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MRC-86

BATTERY CHARGER/CONDITIONER

Operation Manual

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Section 1

INTRODUCTION

1.1 **IMPORTANT SAFETY INSTRUCTIONS (SAVE THESE INSTRUCTIONS)**

1. This manual contains important safety and operating instructions for the MRC-86 Battery Charger.

2. Before using the MRC-86 Charger, read all instructions and cautionary markings on (1) battery charger, (2) battery, (3) product using the battery.

3. **CAUTION** - **To reduce the risk of injury, charge only BB-390/U and MAI-390 Nickel Metal Hydride, MRC-2590 and BB-2590/U Lithium Ion and, BB-590/U and MAI-590 Nicad batteries. Other types of batteries may burst causing personal injury and damage.**

4. DO NOT EXPOSE CHARGER TO RAIN or SNOW WITH THE LID OPEN.

5. Use of an attachment not recommended or sold by the battery charger manufacturer may result in risk of fire, electric shock, or personal injury to persons.

6. To reduce risk of damage to electric plug or cord, pull by plug rather than cord when disconnecting charger.

7. Make sure cord is located so that it will not be stepped on, tripped over, or otherwise subjected to damage or stress.

8. An extension cord should not be used unless absolutely necessary. Use of improper extension cord could result in risk of fire and electric shock. If extension cord must be used, make sure:
   a. That the pins on the plug of the extension cord are the same number, size and shape as those on the charger;
   b. That extension cord is properly wired and in good electrical condition:
   and
   c. That wire size is a minimum of 18 AWG.

9. Do not operate the charger with damaged cord or plug - replace it immediately.

10. Do not operate charger if it has received a sharp blow, been dropped, or otherwise damaged in anyway; take it to a qualified repair technician.

11. Do not disassemble charger; take it to a qualified serviceman when service or repair is required. Incorrect reassembly may result in a risk of electric shock or fire.

12. To reduce risk of electric shock, unplug charger from outlet before attempting any maintenance or cleaning. Turning off controls will not reduce this risk.

1.1.1 GROUNDING AND AC POWER CORD CONNECTION INSTRUCTIONS

The MRC-86 should be grounded to reduce risk of electric shock. The MRC-86 is equipped with an electric cord having an equipment-grounding conductor and a grounding plug. 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 AC cord or plug provided. If it will not fit outlet have proper outlet installed by a qualified electrician. Improper connection can result in a risk of an electrical shock.

The AC power cord supplied with the MRC-86 is designed for use on a nominal 120-volt circuit, and has a grounding plug. A temporary adapter can be used to connect this plug to a two-pole receptacle, if a properly grounded outlet is not available. The temporary adapter should only be used until a properly grounded outlet can be installed by a qualified electrician. (See 1.3.2 EQUIPMENT CHARACTERISTICS for input power capabilities of the MRC-86).

DANGER-Before using adapter be certain the center screw of outlet plate is grounded. The green colored rigid ear or lug extending from adapter must be connected to a properly grounded outlet - make certain is grounded. If necessary, replace original outlet cover plate with a longer screw that will secure adapter ear or lug to outlet cover plate and make ground connection to grounded outlet.

1.1.2 SAFETY AND CAUTIONS

Prior to charging any rechargeable battery, verify the type of battery to be charged. The MRC-86 consists of 2 “smart charge” modules and a Control/Filter Board. The MRC-86 will safely and completely recharge MRC-2590, BB-2590 LiION, BB-390/U, and BB-590/U batteries.
The MRC-86 will charge 2 batteries at one time (including different battery chemistries or 2 of the same). Each battery’s type will automatically be detected when placed on the charger. The MRC-86 “smart charge” module allows the unattended recharge of batteries. The module also assures a safe and effective recharge of the battery. The charger has a built-in timer to shut off the MRC-86 to prevent the battery from being overcharged.

Table 1-1

BATTERY	DESCRIPTION	MANUFACTURER
BB-390/U	Nickel Metal Hydride12/24VDC	Bren-Tronics
MAI-390	Nickel Metal Hydride 12/24VDC	Mathews & Associates
BB-590/U	NiCad 12/24 VDC	Various
MAI-590	NiCad 12/24 VDC	Mathews & Associates
BB-2590/U	Lithium-Ion	Various
MRC-2590	Lithium-Ion	McDowell Research

If a battery type is encountered which is not listed in Table 1-1 please contact:
McDowell Research Corporation, an Ultralife Company
(254) 752-1411 (PHONE) (254) 752-1812 (FAX)
service@mcdowellresearch.com

The MRC-86 allows the operator to discharge batteries. During the discharge function the top heat sink surface of the charger will become warm. This is normal operation. During discharge operation locate the MRC-86 in a well-ventilated area and ensure no flammable materials are near the unit. The MRC-86 has NO user serviceable parts. Units requiring repair should be sent to a qualified service depot for repair.

1.2 SCOPE

This manual has been prepared by McDowell Research for the purpose of providing a maintenance technician the information necessary to understand and to maintain the MRC-86 BATTERY CHARGER/CONDITIONER. **Section 1 -Introduction**, provides CRITICAL SAFETY INSTRUCTIONS **Section 2 -Operation**, provides information necessary for operating the MRC-86, and Theory of Operation describing how the MRC-86 accomplishes its intended purpose. **Section 3 Physical Description**, provides physical and functional descriptions of components that pertain to the operation of the MRC-86.

1.3 INTRODUCTION

The MRC-86 Battery Charger/Conditioner is designed to provide a safe and effective recharge of the following batteries:

BB-390/U / MAI-390 Nickel Metal Hydride Battery
BB-590/U / MAI-590 NiCAD Battery
BB-2590/U LITHIUM-ION
MRC-2590 LITHIUM-ION

These batteries are rechargeable batteries commonly used with Tactical Communication Equipment. Each battery has the same form factor and in many cases is interchangeable for battery operated equipment. The MRC-86 will charge two batteries at one time. Additionally the user can charge two different battery types at the same time.

PRIOR TO USING THE MRC-86 PLEASE READ THE SAFETY AND CAUTION INSTRUCTIONS LOCATED IN SECTION 1.1 TO PREVENT THE MISCHARGE OR CATASTROPHIC DESTRUCTION OF A BATTERY.

WHILE INHERENTLY SAFE, IF THE MRC-86 IS USED INCORRECTLY AN INCIDENT COULD OCCUR!

MISUSE OF MRC-86 MAY RESULT IN DAMAGE TO THE BATTERY AND/OR THE MRC-86 BATTERY CHARGER.

1.3.1 FEATURES

The MRC-86 is based on "smart charging" technology. The unit automatically detects battery problems such as open cells or other battery problems, which prevent a safe and efficient charge. There are a number of internal safeguards built into the unit. Temperature, voltage and time are monitored throughout the fast charge. Fast charge is terminated when the unit detects the battery has been fully charged. The MRC-86 also automatically detects different battery chemistries by the contacts or lack of contacts on the battery itself.

The charger detects the BB-2590 LiION battery through the contact on the battery. When it is detected, the charger will charge using a constant current of 1.0A until the voltage reaches 16.4V. When the voltage is reached, the charger will go into a constant voltage mode. When the charge current falls below 140mA, the charge is complete. There is a 12 hour safety timer if the charge current never goes low enough. This will terminate the charge.

UNATTENDED CHARGING

Smart Charge Modules, which detect open or shorted cells. If a defective cell is detected the MRC86 will not start the charge cycle.
Once Charge is completed the MRC-86 will maintain the battery being charged with a trickle charge, if battery is left connected to the MRC-86.
In no event will a battery be overcharged using the SMART CHARGING TECHNIQUES of the MRC-86.

With the lack of a contact, as with Lithium Ion batteries, the MRC-86 will assume that

the battery is a Nickel-based chemistry (NiCd or NiMH). The charger will charge at a constant current of 1A while sampling change in voltage. When a negative change in voltage is detected, the peak has been found and the charge is complete. There is a 6 hour safety timer that will terminate the charge if the battery never peaks. On the NiMH battery are thermister contacts for each section that detect the battery's temperature.

If the battery's temperature is above 65°C when it is put on to charge, the charger goes into a fault condition and waits until the battery cools down before going into fast charge. If the battery gets above 65° C while charging, the charger will suspend the charge until the battery cools down, and then go back into fast charge to complete.

WIDE RANGE INPUT VOLTAGE
Wide range of input AC and DC power allows for operation from nearly any AC or DC power source likely to be encountered worldwide.

CONDITIONING CYCLE
Automatic discharge/recharge function included. The conditioning cycle can be activated individually per battery at operators' option.

1.3.2 EQUIPMENT REQUIRED

Equipment Supplied Provided with the MRC-86 Charger/Conditioner is an AC power cable and this technical manual.

Section 2
OPERATION

2.1 INTRODUCTION

The MRC-86 Battery Charger consists of two "smart charge" modules, an AC to DC power module and Control/Filter Board. The MRC-86 will charge two batteries at one time. (Two different batteries or two of the same type of battery) Each battery type is automatically detected, and a push-button switch is used to initiate a discharge cycle at the users' option. The MRC-86 "smart charge" module allows the unattended recharge of batteries. The module also assures a safe and effective recharge of the battery. The charger has a built in timer to shut off the MRC-86 to prevent the battery from being overcharged.

2.2 START UP

Verify appropriate battery type selected for charging (Table 1-1); battery is properly installed in charger, and the correct LED indicator is lit. The MRC-86 automatically determines the battery type connected. The operator can either plug the MRC-86 into a power source or attach the batteries to the unit first. Once the batteries are attached and power applied to the unit the batteries automatically start charging.

2.3 OPERATING PROCEDURES

With the battery connected and power applied, the charger will automatically start the charge of the battery. The MRC-86 will also allow the discharge of the battery at the user's option. If the user decides to first discharge the battery, press the appropriate red push-button to initiate the discharge function. The unit will discharge the battery to a level of 10V per section. Once the MRC-86 detects the complete discharge of the battery it will automatically start the recharge of that section.

2.3.1 LED INDICATORS

There are four groups of LEDS indicating the status of the charger.

2.3.2 "BATTERY TYPE" INDICATOR LEDs

When a battery is plugged in to the charger, one of the two green LEDs labeled "BATTERY TYPE" will indicate which type of battery (UBI-2590/MRC-2590/BB-2590 or BB-390/BB-590) is plugged in. When the correct type of battery is indicated, the battery will be charged correctly. If the incorrect type of battery is indicated, remove the battery from charger. The incorrect type of battery has been detected because of defect or damage to the battery contact, or damage to the charger. A battery that has been indicated as an incorrect battery will not charge correctly if left on the charger, and may cause damage to the battery or charger.

2.3.3 "CHARGING" INDICATOR LEDs

The two green LEDs labeled "CHARGING" indicate the state of charge a section of the battery is in. One indicator is for each section of the battery.

Solid green: Indicates the battery is fast charging.
Extinguished: Indicates the charge is complete.
Blinking: Indicates a trickle charge condition. Trickle charge condition means the battery section voltage is too low or the battery section is too cold or too hot to fast charge. If a battery section's voltage is too low, or, is too cold (below optimum charging temperature) to charge, the charger will trickle charge until the voltage or temperature is high enough and then go into fast charge. If the battery section is too hot, the charger will wait until the section cools down before going into fast charge.

2.3.4 "90% CHARGE" INDICATOR LEDs

The two yellow LEDs labeled "90% CHARGE" indicate when the battery section is at least 90% full capacity. One indicator is for each section.

If the battery is charging and it is removed and then reinstalled back on the charger, the unit will restart the charge cycle.

2.3.5 "DISCHARGE" INDICATOR LEDs

The two yellow LEDs labeled "DISCHARGE" indicate when the battery section is being discharged / conditioned. One indicator is for each section.

Section 3

PHYSICAL DESCRIPTION

3.1 GENERAL

The MRC-86 is 13.37"L x 11.62"W x 6.00"D and weighs approximately 12lbs. Figure 3-1 shows the physical layout of the charger. The MRC-86 consists of 2 smart charge modules, an AC to DC Power Module and a Control/Filter Board.

FIGURE 3-1 FRONT VIEW

3.2 FUNCTIONAL DESCRIPTION

The MRC-86 Charger (reference Figure 3-1) consists of the following items:

Smart Charge Module (2 ea.)
Control/Filter Board
AC to DC Power Supply

3.3 INTERNAL COMPONENTS

3.3.1 Smart Charge Supply

The Smart Charge Modules are non-repairable potted modules. These modules accept a DC input voltage, monitor battery selection and provide the charging functions for the battery to be charged. The battery detection circuit, discharge switches, battery charge indicator LEDS and charge circuitry are all located on these boards. Each module provides the necessary voltage/current parameters to the battery charge connectors.

3.3.2 Control/Filter Board

The Control Filter Board accepts the AC and/or DC input power, contains self-resetting circuit breakers to protect the unit, filters for EMI suppression and functions as the interconnect point between the charge modules and AC to DC Power module.

3.3.3 AC to DC Power Supply

The AC to DC Power Module accepts 95 to 265 VAC, 47 to 440 Hz input and converts the AC input to a regulated DC output to provide the proper DC voltage to the Charge Modules.

3.3.4 Input Power Requirements

DC Input - The DC Input requires approximately 75 watts. Input current will vary depending on the voltage.

AC Input - The AC Input requires approximately 90 watts. Input current will vary depending on the input voltage.

3.4 EQUIPMENT CHARACTERISTICS

The MRC-86 is designed to function with the following input Power and Environmental Characteristics.

3.4.1 Input Power Capabilities

DC Input Range: 12 to 36 VDC auto ranging
AC Input Range: 95 to 260 VAC, 47 to 440 Hz auto range

3.5 TYPICAL CHARGE/DISCHARGE CYCLE

The typical charge and discharge cycle for the three types of batteries listed below assumes a fully discharged battery for the charge time and a fully charged battery for the discharge cycle. Note these are average times and are listed to show a reasonable time frame for the charge cycle.

3.5.1 BB-390/U Nickel Metal Hydride Battery Cycle
The discharge time for the BB-390/U is approximately 6.5 hours.
The charge cycle for the BB-390/U is approximately 5 hours.

3.5.2 BB-590/U NiCad Battery Cycle
The discharge time for the BB-590/U is approximately 4.5 hours.
The charge cycle for the BB-590/U is approximately 3 hours.

3.5.3 BB-2590U Lithium-Ion
The discharge time for the BB-2590/U is approximately 4.5 hours. The charge cycle for the BB-2590/U is approximately 3 hours.

SECTION 4

Maintenance and Warranty Information

4.1 Preventative Maintenance
All maintenance procedures should be in the subsequent sections.

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4.1.1 Dirt and Dust
All external components to the MRC-143 can be cleaned with a water dampened non-abrasive cloth and allowed to air dry or wipe dry with a clean dry non-abrasive cloth.

4.1.2 Oils and Grease
All external components of the MRC-143 can be cleaned with a mild soap/water solution dampened non-abrasive cloth. Rinse with water dampened non-abrasive cloth and allowed to air dry or wipe dry with a clean dry non-abrasive cloth.

4.1.3 Corrective Maintenance
The MRC-143 has **NO** user serviceable parts. Units requiring corrective maintenance should be sent to McDowell Research for repair. Contact information is provided below in section 3.6.

4.2 WARRANTY MAINTENANCE

Warranty Statement

4 years for equipment shipped after May 1, 2004
3 years for equipment shipped prior to May 1, 2004

McDowell Research warrants to its customers that the products it manufactures and sells will be free from defects in materials and workmanship for a period of four (4) years for equipment shipped after May 1, 2004.

This warranty shall not apply to any defect, failure or damage caused by improper use or inadequate maintenance and care. McDowell shall not be obligated to provide service under this warranty to repair, service, or modify these products.

In order to obtain service under this warranty, customers must return a failed unit to McDowell with a description of the failure, contact information (in case questions arise and to speed up processing of guarantee claims) and finally a return shipping address. McDowell will return any failed unit at McDowell's cost. **NOTE: THIS WARRANTY DOES NOT APPLY TO BATTERIES SUPPLIED BY MCDOWELL RESEARCH. ALL BATTERIES SUPPLIED BY MCDOWELL RESEARCH ARE WARRANTIED FOR 90 DAYS FROM SHIPMENT.**

4.3 CONTACT INFORMATION:

Please call (254) 752-1411 to obtain an RMA number then you may return any failed unit(s) to:

McDowell Research, an Ultralife Company
300 South 8th Street
Waco, Texas 76701
Phone: (254) 752-1411
Fax: (254) 752-1812

Online RMA requests can be located and submitted at:
http://www.mcdowellresearch.com/shop/RMArequest.asp