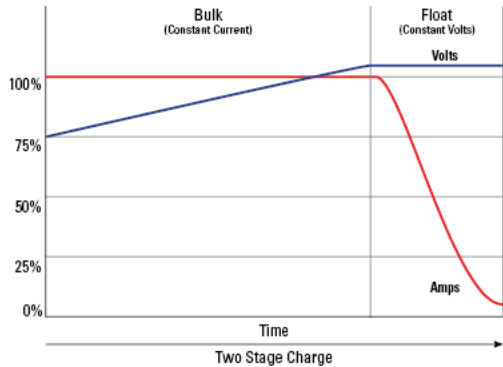
# Charging Profiles

This unit has both two-stage and three-stage charging capability. You can choose which charging profile is used during operation by using the Stage Select switch on the front panel.

Below are explanations of the two profiles:

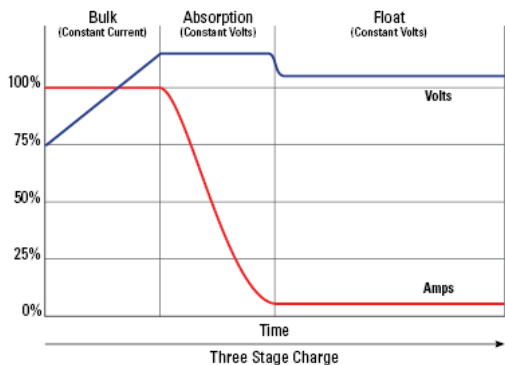
## TWO-STAGE CHARGING

- The battery is charged at a constant current until the battery's voltage reaches the float voltage.
- Then the charging current diminishes as necessary to maintain the battery at that voltage.
- Once the current drops to 10%, the charging cycle is complete. The unit will maintain the battery at full charge until needed.
- Two-stage charging is gentler on the battery since the battery is subjected to lower voltages and currents than in three-stage. In addition, a reasonable load can be connected to the battery without affecting the charger's ability to keep the battery at full charge.



## THREE-STAGE CHARGING

- The battery is charged at a constant current (higher than in two-stage) until the battery's voltage reaches the absorption voltage.
- Then the charging current diminishes as necessary to maintain the battery at that voltage.
- Once the current drops to 10%, the charging cycle is complete. The unit switches to keeping the battery at the float voltage and will maintain the battery at full charge until needed.
- Three-stage charging is faster than two-stage, however the battery is subjected to higher voltages and currents. Three-stage charging is not recommended for charging loaded batteries because the unit cannot differentiate between current going to a load connected to the battery and current being absorbed by the battery; this can cause overcharging.



# Operation

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The BCA310 is designed for simple and intuitive operation. Before operating, make sure this unit is properly installed and connected. See *Installation* for more information.

## TO CHARGE A LEAD-ACID BATTERY

1. Select a two-stage or three-stage charging profile by moving the Stage Select switch to the correct position. See Charging Profiles for more information.
2. Move the Power Switch to the ON position. The alarm buzzer will sound and the UNDER-VOLTAGE OUTPUT LED will glow red briefly, then the POWER LED will glow green.
3. The CHARGING LED will glow green and the unit will charge the battery.
4. Once the battery is fully charged, the CHARGING LED will turn off. The unit will maintain the battery at the float voltage for as long as it is connected.

## TO ADJUST THE CHARGING VOLTAGE

1. Disconnect the waterproof battery temperature sensor from the unit, if it is connected.
2. Move the Power Switch to the ON position to turn on the charger.
3. Using an appropriately sized flat-blade screwdriver, rotate the Output Voltage Adjustment Potentiometer. The charging voltage can be adjusted over a range of  $\pm 10\%$ .
4. Rotating the potentiometer clockwise increases the output voltage; rotating it counter-clockwise decreases the output voltage.
5. Check the charging voltage using a voltmeter or multimeter at the battery terminal.
6. Reconnect the waterproof battery temperature sensor when satisfied with the voltage.

## TO CHARGE A LITHIUM-ION BATTERY

1. Select a two-stage charging profile by moving the Stage Select switch to the correct position.
  2. Move the Power Switch to the ON position. The alarm buzzer will sound and the UNDER-VOLTAGE OUTPUT LED will glow red briefly, then the POWER LED will glow green.
  3. Use the procedure above to adjust the charging voltage to a suitable voltage. Consult the Li-On battery manufacturer for the recommended charging voltage.
  4. The CHARGING LED will glow green and the unit will charge the Li-On battery.
  5. Once the battery is fully charged, the CHARGING LED will turn off. The unit will maintain the battery at the float voltage for as long as it is connected.
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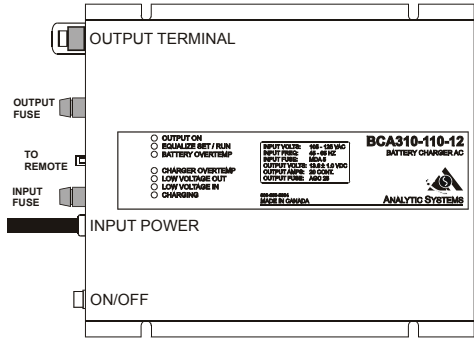


# Installation

## MOUNTING

Mount the unit in a DRY and WELL VENTILATED location with at least 1 inch of clearance all around it. The ideal mounting configuration is to mount the unit on a vertical surface oriented as shown. #10 screws are recommended for attaching the unit to the surface.

There is 1500 volts of isolation between the input and output, and the input and case. There is 500 volts (1500V for 48V output units) of isolation between the output and case. Therefore, the unit may be mounted on any surface without fear of electrolysis or ground fault.



### **CAUTION: THE POWER SWITCH MUST BE IN THE OFF POSITION BEFORE MAKING CONNECTIONS.**

When connecting the battery to the unit a small arc can form between the connectors. To ensure spark-free connections, make connections only when the power switch is in the OFF position.

## AC INPUT CONNECTION

This unit is equipped with a 5-foot (2.5m) power cable terminating in a NEMA 5-20 Connector (for North American models) or a CEE7/7 Connector (for European models) to serve as an AC Input Connection.

If you must extend the power cable be sure to use a 3 conductor grounded type extension cable. For hard wiring to a source of power, cut off the plug, and strip the wires as necessary.

The wire colors are as follows:

### North American Plug

Black - AC Hot

White - AC Neutral

Green - Ground

### European Plug

Brown - AC Hot / Phase 1

Blue - AC Neutral / Phase 2

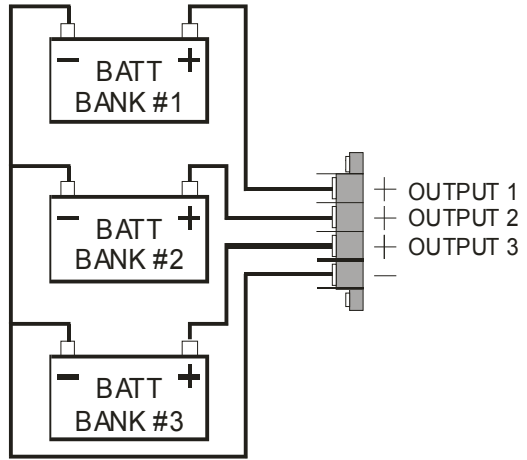
Green/Yellow - Ground

All connections should be made inside of an appropriate junction box with appropriately rated circuit breakers used in the circuit panel to feed power to the BCA310. See *Specifications* for the maximum input current and recommended fuses.

## DC OUTPUT CONNECTION

This unit is equipped with a Molex 4-pin BEAU Terminal Strip to serve as a DC Output Connection. The connection can support up to 3 battery banks.

Remember, If you are charging multiple battery banks that they **MUST** share a common ground! If you are charging 3 battery banks, hook them up as is shown to the right.



**IMPORTANT:** ENSURE THAT THE TOTAL LOAD DOES NOT EXCEED THE BATTERY CHARGER'S CONTINUOUS CURRENT RATING. See *Specifications* for more details.

The wiring of this connection can be found on the unit's front panel label and is as follows:

Pins	Polarity
1	Battery 1 Positive Output
2	Battery 2 Positive Output
3	Battery 3 Positive Output
4	Common Battery Negative

**CAUTION:** DO NOT CONNECT THE BATTERY IN THE REVERSE POLARITY!

This will activate the reverse connection protection which will blow the output fuses inside the unit in order to protect the device. The unit will be inoperable until these fuses have been replaced.

# Digital Meter Option

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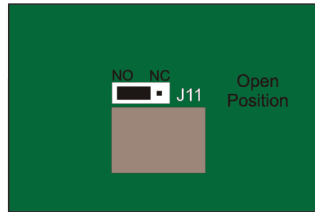
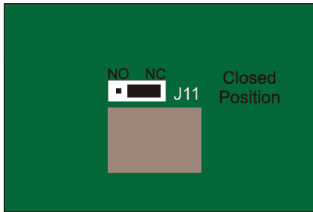
A high quality digital meter can be added to the voltage converter (factory installed only). The meter shows simultaneous voltage and current on either of the two output terminals. A toggle switch permits selection between the output terminals. The meter features bright red LED readouts to permit easy monitoring from many feet or meters away.

# Dry Contact Output Relay

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This unit features a dry contact output fail relay to indicate output failure to an external monitoring system. The relay can be accessed through pins 1 and 6 of the 9-pin D connector remote control port on the front panel.

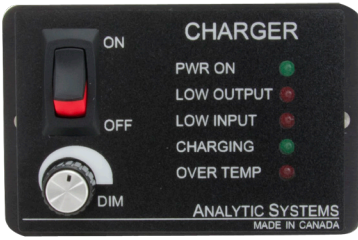
The relay is factory-preset to fail in the Closed position when the LOW OUTPUT LED and buzzer come on. If you wish to have the relay fail in the Open position instead, follow the steps below.



## **TO CHANGE THE RELAY'S FAIL POSITION:**

1. Turn the unit OFF and disconnect it from the power source and battery bank(s).
  2. Move the Power Switch to the ON position for 30 seconds to discharge the capacitors, then return to switch to OFF.
  3. Remove the screws securing the cover panel to the chassis.
  4. Remove the cover panel to access the circuit board.
  5. Locate pin header J11 on the main PCB. It will be near the relay as shown in the above diagram above.
  6. Move the jumper to the desired fail position as shown in the above diagram.
  7. Replace the cover and re-install the screws. Reconnect the unit to the power source and battery bank(s).
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# Remote Control Option



**IMPORTANT: This remote is to be used only on Battery Chargers manufactured by Analytic Systems.**

The remote control panel and 9-pin D-connector are an optional feature for this product line. The remote control panel allows the unit to be operated remotely and duplicates all the diagnostic LED indicators with audible alarm. A built-in dimmer switch allows you to control the brightness of the remote control LEDs.

**CAUTION: DO NOT CONNECT THE REMOTE CONTROL WHILE THE UNIT IS ON!**

To prevent the possibility of high voltage electrical shock, the power supply must be OFF while connecting the remote control. Do not remove the dust-cover on the remote control connector if it is not being used.

**CAUTION: DO NOT CONNECT THIS PORT TO A COMPUTER!**

This will cause serious damage to the power supply and computer. This damage is not covered under warranty.

Pin Number	Function
1	Dry Contact Relay (Closed for fault)
6	Dry Contact Relay (Closed for fault)
2	Remote Off (Short to 5 to turn unit OFF)
7	OverTemp (Low for fault)
3	UnderVolt In (Low for fault)
8	OverLoad (Low for fault)
4	UnderVolt Out (Low for fault)
9	+12 Volts
5	Common

## DRY CONTACT RELAY

The relay is factory preset to fail when the low output LED and buzzer come on. Both normally open and normally closed contacts are available on the connector. If your system detects an alarm condition when the charger is operating normally, simply move the wire connected to Pin 1 of the dry contact terminal block to Pin 3, or vice versa as needed.

# Battery Temperature Sensor

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This unit is supplied with one battery temperature sensor. This sensor communicates the temperature of the battery to the charger and is required to access the charger's voltage temperature compensation, battery over temperature alarm and equalize cycle functions.



**Pictured:** An *Analytic Systems* Battery Temperature Sensor (B-TEMP)

## BATTERY TEMPERATURE SENSOR CONNECTION

This unit is equipped with 2 RJ45 Telephone Jack connector to connect to up to two *Analytic Systems* battery temperature sensor(s).

There are multiple ways to install the sensor at the battery. Regardless of which method you use, the sensor must be firmly secured to the battery. The sensor should not lose physical contact with the battery at any point in the charging cycle.

### ***TO INSTALL THE SENSOR AT THE BATTERY, YOU MAY:***

- Slide the sensor between the side of the battery and wall of the battery platform so it sits flush.
- Place the battery so it is sitting on top of the sensor to hold it in place.
- Apply a small amount of silicone RTV sealant to the sensor and stick it to the top of the battery.

## VOLTAGE TEMPERATURE COMPENSATION

Heat is a normal by-product of the charging cycle. However, excessive heat can cause overcharging, damaging the battery. With a battery temperature sensor installed, your battery charger will automatically reduce the charging voltage to compensate for rising temperature.

The ambient battery temperature is set to 77°F (25°C). For each degree above 77°F (25°C), the charger will reduce the charging voltage by a small amount. See *Specifications* for the temperature compensation coefficient specific to your unit. You can adjust the voltage temperature compensation and the temperature compensation range using Analytic System's free-to-download software PowerWizard.

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# Equalize Cycle

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If a battery is left discharged for too long, sulfate crystals can form on its internal electrode plates. This interferes with their conductance reducing battery's capacity and charging speed.

Your battery charger can perform an Equalize Cycle to correct this condition. An Equalize Cycle ensures all the cells of the battery are fully charged; deliberately overcharging the battery at a low current (approximately 10% of its normal output) until it reaches the unit's programmed Equalize Voltage. The charger maintains the battery at that voltage for three hours after which time the Equalize Cycle ends and the battery charger resumes normal operation; maintaining the battery at the float voltage.

**DANGER: AN EQUALIZE CYCLE CAN ONLY BE PERFORMED IN A WELL VENTILATED AREA!**

Hydrogen gas is a normal by-product of the Equalize Cycle and is explosive at concentrations greater than 4% of the local atmosphere.

**CAUTION: A BATTERY TEMPERATURE SENSOR MUST BE INSTALLED AND USED!**

Heat is a normal by-product of the Equalize Cycle and excessive heat will damage the battery bank. The battery temperature sensor must be connected and installed to allow the unit to monitor the temperature and ensure it is within safe operating limits.

**TO PERFORM AN EQUALIZE CYCLE:**

1. Connect and install the supplied Analytic Systems Battery Temperature Sensor. See *Installation* for more information.
  2. Push the Equalize Button on the front panel. On some units, this button is recessed to prevent accidental operation; a ballpoint pen can be used to access it.
  3. If the unit is not currently charging a battery, the EQUALIZE LED will glow red and the Equalize Cycle will begin.
  4. If the unit is currently charging a battery, the EQUALIZE LED will blink red. Once the charging cycle ends, the CHARGING LED will shut off and the EQUALIZE LED will glow red and the Equalize Cycle will begin.
  5. Three hours later, the Equalize Cycle will end. The battery charger will automatically resume normal operation maintaining the battery at the float voltage.
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# Troubleshooting

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This unit is fitted with LED indicators and an alarm buzzer to display and diagnose any problems in operation. In the event of a malfunction, the unit will sound the buzzer to alert you prior to shutting itself down. You should immediately check which LEDs are glowing to determine the cause of the alarm.

LED Indicator	Meaning
<b>BATTERY OVERTEMP</b>	The battery temperature is too high for safe charging.
<b>Fix:</b>	The battery may be defective or there may not be adequate ventilation to cool the battery.  Check that the battery is not defective. If it is working correctly, reposition the battery for better air circulation.
<b>OVERTEMP</b>	The unit's internal temperature is too high for normal operation.
<b>Fix:</b>	The internal cooling fan may have failed or there may not be adequate ventilation to cool the charger. Check that the cooling fan is still working; if it is not then the unit must be returned to an authorized service center for repair.  If it is working correctly, remount the battery charger for better air circulation.
<b>LOW INPUT</b>	The battery charger's input voltage is too low for normal operation
<b>Fix:</b>	Check that the power source is properly rated for the battery charger. Check that the input cables and connection are free of damage and corrosion.  If all of the above are in proper working order, the cause is likely an internal component failure and the unit must be returned to an authorized service center for repair.
<b>LOW OUTPUT</b>	The battery charger's output voltage is too low for normal operation.
<b>Fix:</b>	The charging current might be exceeding the unit's maximum rating causing the output voltage to drop to maintain the current at that level. Check that the charging current is not over its limit, by using a multimeter at the output terminals. If it is, reduce the load connected to the charger.  Check that the output cables and connections are free of damage and corrosion.  If all of the above are in proper working order, the cause is likely an internal component failure and the unit must be returned to an authorized service center for repair.

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# Specifications

Input		
Nominal Voltage	110 VAC	220 VAC
Actual Voltage	90 - 130 VAC	180 - 260 VAC
Frequency	45 - 65 Hz	
Input Amps (max)	5.2 A	2.6 A
Input Fuse (slow blow)	MDA-7	MDA-4

Output Voltages				
Nominal Voltage	12 VDC	24 VDC	32 VDC	48 VDC
Float Voltage	13.6 ± 0.05 VDC	27.2 ± 0.05 VDC	36.3 ± 0.05 VDC	54.4 ± 0.05 VDC
Absorption Voltage	14.4	28.8	38.4	57.6
Charging Amps	20 A	10 A	7.5 A	5A
Absorption to Float	3.0 Amps	1.5 Amps	1.13 Amps	0.75A
Battery Banks	1, 2 or 3			
Battery Size (Amp Hours)*	80 – 120	40 - 60	30 – 45	20-35
Output Adjust	± 1.0 Volts			
Output Fuses	AGC-25	AGC 15	AGC 10	AGC10
Output Crowbar	16.0 ± 0.5 V	32.0 ± 1.0 V	42.7 ± 1.3 V	63.5 ± 2.0V
Temperature Compensation Coefficient	-30mV /°C	-60mV /°C	-80mV /°C	-120mV /°C

General	
Efficiency	> 75 % @ maximum output
Stages	2 or 3
Temp. Range	-25°C to +40°C @ maximum output
Isolation	Input-Case & Input-Output 1500 VDC, Output-Case: 500 VDC
Length	9.6 in / 24.4 cm
Width	8.2 in / 20.8 cm
Height	3.5 in / 6.4 cm
Clearance	1 Inch (2.5 cm) all around
Material	Marine Grade Aluminum
Finish	Black Powder Epoxy
Fastenings	18-8 Stainless
Weight	7.0 lb / 3.2 kg
Safety	ABS 11-HS794404A-PDA

\* This is Analytic Systems' suggested range. Please consult your battery manufacturer for their recommendations.

\* Specifications subjects to change without notice.



# Limited Warranty

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1. The equipment manufactured by Analytic Systems Ware (1993) Ltd. (the "Warrantor") is warranted to be free from defects in workmanship and materials under normal use and service.
2. This warranty is in effect for:
  - a. 3 Years from date of purchase by the end user for standard products offered in our catalog.
  - b. 2 Years from date of manufacture for non-standard or OEM products
  - c. 1 Year from date of manufacture for encapsulated products.
3. Analytic Systems will determine eligibility for warranty from the date of purchase shown on the warranty card when returned within 30 days, or
  - a. The date of shipment by Analytic Systems, or
  - b. The date of manufacture coded in the serial number, or
  - c. From a copy of the original purchase receipt showing the date of purchase by the user.
4. In case any part of the equipment proves to be defective, the Purchaser should do the following:
  - a. Prepare a written statement of the nature of the defect to the best of the Purchaser's knowledge, and include the date of purchase, the place of purchase, and the Purchaser's name, address and telephone number.
  - b. Call Analytic Systems at 800-668-3884 or 604-946-9981 and request a return material authorization number (RMA).
  - c. Return the defective part or unit along with the statement at the Purchaser's expense to the Warrantor, Analytic Systems Ware (1993) Ltd., 8128 River Way, Delta, B.C., V4G 1K5, Canada.
5. If upon the Warrantor's examination the defect proves to be the result of defective material or workmanship, the equipment will be repaired or replaced at the Warrantor's option without charge, and returned to the Purchaser at the Warrantor's expense by the most economical means. Requests for a different method of return or special handling will incur additional charges and are the responsibility of the Purchaser.
6. Analytic Systems reserves the right to void the warranty if:
  - a. Labels, identification marks or serial numbers are removed or altered in any way.
  - b. Our invoice is unpaid.
  - c. The defect is the result of misuse, neglect, improper installation, environmental conditions, non-authorized repair, alteration or accident.
7. No refund of the purchase price will be granted to the Purchaser, unless the Warrantor is unable to remedy the defect after having a reasonable number of opportunities to do so.
8. Only the Warrantor shall perform warranty service. Any attempt to remedy the defect by anyone else shall render this warranty void.
9. There shall be no warranty for defects or damages caused by faulty installation or hook-up, abuse or misuse of the equipment including exposure to excessive heat, salt or fresh water spray, or water immersion except for equipment specifically stated to be waterproof.
10. No other express warranty is hereby given and there are no warranties that extend beyond those described herein. This warranty is expressly in lieu of any other expressed or implied warranties, including any implied warranty of merchantability, fitness for the ordinary purposes for which such goods are used, or fitness for a particular purpose, or any other obligations on the part of the Warrantor or its employees and representatives.
11. There shall be no responsibility or liability whatsoever on the part of the Warrantor or its employees and representatives for injury to any person or persons, or damage to property, or loss of income or profit, or any other consequential or resulting damage which may be claimed to have been incurred through the use or sale of the equipment, including any possible failure of malfunction of the equipment, or part thereof.
12. The Warrantor assumes no liability for incidental or consequential damages of any kind