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RHF2

Railroad High Frequency Battery Charger



Installation and Operation Manual

Important Safety Instructions

Before using this equipment, read all manuals and other documents related to this unit and other equipment connected to this unit. Always have a copy of a unit's manual on file nearby in a safe place; if a replacement copy of a manual is needed, it can be found at www.lamarchemfg.com.

Electrical Safety



WARNING: Hazardous Voltages are present at the input of power systems. The output from rectifiers and from batteries may be low in voltage but can have a very high current capacity that may cause severe or even fatal injury.

When working with any live battery or power system, follow these precautions:

- Never work alone on any live power system, someone should always be close enough to come to your aid.
- Remove personal metal items such as rings, bracelets, necklaces, and watches.
- Wear complete eye protection (with side shields) and clothing protection.
- Always wear gloves and use insulated hand tools.



WARNING: Lethal Voltages are present within the power system. Parts inside the unit may still be energized even when the unit has been disconnected from the AC input power. Check with a meter before proceeding. Do not touch any uninsulated parts.

- A licensed electrician should be used in the installation of any unit.
- Always disconnect the unit from the supply, batteries and loads before performing maintenance or cleaning.
- Always assume that an electrical connection is live and check the connection relative to ground.
- Be sure that neither liquids nor any wet material comes in contact with any internal components.
- Do not operate this unit outside the input and output ratings listed on the unit nameplate.
- Do not use this unit for any purpose not described in the operation manual.

Mechanical Safety

- This unit or parts of the unit may get hot during normal operation, use care when working nearby.
- Do not expose equipment to rain or snow. Always install in a clean, dry location.
- Do not operate equipment if it has received a sharp blow, been dropped, or otherwise damaged in any way.
- Do not disassemble this unit. Incorrect re-assembly may result in a risk of electric shock or fire.

Battery Safety



WARNING: Follow all the battery manufacturer's safety recommendations when working with or around battery systems. DO NOT smoke or introduce a spark or open flame in the vicinity of a battery. Some batteries generate explosive gases during normal battery operation.

- To reduce risk of arc, connect and disconnect the battery only when the unit is off.
- If it is necessary to remove the battery connections, always remove the grounded terminal from the battery first.
- Remove personal metal items such as rings, bracelets, necklaces, and watches.
- Always wear rubber gloves, safety glasses, and a rubber lined vest/apron when working near a battery.
- Have plenty of fresh water and soap nearby in case the battery electrolyte contacts skin, clothing, or eyes.
- If the battery electrolyte contacts skin or clothing, wash immediately with soap and water.
- If the electrolyte enters the eye, immediately flood the eye with running cold water for at least ten (10) minutes and seek medical attention immediately.
- Do not drop metal on the battery. A spark or short-circuit could occur and could cause an explosion.

Charger Location

- Allow at least 4 inches of free space on the sides of the unit for proper cooling.
- Do not operate this unit in a closed-in area or restrict ventilation in any way.
- Do not set any battery on top of this unit.
- Never allow battery electrolyte to drip on this unit when reading the specific gravity or filling the battery.
- Never place this unit directly above a standard flooded battery. Gases from the battery will corrode and damage equipment.
- A sealed maintenance free or valve regulated lead acid (VRLA) battery may be placed below this equipment.

Check for Damages

Prior to unpacking the product, note any damage to the shipping container. Unpack the product and inspect the exterior of the product for damage. If any damage is observed, contact the carrier immediately. Continue the inspection for any internal damage. In the unlikely event of internal damage, please inform the carrier and contact La Marche for advice on the risk due to any damage before installing the product. Verify that you have all the necessary parts per your order for proper assembly.



CAUTION: Failure to properly file a claim for shipping damages, or provide a copy of the claim to La Marche, may void warranty service for any physical damage reported for repair.

Returns for Service

Save the original shipping container. If the product needs to be returned for service, it should be packaged in its original shipping container. If the original container is damaged/unavailable, make sure the product is packed with at least three inches of shock-absorbing material to prevent shipping damage. *La Marche is not responsible for damage caused by improper packaging of returned products.*

Inspection Checklist

- Enclosure exterior and interior is not marred or dented.
- There are no visibly damaged components.
- All internal components are secure.
- Printed circuit boards are firmly seated.
- All hardware and connections are tight.
- All wire terminations are secure.
- All items on the packing list have been included.

Handling

Equipment can be heavy with uneven distribution of weight. Use adequate manpower or equipment for handling. Until the equipment is securely mounted, care must be used to prevent equipment from being accidentally tipped over or dropped.

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RHF2 General Description

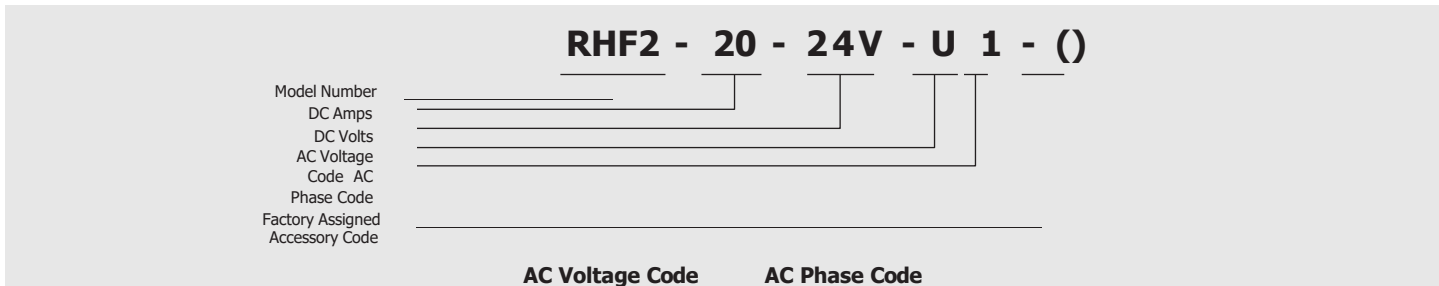
The La Marche model RHF2 series uses proven High Frequency charging technology and is developed specifically for the railroad market. It is typically used for signaling, highway crossing and motion detection systems where the battery is cycled frequently.

This filtered unit is designed and built to charge VRLA, Flooded Lead Acid and Nickel Cadmium batteries. One of the features that make this product unique is lightning protection.

The RHF2 series is equipped with AAR style hardware on the input and output connections. Temperature compensated charging is standard to maximize the life of the battery. The unit is designed to achieve MTBF in excess of 100,000 hours.

Understanding the Model Number

The RHF2 model number is coded to describe the charger and the options that are included. Find the model number on the nomenclature nameplate of the charger. Then follow the chart to determine the configuration of your battery charger.



1 Equipment Handling

1.1 Storing the RHF2

If the RHF2 is to be stored for more than a few days after delivery, it should be stored within its shipping container. The location chosen for storage should be within an ambient temperature of -40 to 185° F (-40 to 85° C) with a non-condensing relative humidity of 0 to 95%. Storage should not exceed 2 years due to the limited shelf life of the DC filter capacitors when they are not in service.

1.2 Moving the RHF2

After careful inspection and upon verification that the RHF2 is undamaged, identify the enclosure style and weight of the RHF2 unit. Refer to the table below.

Model Number	AC Input 100% (load)**		DC Output		Overall Dimensions W x D x H	Case No.	Net Weight*	
	Volts (Nominal)	Amps	Volts (Nominal)	Amps			lbs	kg
RHF2-20-12V	120	2.6	12	2 0	14.06 x 5.08 x 12.55 in 357 x 129 x 318 mm	500	11	5.0
	240	1.4						
RHF2-40-12V	120	5.0	12	4 0	14.06 x 5.08 x 12.55 in 357 x 129 x 318 mm	500	11	5.0
	240	2.4						
RHF2-60-12V	120	7.5	12	6 0	14.06 x 8.76 x 12.55 in 357 x 222 x 318 mm	501	18	8.2
	240	3.6						
RHF2-20-24V	120	5.0	24	2 0	14.06 x 5.08 x 12.55 in 357 x 129 x 318 mm	500	11	5.0
	240	2.4						
RHF2-30-24V	120	7.5	24	3 0	14.06 x 5.08 x 12.55 in 357 x 129 x 318 mm	500	11	5.0
	240	3.6						
RHF2-50-24V	120	12.3	24	5 0	14.06 x 8.76 x 12.55 in 357 x 222 x 318 mm	501	18	8.2
	240	6.00						
RHF2-20-36V	120	3.9	36	2 0	14.06 x 5.08 x 12.55 in 357 x 129 x 318 mm	500	11	5.0
	240	1.9						
RHF2-6-130V	120	8.1	130	6	14.06 x 5.08 x 12.55 in 357 x 129 x 318 mm	500	11	5.0
	240	3.9						

Table 1 – RHF Weights and Dimensions

2 Installation

2.1 Mounting

The RHF2 can be shelf mounted using two #10 bolts. Install the RHF2 using appropriate hardware on the shelf.

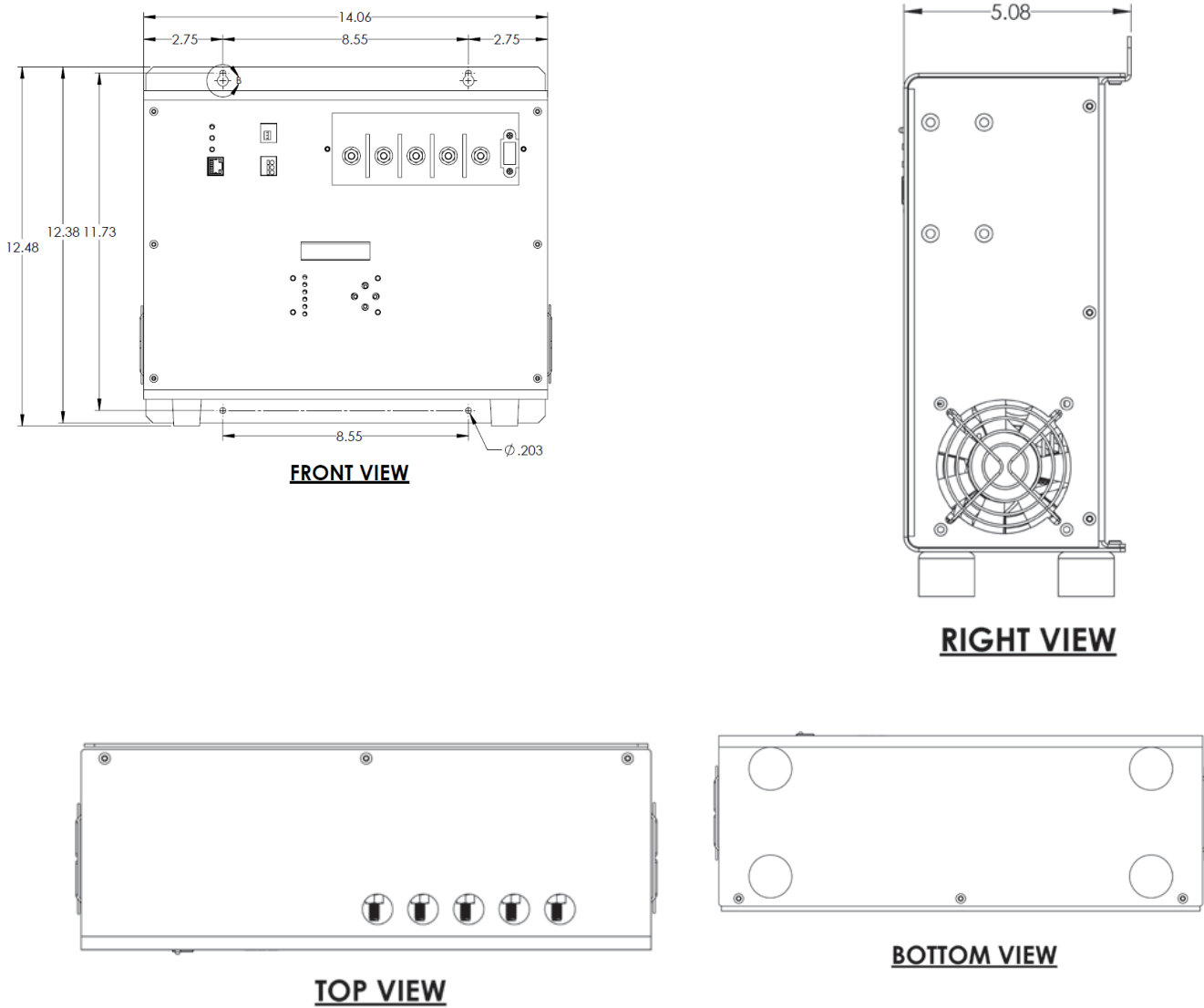


Figure 1 - RHF2 Mounting Dimensions for Small Case #500

2.2 Electrical Connections

Before beginning any work, ensure that all incoming AC supply and DC load wires are de-energized. Verify that no voltage is present by using a voltmeter at all input and output terminals. The RHF2 is equipped with lug- type terminals for the output connections. See Figure 2.

2.2.1 Input Connections

Check that the source voltage and frequency match the charger nameplate specifications. Select wire size using Table 2. Before connecting the Battery and/or DC loads, it is recommended to apply AC power and set the configuration for the correct output, see section 3.3 for the configuration instructions. Once the configuration is set, remove the AC power to the charger.

NOTE: Feeder breaker should be sized to match the size of the AC protection used in charger.

Charger Rating (DC Amps)	Minimum Wire Size Requirement		
	AC	DC	Grounding
20A-12V	#14	#10	#14
40A-12V	#14	#8	#14
60A-12V	#12	#8	#12
20A-24V	#14	#10	#14
30A-24V	#14	#8	#14
50A-24V	#12	#8	#12
20A-36V	#14	#8	#14
6A-130V	#14	#8	#14

Table 2 - Wire Size Minimum Requirements

NOTE: All wires specified in the table are rated at 90 °C or 194 °F. These are recommended sizes. All National and Local Codes must be followed.

2.2.2 Output Connections

Select proper size for the DC wiring from the wire size Table 2 on the previous page. If the distance between the charger's DC output and the battery/load exceeds 10 feet, use the Power Cable Guide in Appendix B to minimize the voltage drop across the wire distance.



Figure 2 – RHF2 Input and Output Terminals



CAUTION: When connecting the DC cables to the battery, be certain the positive terminal of the charger is connected to the positive battery terminal and the negative terminal is connected to the negative battery terminal.

Charger Fail Alarm Connections

The **Charger Fail** Alarm is included with one set of Form 'C' contacts as a standard feature on the RHF2. Charger Fail LED will illuminate solid and Charger Fail contacts will De-Energize when alarm is triggered.

Alarm Relay	Relay Logic	Contact Ratings
Charger Fail	De-Energize on Fail	2A @ 30VDC

Table 3 – Alarm Relay Information

Customer alarm connections are made by pushing in the wiring to the appropriate terminal. To remove the alarm wire, push a small flathead screwdriver to open the contact point, then pull the wire out and remove the screwdriver. See Figure 3.

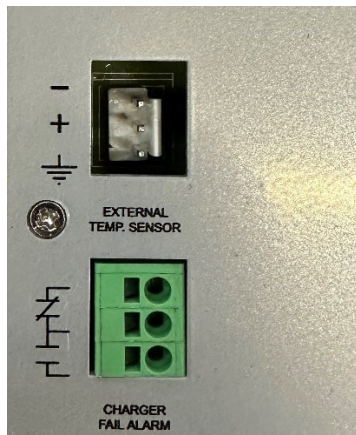


Figure 3 - Charger Alarm Connections

2.3 Temperature Compensation

Temperature Compensation feature of the RHF2 adjusts the charger's output voltage based on the temperature read by the optional external temperature probe. The external temperature probe is offered as a 24-foot-long temperature probe or 100-foot-long probe. If temperature compensation is disabled in the customer settings window, unit will run in default mode and output of unit will not be compensated. If temperature compensation is enabled in the customer settings window and the temperature probe is faulty, output will be compensated. If temperature probe is shorted or connected in reverse, unit will display "Temp Probe Short" on digital display. If temperature probe wiring is broken or not connected properly, unit will display "Temp Probe Open" on digital display.

2.3.1 External Probe Connection Procedure

Before making any connections to the RHF2, ensure that the AC power to the unit is off. Disconnect the battery from the charger via the battery disconnect breaker or by manually disconnecting the battery cables. Verify that no voltage is present by using a voltmeter at all input and output terminals.

For the most accurate temperature compensation charging, connect and secure the ring lug of the temperature probe directly on the negative battery terminal. The lug of the probe is electrically isolated from the compensation circuitry in the RHF2 unit, so the battery voltage will not affect the operation of the charger. If it is not possible to mount the probe directly on the negative terminal of the battery, the probe may be mounted and secured in the vicinity of the battery installation per the battery manufacturer's recommendations.

Caution must be taken when installing the temperature probe wires to the charger as polarity is important. Install the probe wires into the "External Temp. Sensor" terminal at the bottom of the unit. After connecting the probe, enter the configuration menu and assure that "Temperature Compensation" feature has been enabled (for more details, see Section 3.3). To remove the sensor wires, push a small flathead screwdriver to open the contact point, then pull the wire out and remove the screwdriver. See Figure 3.

3 Operation



All equipment is shipped from the factory fully checked and adjusted to factory default settings. Before connecting the battery check with the battery manufacturer for the correct voltage settings and adjust the configuration accordingly (refer to Section 3.3). Failure to match the charger settings with the connected battery may damage or shorten the life of the battery.

3.1 Initial Setup

Before starting up the RHF2, check and verify that all connections are correct and are tightened securely. Check that the input voltage and frequency of the power source match the rating on the nameplate of the charger. Apply AC power to the input terminals of the RHF2 in order to start up the charger.

3.2 3-Stage Deep Discharge Battery Algorithm

The RHF2 uses a 3-stage charging algorithm on deeply discharged batteries. This method protects the battery as well as the charger by using a controlled sequence to limit the output current. Maximum duration for charger to be in stage 1 & 2 is 4 hours. Charger will go into battery fail condition if it doesn't reach stage 3 of charging within 4 hours.

Deep Discharge Charging Algorithm – Stage 1

Output current maintains its first level current limit depending on charger rating for 50 seconds then goes to second level current depending on charger rating for 10 seconds (refer to table 4 below). This charging process continues until output voltage reaches 2.1V (12V charger) or 4.1V (24V charger), which then it will go into the second stage of charging.

Charger Current Rating	10A	20A	25A	30A	35A	40A	Time
First Level Current Limit	1A	2A	2A	3A	3A	4A	50 seconds
Second Level Current Limit	5A	10A	10A	15A	15A	20A	10 seconds

Table 4 – First Stage Charging Information

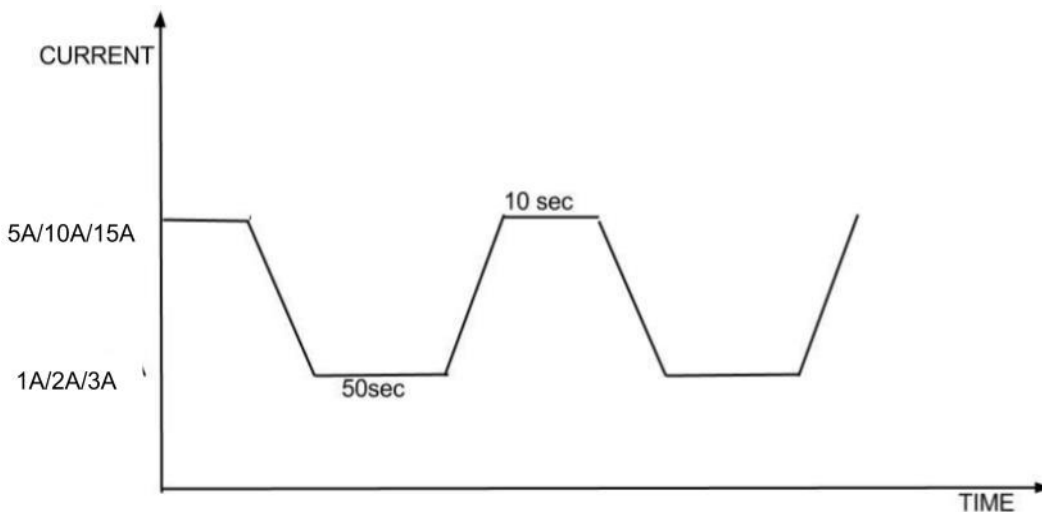


Figure 4 – First Stage Charging Graph

Deep Discharge Charging Algorithm – Stage 2

Output current will rise linearly until reaching the constant current level. This will take an approximate time of 50 seconds. Output will then go to constant current mode, depending on charger rating for 10 seconds (refer to table 5 below). This process continues until output voltage reaches 6.1V (12V charger) or 12.1V (24V charger) which then it will go to the third state of charging.

Charger Current Rating	10A	20A	25A	30A	35A	40A	Time
First Level Current Limit	1A	2A	2A	3A	3A	4A	50 seconds
Second Level Current Limit	5A	10A	10A	15A	15A	20A	10 seconds

Table 5 – Second Stage Charging Information

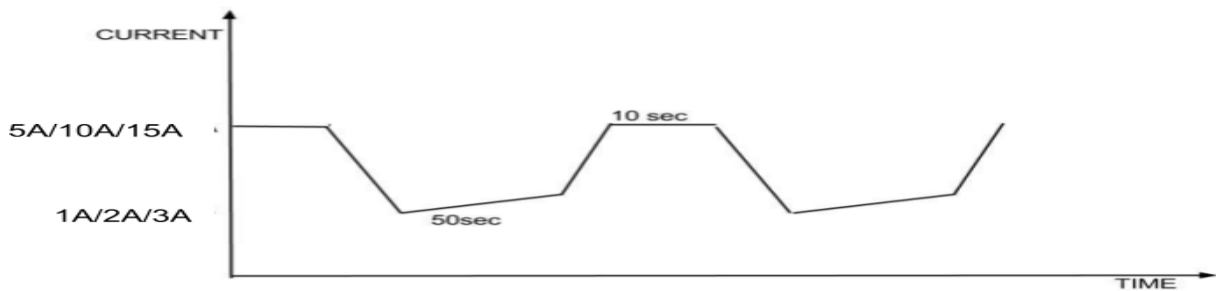


Figure 5 – Second Stage Charging Graph

Deep Discharge Charging Algorithm – Stage 3

When output voltage reaches 6.1V (12V charger) or 12.1V (24V charger) the charger current limit is returned to nominal. The charger output voltage will eventually return to nominal float rate.

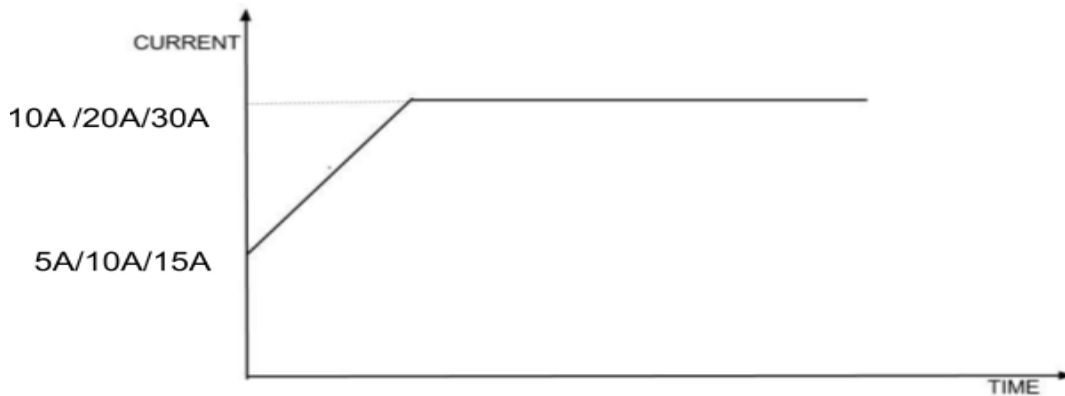


Figure 6 – Third Stage Charging Graph

3.3 Front Display and Indicators

Upon powering up the RHF2, the LCD will display the unit's software revision and LEDs will perform a lamp test. After the unit has completed the start-up procedure, the "AC ON" indicator on the front panel will illuminate and the display will show the DC output voltage and DC output current readings.



Figure 7 – Front Panel Display (*display type may vary*)

3.3.1 Controls

Up/Down Arrows – The Up and Down arrows are strictly used for navigating through the configuration menu and increasing or decreasing setting values.

Back Button – Pressing the Back button allows the user to navigate to a previous screen or out of the configuration menu.

SET Button – The Set button is used to access the Configuration Mode menu, allow the user to set the charger parameters, and make selections within the menus.

3.3.2 LED Indicators

Current Limit (Yellow) – The Current Limit LED will illuminate when the rectifier is operating in a current limit condition (amperage greater than unit output rating).

AC On (Green) – The AC ON LED will illuminate whenever AC voltage is present at the RHF2 input terminals. AC ON LED will turn off when AC input is out of range (below 95 or above 270VAC).

Charger Fail (Red) – The Charger Fail/Low Current LED will remain lit and the LCD display will read “CHARGER FAIL” with the following charger conditions:

- Charger is not able to regulate the output voltage
- AC input is out of range (below 95 or above 270VAC), LCD will also display “AC OUT OF RANGE”
- Unit ambient temperature exceeds 70°C, LCD will also display “THERMAL SHUTDOWN”

Low Current (Red) – The Charger Fail/Low Current LED will illuminate and continue blinking when the DC current is below 0.25 Amps.

3.3.3 Display Indicators

OLED Display – The OLED display shows the output DC voltage and output DC amperage at all times. Charger modes and different alarm conditions will also be displayed should they occur.

Thermal Derating – With Thermal Derating feature enabled, “THERMAL PROTECTION - OUTPUT DERATED TO 70%” will display on the LCD when the ambient temperature exceeds 50°C.

Thermal Shutdown – “THERMAL SHUTDOWN” will display on the LCD and the unit output will shut off when the ambient temperature exceeds 70°C and will recover when temperature goes below 60°C.

Communication Error – Message is displayed when communication between the control circuit and the display circuit has been lost.

Rectifier Fail – Message is displayed when there is no charger output.

Cranking Off – Message is displayed when cranking off feature is enabled and has been triggered (disabled by default). With this feature enabled, during engine cranking, the output of the charger will be disabled if the output of the unit drops below 50% of nominal voltage during cranking. The output will stay disabled for 100 seconds and then auto recover.

Short Circuit – Message is displayed when the output is shorted. If unit not energized and battery is connected in reverse, DC output fuses will blow and need to be replaced. If unit is energized and battery is connected in reverse, DC output fuses will blow and digital screen will show “Short Circuit” and “Charger Fail”. Unit will need to be power cycled to clear the short circuit condition.

AC Out of Range – Message is displayed when the AC input voltage is out of range. (95VAC – 264 VAC).

3.4 Configuration Mode

To enter Configuration Mode, press the SET button. Once in Configuration Mode, use the Up and Down buttons to cycle through the available options and the SET button to choose the highlighted option. See the chart below for the available settings in Configuration Mode. The controller settings will remain stored even in the event of total power failure.

3.4.1 Setting Charging Mode

Press SET with "CHARGING MODE" selected to change output mode. The asterisk (*) on the display indicates the current setting.



Float charging mode is used for all normal battery charging needs. Equalize mode is used when it is necessary to equalize (or balance) the level of charge across all cells present in the battery. Consult the battery manufacturer for the proper equalize procedures and parameters.

If the charger is in Equalize mode, it will automatically switch back to Float mode after the designated equalize time. The charger can manually be switched to float mode by selecting FLOAT MODE in the CHARGING MODE submenu.

3.4.2 Setting Battery Type

Press SET with "BATTERY TYPE" selected to change the battery type being used. The asterisk (*) on the display indicates the current setting.



Refer to the table below for default battery voltage settings. Please confirm with battery manufacturer.

Battery Type	Float Voltage	Equalize Voltage
Lead Acid	13.1V for 12V units 26.1V for 24V units	14.1V for 12V units 27.9V for 24V units
VRLA/AGM/Gel	13.5V for 12V units 27V for 24V units	13.6V for 12V units 27.3V for 24V units
NiCad	12.6V for 12V units 26.6V for 24V units	13.9V for 12V units 29.0V for 24V units

Table 6 - Recommended Voltage Settings

3.4.3 Setting Float Voltage

Press SET with "FLOAT VOLTAGE" selected to change the Float voltage.



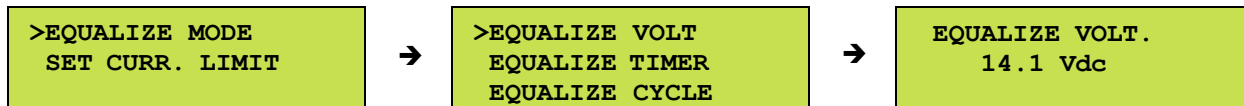
The setting adjusts in increments/decrements of 0.1V. Press the SET button to save the setting. The charger will return to the Configuration Mode menu.

Lead Acid/VRLA: 12V	10.5V – 14.1V (Float) - 14.5V (Equalize)
Lead Acid/VRLA: 24V	21.0V – 28.2V (Float) - 29.0V (Equalize)
Nicad 12V	10.5V – 16.0V (Float) - 17.6V (Equalize)
Nicad 24V	21.0V – 32.0V (Float) - 33.0V (Equalize)

Table 7 - Adjustable Voltage Ranges

3.4.4 Setting Equalize Voltage

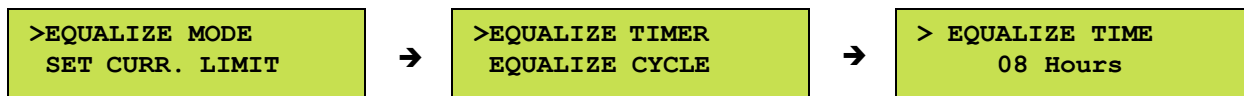
Press SET with "EQUALIZE MODE" selected to access the equalize settings. While in "EQUALIZE MODE", press SET with "EQUALIZE VOLT" selected to change the Equalize voltage.



The setting adjusts in increments/decrements of 0.1V. Press the SET button to save the setting. The charger will return to the Configuration Mode menu.

3.4.5 Setting Equalize Timer

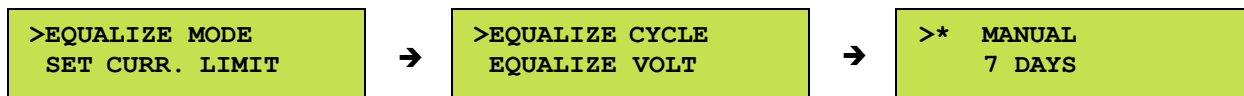
While in the "EQUALIZE MODE" menu, press SET with "EQUALIZE TIMER" selected in order to change the Equalize timer.



The Equalize Timer setting changes the amount of time that the charger remains in Equalize charging cycle once activated. When an equalize cycle is started, the charger will remain in Equalize Mode until the time selected by this setting has passed. The equalize timer can be set between 1-24 hours, in 1-hour increments. By default, the Equalize timer is set for 8 hours. Press the SET button to save the setting. The charger will return to the "EQUALIZE MODE" menu.

3.4.6 Setting Equalize Cycle

While in the "EQ MODE" menu, press SET with "EQUALIZE CYCLE" selected in order to change the equalize cycle. The asterisk (*) on the display indicates the current setting.



The Equalize Cycle determines when the charger will go into an Equalize charging. The cycles are "MANUAL", "7 DAYS" and "30 DAYS". The asterisk (*) on the display indicates the current setting. The default setting for the equalize cycle is MANUAL. Press the SET button to save the setting. Press BACK to return to the Configuration Mode menu.

3.4.7 Setting Current Limit

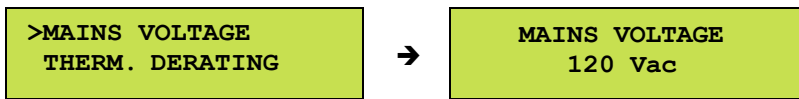
Press SET with "SET CURR. LIMIT" selected to change the maximum charging current of the RHF2 battery charger.



Pressing the UP button will increment the current limit by 1%. Pressing the DOWN button will decrement the current limit by 1%. The range for the battery current limit is 50 – 100%. The default value is 100%. Please consult the battery manufacturer for the maximum charging current of the connected batteries. Press the SET button to save the setting. The charger will return to the Configuration Mode menu.

3.4.8 AC Mains Voltage

Press SET with "MAINS VOLTAGE" selected to view the voltage from the AC mains. The Mains Voltage is not a setting; it is simply a way to view the AC Voltage present to the RHF2. Press BACK to return to the configuration menu.



3.4.9 Thermal Derating

Press SET with "THERM.DERATING" selected to enable/disable Thermal Derating feature. The asterisk (*) on the display indicates the current setting.



When enabled, the unit will monitor the charger's temperature. If the ambient temperature exceeds 50°C, it will lower the current limit to 70% in order to prevent the charger from overheating. LCD will display scrolling message "THERMAL PROTECTION – OUTPUT DERRATED TO 70%". When the ambient temperature returns below 50°C, the current limit will return to the previously set value. When "Therm. Derating" is disabled, the unit will provide maximum required output regardless of ambient temperature.

Additionally, all chargers are equipped with a thermal shutdown function which cannot be disabled. If the ambient temperature exceeds 70°C, the DC output will shut off. LCD will display "THERMAL SHUTDOWN" and "CHARGER FAIL". The charger will continue to monitor the ambient temperature, when the temperature returns to a safe level of 40°C, the output will be restored.

To turn on temperature derating, move the arrow in front of the "ENABLE" selection and press SET. To turn off thermal derating, move the arrow in front of the "DISABLE" selection and press SET.

3.4.10 Temperature Compensation

Press SET with "TEMP. COMP." selected to set Temperature Compensation. The asterisk (*) on the display indicates the current setting.



When enabled the output voltage will change dynamically in respect to the external temperature probe of the RHF2. The RHF2 compensates at 3mV per cell of every °C change. To turn on temperature compensation, move the arrow in front of the "ENABLE" selection and press SET. To turn off temperature compensation, move the arrow in front of the "DISABLE" selection and press SET.

3.4.11 Low Current Alarm

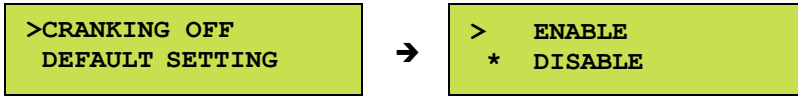
Press SET with "LOW CURR. ALARM" selected to enable/disable the Low Current alarm. The asterisk (*) on the display indicates the current setting.



When enabled, the Low Current alarm will be activated when the DC current is below 0.25 Amps. The Low Current alarm shares the same LED as the Charger Fail Alarm. In the case of Low Current, the LED will blink. To turn on Low Current alarm, move the arrow in front of the "ENABLE" selection and press SET. To turn off Low Current alarm, move the arrow in front of the "DISABLE" selection and press SET.

3.4.12 Cranking Off

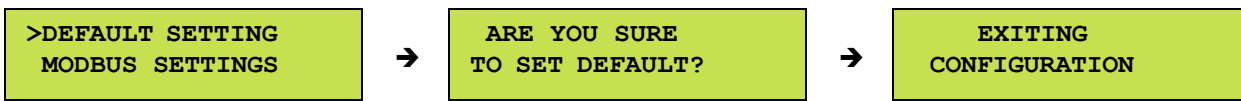
Press SET with "CRANKING OFF" selected to enable/disable (disabled by default) the Auto DC Output feature. The asterisk (*) on the display indicates the current setting.



With this feature enabled, during engine cranking, the output of the charger will be disabled. The output will stay disabled for 100 seconds. The message "CRANKING OFF" will appear on the LCD screen. However, the alarm LED and the relay contacts will not be triggered. The cranking off feature is activated after the unit ramps up.

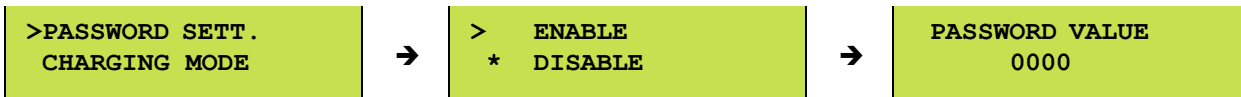
3.4.13 Default Setting

Press SET with "DEFAULT SETTING" selected to reset the controller settings to default. The control will ask to verify the reset settings. Press SET to reset the settings or BACK to exit and cancel the change.



3.4.14 Password Setting

Press SET with "PASSWORD SETT." selected to enable/disable the password feature. The asterisk (*) on the display indicates the current setting.



The "PASSWORD SETT." menu allows the user to set a password to enter Configuration Mode. By default, the password is disabled. To enable the menu password, scroll to "PASSWORD SETT.", press the SET button, then select ENABLE. Set password to desired four-digit pin. Make sure to save this new number as it will be necessary to access the menu after enabling the security feature.

NOTE: If a password is set, no changes can be made within this menu without knowing the password. In case the password is forgotten or lost, consult factory for password reset.

4 Service

All work inside the RHF2 should be performed by a qualified electrician. La Marche is not responsible for any damages caused by an unqualified technician.



Before working inside the RHF2, ensure that the AC power is off at the main breaker box. Disconnect the battery from the charger via the battery disconnect breaker or manually disconnecting the battery cables. Verify that no voltage is present by using a voltmeter at all input and output terminals.

4.1 Performing Routine Maintenance

Although very little maintenance is required with the RHF2 charger, routine checks and adjustments are recommended to ensure optimum system performance.

Yearly

1. Confirm air vents are open.
2. Confirm fans are functioning.
3. Check front panel meters and LEDs for accuracy.

4.2 Troubleshooting Procedure

Troubleshooting should be performed only by trained service personnel or experienced electricians. Before setting up any complicated testing, give the unit a general inspection.

Check the following:

1. Check DC output cables, connections, battery type, and number of cells against the unit's rating.
2. Check unit specifications against customer order.
3. Check input connections, input voltage and feeder breaker/fuse
4. Check any internal wiring, fuses, and breakers.
5. Check for shipping damage, loose connections, broken wires, etc.
6. Certain failures can be caused by defective batteries; make sure batteries are free from defects.

When calling in for a service inquiry or for troubleshooting assistance, be sure to have all of the following information on hand:

1. Equipment model number and serial number.
2. The actual AC input voltage.
3. The DC output voltage with and without the battery.
4. Result of the check of the AC and DC fuses/ breakers.
5. The actual DC output current and voltage, measured with battery and load connected to charger.

NOTE: When ordering replacement parts, drawings, or schematics, always give model number and serial number.

Appendix A: RHF2 Specifications

<i>ELECTRICAL</i>	
AC Input	Voltage range: 105 – 264VAC Frequency Range: 45-65Hz
DC Output	20 – 60A @ 12VDC 20 – 50A @ 24VDC
Output Filtering Regulation	Suitable for Valve-Regulated batteries ± 0.5% from no load to full load over the specified input voltage, frequency and ambient temperature range.
Meters	Digital DC Ammeter & DC Voltmeter ± 1% Accuracy AC Input Voltmeter
<i>PROTECTION</i>	
Current Walk-In	The output current will gradually increase after the charger is turned on, eliminating surges and overshoot
Current Limit	DC Current limiting. Adjustable from 50 to 100% of rated output current.
Input/ Output	Standard AC and DC fuse with surge protection
	Reverse Current Polarity
	Short circuit protection
Environmental	Thermal Protection
Emergency Restoration	The battery charger may be connected to a battery which is heavily discharged and recharge it without clearing any protective devices.
<i>ENVIROMENTAL</i>	
Audible Noise	Less than 65dBA at any point 5 feet from any vertical surface
Operating Temperature	-40 to 158°F (-40 to 70°C)
Storage Temperature	-40 to 185°F (-40 to 85°C)
Relative Humidity	0 to 95% (non-condensing)
Cooling	Fan-Assisted
Shock	The battery charger in its shipping container withstands shock developed when one edge of the container is dropped six inches while the opposite edge is resting on the ground, or it is dropped two inches without any physical damage or degradation of the electrical performance.
Vibration	The battery charger in its shipping container withstands vibration encountered in shipping without physical damage or degradation of the electrical performance.
Altitude	This battery charger is capable of operation at altitudes up to 3,000 feet at an ambient temperature of up to +50°C.
Ventilation	The unit should be mounted so that ventilating openings are not blocked and air entering the cabinet does not exceed 70°C (158°F).

Appendix B: Power Cabling Guide

Use the following formulas and table to determine proper wire size for minimal voltage drop. At distances exceeding 10 feet, the DC wire size should be chosen to keep the voltage difference between the units DC output terminals and the battery at less than 1/2 volt when unit is fully loaded.

Table of Conventions

CMA	= Cross section of wire in circular MIL area
A	= Ultimate drain in amperes
LF	= Conductor loop feet
MaxAmp	= Max. allowable amperes for given voltage drop
AVD	= Allowable voltage drop
K	= 11.1 for commercial (TW) copper wire = 7.4 for aluminum

Calculating Wire Size Requirements

$$CMA = \frac{A \times LF \times K}{AVD}$$

Calculating Current Carrying Capacity of Wire

$$MaxAmp = \frac{CMA \times AVD}{LF \times K}$$

Example: If the charger being used has a max ampere output of 33A, and 30 loop feet of copper wire cable is required with an allowable voltage drop of 0.5Volts, the wire size calculation will be.

$$CMA = \frac{A \times LF \times K}{AVD}$$

$$A = 30$$

$$LF = 30$$

$$K = 11.1$$

$$AV = 0.5$$

$$CMA = \frac{33 \times 30 \times 11.1}{0.5} = \mathbf{21978 \text{ or } \#6AWG \text{ wire}}$$

SIZE (AWG)	AREA CIR.MILS	SIZE (MCM)	AREA CIR.MILS
18	1620	250	250000
16	2580	300	300000
14	4110	350	350000
12	6530	400	400000
10	10380	500	500000
8	16510	600	600000
6	26240	700	700000
4	41740	750	750000
3	52620	800	800000
2	66360	900	900000
1	83690	1000	1000000
0	105600	1250	1250000
00	133100	1500	1500000
000	167800	1750	1750000
0000	211600	2000	2000000

Table 8 - Wire Size/Area Table

Appendix C: Manufacturer's Warranty

All La Marche Manufacturing Co. equipment has been thoroughly tested and found to be in proper operating condition upon shipment from the factory and is warranted to be free from any defect in workmanship and material that may develop within two (2) years from date of purchase.

Any part or parts of the equipment (except fuses, DC connectors and other wear-related items) that prove defective within a two (2) year period shall be replaced without charge providing such defect, in our opinion, is due to faulty material or workmanship and not caused by tampering, abuse, misapplication or improper installation.

Should a piece of equipment require repair during the warranty period, the equipment can be returned to the La Marche factory to have the inspection, parts replacements and testing performed by factory personnel. Should it be necessary to return a piece of equipment or parts to the factory, the customer or sales representative must obtain authorization from the factory. If upon inspection at the factory, the defect was due to faulty material or workmanship, all repairs will be made at no cost to the customer during the first three years. Transportation charges or duties shall be borne by purchaser.

In accepting delivery of the equipment, the purchaser assumes full responsibility for proper installation, installation adjustments and service arrangements. Should minor adjustments be required, the local La Marche sales representative should be contacted to provide this service only.

All sales are final. Only standard La Marche chargers will be considered for return. A 25% restocking fee is charged when return is factory authorized. Special chargers are not returnable.

In no event shall La Marche Manufacturing Co. have any liability for consequential damages, or loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause. In addition, any alterations of equipment made by anyone other than La Marche Manufacturing Co. renders this warranty null and void.

La Marche Manufacturing Co. reserves the right to make revisions in current production of equipment, and assumes no obligation to incorporate these revisions in earlier models.

The failure of La Marche Manufacturing Co. to object to provisions contained in customers' purchase orders or other communications shall not be deemed a waiver of the terms or conditions hereof, nor acceptance of such provisions.

The above warranty is exclusive, supersedes and is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness. No person, agent or dealer is authorized to give any warranties on behalf of the Manufacturer, nor to assume for the Manufacturer any other liability in connection with any of its products unless made in writing and signed by an official of the manufacturer.

Appendix D: Document Control and Revision History

Part Number: 147053

Instruction Number: P25-LRHF2-1

Issue ECN: 23204