

**RICH-MAR THERASOUND 3 SERIES  
ULTRASOUND OPERATION  
HANDBOOK AND MANUAL**



*Part # MN 2430*

*Rev. I*

*Batch 001*



## **CAUTION**

This device is not designed to be connected with any electrical equipment unless manufactured and approved by Rich-Mar.

NOTE: This includes whirlpools and carbon electrodes NOT manufactured by Rich-Mar.

CAUTION: When using carbon electrodes with any Rich-Mar stimulator, a moistened interface (cloth or sponge) **MUST** be utilized between these electrodes and the patient to avoid skin irritation and/or electrical burns.



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## **LIMITED WARRANTY**

This equipment is sold under an exclusive two-year warranty from date of sale, which warrants it to be free from defects in material and workmanship. We agree to repair or replace at the point of manufacture, without charge, all parts showing such defects, provided the unit is delivered to us, prepaid to our factory, intact for our examination, within two years from date of sale, and provided such examination discloses in our final judgement that it is defective.

This warranty does not apply if the equipment has been subject to misuse, neglect, accidents, incorrect wiring (not our own), improper installation, or put to use in violation of instructions furnished by us, has been damaged by excess voltage or has been repaired or altered outside our factory or if the equipment has had its serial number altered or removed.

Changes: Rich-Mar reserves the right to modify or change the equipment in whole or in part, at any time prior to delivery, in order to include refinements deemed appropriate by the Company but without incurring any liability to modify or change equipment previously delivered, or to supply new equipment in accordance with earlier specifications. This warranty will be honored only if the enclosed card is filled out and returned to the factory. This warranty is valid only to original purchaser.

This warranty is expressly in lieu of all other warranties expressed or implied including the warranties of merchantability and fitness for use and all other obligations on our part, and we neither assume, nor authorize any other person to assume for us, any other liability in connection with the sale or use of this equipment. In no event shall we be liable for consequential or special damages. We make no warranty whatsoever in respect to accessories or parts not supplied by us.

## **Ultrasound Indications for Treatment** (Therapeutic Ultrasound)

*Rich-Mar Ultrasound devices are indicated to produce therapeutic deep heat for the following conditions:*

- 1) Relief of pain.
- 2) Muscle spasms.
- 3) Joint contractures.

*But not for the treatment of malignancies.*

**WARNING** - Federal law restricts this device to sale by or on the order of a physician or any other practitioner licensed by the law of the state in which said person practices.

### **Ultrasound Contraindications**

#### **Contraindications**

*Ultrasound should not be used in the following areas:*

- 1) Near or over the heart.
- 2) Near or over the eyes.
- 3) On the head.
- 4) Near or over reproductive organs.
- 5) On the lower back during pregnancy or over the pregnant uterus.
- 6) Directly over the spinal column.
- 7) Over growing bone in children.
- 8) Where the skin suffers from any sensory impairment.
- 9) Over areas of malignancies.
- 10) In the area of visceral plexus and large autonomous ganglion.
- 11) Over the thoracic area if the patient is using a cardiac pacemaker.
- 12) Over a healing fracture.
- 13) Over ischemic tissues in individuals with vascular disease where the blood supply would be unable to follow the increase in metabolic demand and tissue necrosis might result.

#### **Precautions**

*Precautions should be taken when used:*

- 1) Over anesthetized areas.
- 2) On patients with hemorrhagic diatheses.
- 3) Ultrasound treatment should not be performed over an area of the spinal cord following laminectomy (i.e.- when major covering tissues have been removed).

#### **Caution**

- 1) Excessive doses of ultrasound may cause damage to tissue. Periosteal pain is an indication of excess intensity and if it occurs, the power should be reduced; the transducer should be moved more rapidly over the area being treated; or a lower pulsed duty cycle should be used.
- 2) If the soundhead has been operated unloaded for an extended period of time, the transducer will get hot. If the soundhead is applied to the patient while the transducer is hot, a burn may result.

#### **Warning**

Do not operate the soundhead in an unloaded condition. It is possible that unreparable damage may occur to the transducer in an unloaded state.

## Introduction

The Rich-Mar Therasound 3 series was designed to provide therapy professionals with the best technology at affordable prices. The Therasound 3 series offers the most flexible treatment possibilities in a convenient, easy-to-use package.

This manual is meant to familiarize the user with the controls, operations, and ultrasound therapies available in the Therasound 3 units. The simple control of the units allow the user to master the units' vast capabilities quickly and easily.

**Therasound 3.1/3.2 Operation** (see Fig. 1, page 9)  
The Therasound 3.1 ultrasound is a 1MHz unit utilizing a 5cm<sup>2</sup> transducer and the Therasound 3.2 ultrasound is also a 1MHz unit utilizing a 10cm<sup>2</sup> transducer. To operate the unit, make sure that the power cord is plugged into the power receptacle on the back of the unit. The power receptacle is located below the On/Off switch. Turn the switch to the "1," or on position. The device should then activate.

The Therasound unit will then go through a quick diagnostic check where some letters and numbers appear on the display. This is normal. After the diagnostic check green digits will appear in the time and intensity windows.

To set up a treatment, select the parameters desired by pressing their corresponding buttons. A beep will sound every time a button is pressed on the device. Select the duty cycle (100%, 50%, 20%, or 10%) by pressing the Duty Cycle Select button. Then select the desired treatment time by pressing the "+" or "-" buttons in the "Time Set" area. Select how the intensity will be displayed, either in W/cm<sup>2</sup> or Watts, by pressing the Select button in the "Intensity" area. Set the intensity by using the "+" or "-" buttons in the "Intensity" area.

Once all treatment parameters have been set as desired, apply ultrasound-coupling lotion or gel to the patient and place the transducer on the patient. Press the "Start" button and the "Time" indicator will start to flash. This indicates that the treatment is running and time is counting down. Notice that the green "Ultrasonic Active" indicator light next to the soundhead cable on the front of the unit has activated. This indicates that the device is outputting ultrasound.

Please note that any treatment parameter may be modified or changed while the device is operating simply by pressing the button corresponding to the parameter to be changed.

To pause treatment, press the "Pause" button. Time will stop flashing and the intensity will begin to flash. Notice that the ultrasound active indicator is no longer illuminated, indicating that the treatment has been paused. To resume treatment, press the "Resume" button and the time will flash and the ultrasound active indicator will illuminate. When the treatment time ends, a loud beep will sound and time will stop flashing and revert to the last treatment time entered. The intensity will revert to zero and the ultrasound active light will extinguish.

To stop a treatment, press the "Stop" button. Time will stop flashing and revert to the last treatment time entered. Intensity will revert to zero and the ultrasound active light will extinguish.

All most recently used parameters, with the exception of intensity, will remain saved as the default parameters after a treatment ends. To use the same treatment again, enter the desired intensity and press the "Start" button to begin.

**Therasound 3.4 Operation** (see Fig. 2, page 9)  
The Therasound 3.4 device is a dual-frequency (1MHz and 3MHz) ultrasound utilizing a 5cm<sup>2</sup> transducer.

The unit is operated in the same manner as the Therasound 3.1, except that the user is able to choose between the 1MHz and 3MHz frequencies. After choosing the desired duty cycle, select the frequency by pressing the corresponding button.

**Therasound 3.5 Operation** (see Fig. 3, page 9)  
The Therasound 3.5 device is a dual-frequency (1MHz and 3MHz) ultrasound utilizing the patented "Therapy Hammer" 2cm<sup>2</sup>/5cm<sup>2</sup> transducer. Continue with the operation instructions for the Therasound 3.1.

The unit is operated in the same manner as the Therasound 3.1, except that the user is able to choose between the 1MHz and 3MHz frequencies and the 2cm<sup>2</sup> and 5cm<sup>2</sup> transducers. After choosing the desired duty cycle, select the frequency by pressing the corresponding button. Then select the desired transducer (2cm<sup>2</sup> or 5cm<sup>2</sup>) by pressing the "Transducer" button. Continue with the operation instructions for the Therasound 3.1.

When finished making changes, return to the opening screen by pressing stop/clear or start treatment by pressing the start button.



Fig. 1 Therasound 3.1/3.2 front panel

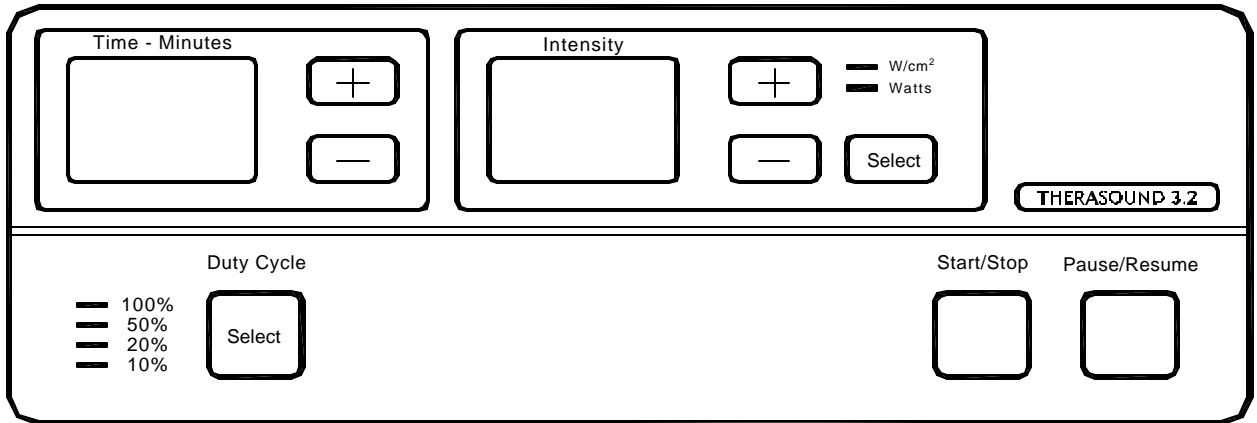


Fig. 2 Therasound 3.4 front panel

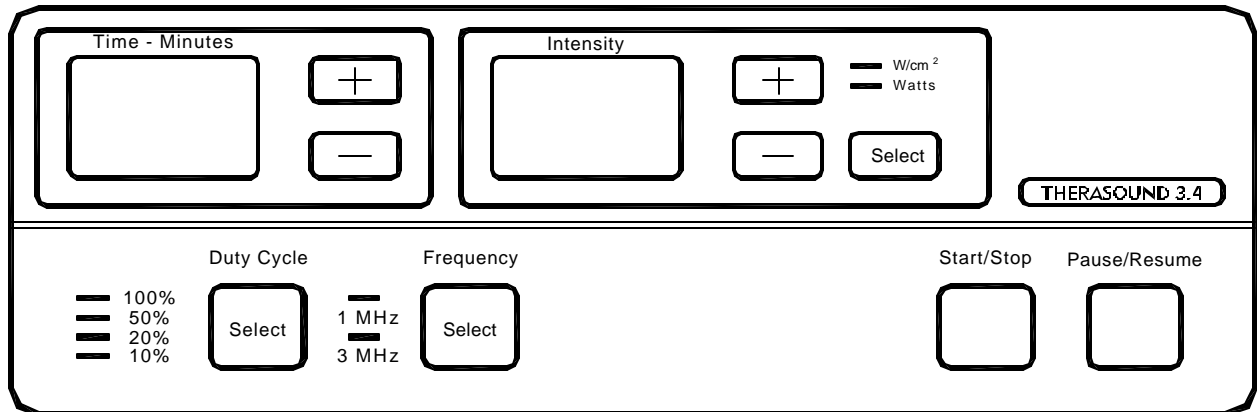
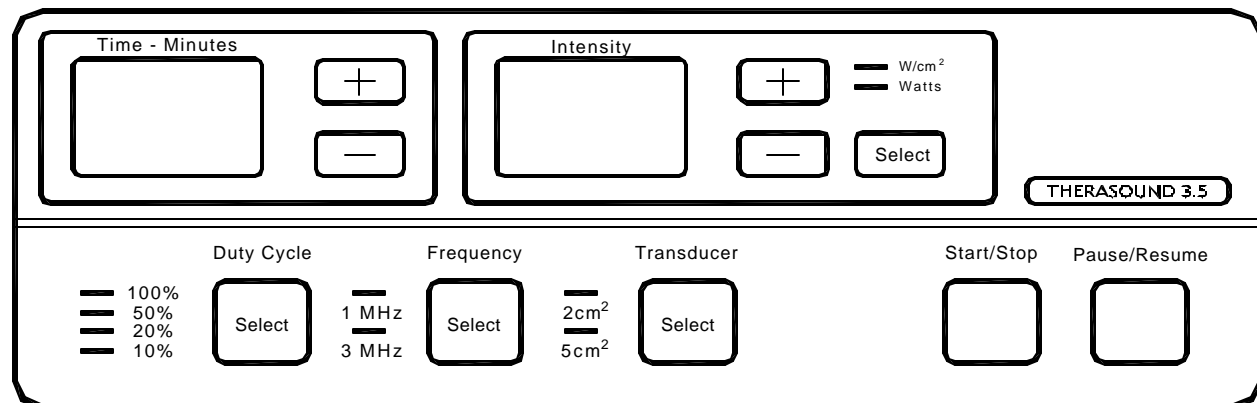


Fig. 3 Therasound 3.5 front panel



**NOTE:** Ultrasonic Active LED is located next to the soundhead cable exiting below the front panel.

## **Combining Ultrasound with Rich-Mar Stimulation**

The Rich-Mar Therasound 3 Series ultrasounds are designed to be connected to any Rich-Mar muscle stimulator, thus enabling the user to provide combination therapy to patients.

To connect the Therasound unit to a stimulator, simply plug an electrode lead from the stimulator into the jack on the lower right rear side of the Therasound ultrasound unit.

Using the indifferent electrode of the stimulator to complete the circuit with the soundhead of the Therasound, the user will be able to provide electrical stimulation as well as ultrasound through the transducer.

**CAUTION:** When using a combination treatment, note that both faces of the “Therapy Hammer” transducer will output stimulation.

### **Disinfecting Recommendations**

To disinfect the soundhead between therapy treatments, Rich-Mar recommends using a disinfectant cleaner for ultrasound. OSHA addresses the need for prudent infection control (OSHA Instruction CPL 2-2.33C) to include decontamination of equipment between patients.

# Ultrasound Calibration and Tuning Procedure

## Ultrasound Service Information

Rich-Mar Corporation recommends that all Rich-Mar ultrasonic therapy products be returned to the factory or to a servicing Rich-Mar distributor for service or calibration. It is recommended that the device be calibrated annually or when any major component is changed.

## Caution

Calibration and peaking adjustments must not be attempted unless the person performing these adjustments has the proper test equipment, which must include an acceptable ultrasonic wattmeter, such as the Ohmic UPM-30 or equivalent. Degassed water must be used to obtain accurate readings (4 parts per million of oxygen).

## Warning

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous exposure to ultrasonic energy.

## Calibration and Tuning Procedure

Note:

**Therasound 3.1** - you need to complete only the 5cm @ 1MHz portion.

**Therasound 3.2** - you need to complete only the 10cm @ 1 MHz portion.

**Therasound 3.4** - you need to complete both the 5cm @ 1 MHz and the 5cm@3 MHz portions.

**Therasound 3.5** - you need to complete the 5cm @ 1MHz, 5cm @ 3MHz, 2cm @ 1MHz, and 2cm @ 3MHz portions.

## Tuning Frequency and Setting Voltage

**5cm @ 1MHz (applies to Therasound 3.1, 3.4, 3.5)**

- 1) Install the 5cm soundhead into the wattmeter making sure that only the face of the transducer is submerged. Zero the wattmeter.
- 2) Hold down the Start/Stop switch and turn on the unit. The software version should appear on the screen.

- 3) Let off the Start/Stop switch and the frequency will appear on the screen for 5cm@1MHz. Find the frequency peak and add 5kHz.

Note: Normal range of operation is 930 to 960.

- 4) Press Start/Stop switch and the voltage will appear. Set maximum output to 10 watts.

\* If Therasound 3.1 see "Setting Thermistor Value" on next page to complete calibration.

**5cm @ 3MHz (applies to Therasound 3.4 and 3.5)**

- 1) ) Press the Start/Stop switch.

- 2) Find the frequency peak for 5cm @3MHz and add 7kHz.

Note: Normal range of operation is 3050 to 3150.

- 3) Press the Start/Stop switch and the voltage will appear. Set maximum output to 10 watts.

\* If Therasound 3.4 see "Setting Thermistor Value" on next page to complete calibration.

**2cm @ 1MHz (applies to Therasound 3.5 only)**

- 1) Press the Start/Stop switch.

- 2) Find the frequency peak for 2cm @ 1MHz and add 5kHz.

Note: Normal range of operation is 950 to 980.

- 3) Press the Start/Stop switch and the voltage will appear. Set maximum output to 4 watts.

**2cm @ 3MHz (applies to Therasound 3.5 only)**

- 1) Press the Start/Stop switch.

- 2) Find the frequency peak for 2cm @ 3MHz and add 5kHz.

Note: Normal range of operation is 3050 to 3150.

- 3) Press the Start/Stop switch and the voltage will appear. Set maximum output to 4 watts.

\* If Therasound 3.5 see "Setting Thermistor Value" on next page to complete calibration.

### **10cm @ 1MHz (applies to Therasound 3.2 only)**

- 1) Install the 10cm soundhead into the wattmeter making sure that only the face of the transducer is submerged. Zero the wattmeter.
- 2) Hold down the Start/Stop switch and turn on the unit. The software version should appear on the screen.
- 3) Let off the Start/Stop switch and the frequency will appear on the screen for 10cm@1MHz. Find the frequency peak and add 5kHz.  
Note: Normal range of operation is 900 to 950.
- 4) Press Start/Stop switch and the voltage will appear. Set maximum output to 20 watts.

Complete calibration by Setting the Thermistor Value.

### **Setting the Thermistor Value**

- 1) After the last frequency and voltage calibration has been made, press Start/Stop. Verify that the soundhead temperature thermistor value is set at "H0 73."  
If so, press Start/Stop to enter this number.

If not, set at H0 73, using the "+" or "-" switches to obtain the correct reading. Once setting is correct press Start/Stop twice.

## **Cable Diagnostic**

Therasound units are equipped with a diagnostic feature that will detect a broken cable. The diagnostic check is run when the device is powered on. If the device detects a variation in cable connection it will display 7E S7 (test) on the display for 2 seconds. If this occurs, conduct the water test outlined in the Output Trouble section on page 9. If the water does not cavitate, or bubble, the device may have a broken cable or it may need to be tuned and calibrated. If the device is outputting ultrasound, there may have been a slight variation in the diagnostic. Rich-Mar recommends that the device be calibrated at least once every year.

# Trouble-Shooting

Rich-Mar Corporation takes pride in its Technical Support Hotline: 1-918-543-2222. We have an outstanding staff ready to take your calls and help with diagnosing and troubleshooting problems. Listed below are several options for troubleshooting the Therasound 3 Series.

## 1.) The device fails to turn on.

Check to verify that the power cord is fully plugged into the corcom power entry module below the AC switch on the rear of the device. Also verify that the power cord is fully plugged into the AC wall outlet.

Check the fuse to verify that it has not blown.

CAUTION: To ensure personal safety, unplug the unit before checking the fuse.

## 2.) Ultrasonic Active LED fails to illuminate

Verify that the soundhead connections are plugged firmly into the main board.

## 3.) Display reads "HEAd."

The "HEAd" warning is a safety feature wherein the soundhead temperature shuts off to avoid overheating. This warning occurs when the soundhead overheats, usually due to an un-coupled or poor coupling situation. Turn the device off for 3-4 minutes to allow it to reset and turn it back on and begin treatment. If the "HEAd" warning is still displayed, please call the factory.

When using the Therasound 3.5, check that the soundhead in use is active. Also, be sure to use an adequate amount of coupling gel or lotion specifically designed for ultrasound transmission.

## Output Troubleshooting

Rich-Mar suggests that ultrasound output be tested once a week. To do this, turn on the device and start a treatment at 100% output. The outputting head should be facing up towards the user. Pour some water on the soundhead and increase the intensity. If the device is outputting ultrasound, the water should cavitate, or bubble, on the soundhead.

CAUTION: Do not operate the ultrasound in an "unloaded" condition for more than one minute at intensities greater than 1.0 W/cm<sup>2</sup>. It is possible that the transducer may overheat and damage the unit.

# Therasound 3 Series Specifications

## Therasound 3.1/3.2

Dimensions:	7.5"W x 7.5"D x 4"H
Weight:	5.5 lbs.
Power Input:	115 VAC, 1.0 A, 60Hz or 230 VAC, 0.5A, 50Hz
Output:	0-2 w/cm <sup>2</sup>
Soundhead ERA:	5cm <sup>2</sup> - 3.1 10cm <sup>2</sup> - 3.2
Frequency:	1MHz
BNR:	5.5:1 maximum

## Therasound 3.4

Dimensions:	7.5"W x 7.5"D x 4"H
Weight:	5.5 lbs.
Power Input:	115 VAC, 1.0 A, 60Hz or 230 VAC, 0.5 A, 50Hz
Output:	0-2 w/cm <sup>2</sup>
Soundhead ERA:	5cm <sup>2</sup>
Frequency:	1MHz & 3MHz
BNR:	5.5:1 maximum

## Therasound 3.5

Dimensions:	7.5"W x 7.5"D x 4"H
Weight:	5.5 lbs.
Power Input:	115 VAC, 1.0 A, 60Hz or 230 VAC, 0.5 A, 50Hz
Output:	0-2 w/cm <sup>2</sup>
Soundhead ERA:	2cm <sup>2</sup> & 5cm <sup>2</sup>
Frequency:	1MHz & 3MHz
BNR:	5.5:1 maximum

# Changing the Voltage from 115V to 230V

**WARNING: RISK OF ELECTRICAL SHOCK.**

**Unplug unit prior to changing the voltage from 115 to 230.**



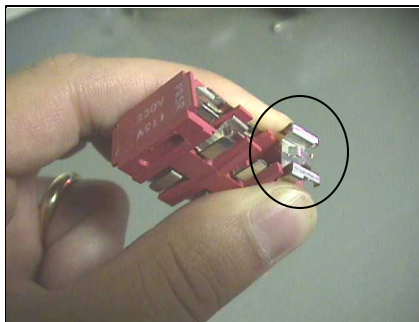
1. After unplugging the unit, open the outlet cover with a flathead screwdriver by inserting it into the notch on the top.



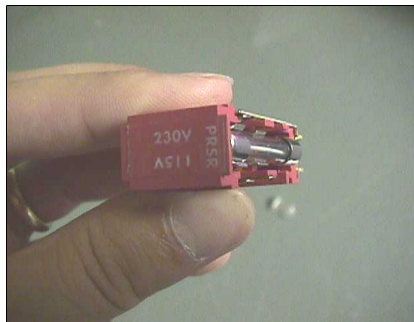
2. Once the outlet cover is open, insert the flathead screwdriver into the notch on the top of the red voltage converter.



3. Holding the regulator so that 115V is right-side up, remove the 1amp slow blow fuse from the right side.



4. Rotate the regulator until 230V is right-side up. Remove the clip from the right-hand side and insert *two* .5amp slow-blow fuses, one on each side.



5. **SAVE THE CLIP AS IT IS NEEDED TO SWITCH BACK TO 115V.** After correct fuses are inserted into each side, insert the regulator into the slot with 230V reading right-side up.



6. Finally, close the outlet cover, ensuring that the desired voltage appears through the window in the outlet cover. Also be sure to use an adapter for the AC plug to suit local wall outlets in use.

## 115V to 230V Quick Check

- , Take out 1amp slow blow fuse and remove clip on back of 230V side.
- , **SAVE CLIP**
- , Insert *two* .5 amp slow blow fuses.
- , Insert regulator with 230V appearing through the window in outlet cover.

# Changing the Voltage from 230V to 115V

**WARNING: RISK OF ELECTRICAL SHOCK.**

**Unplug unit prior to changing the voltage from 230 to 115.**



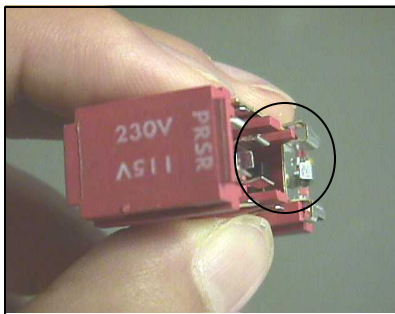
1. After unplugging the unit, open the outlet cover with a flathead screwdriver by inserting it into the notch on the top.



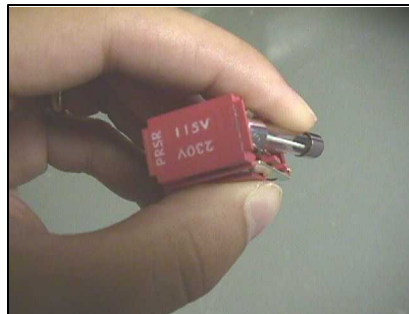
2. Once the outlet cover is open, insert the flathead screwdriver into the notch on the top of the red voltage converter.



3. Remove the two .5 amp slow blow fuses from the voltage regulator.



4. Hold the regulator so that 230V is right-side up. Insert the clip into the right-hand side of the regulator.



5. Rotate the regulator so that 115V is right-side up and insert one 1 amp slow blow fuse into the right side. Insert the regulator into the slot in the unit with 115V reading right-side up.



6. Close the outlet cover, ensuring that 115V appears through the window in the outlet cover. Also be sure to use an adapter for the AC plug to suit local wall outlets in use.

### 230V to 115V Quick Check

- , Take out the two .5 amp slow blow fuses.
- , INSERT THE CLIP INTO THE RIGHT HAND SIDE OF THE 230V REGULATOR
- , Insert one 1 amp slow blow fuse.
- , Insert regulator with 115V appearing through the window in outlet cover.





**APPENDIX A**  
**ULTRASOUND TECHNICAL INFORMATION**

# Ultrasound Technical Information

## Applicator Type:

The ultrasonic radiation fields produced by Rich-Mar therapeutic ultrasound transducers are of the plane wave type and are essentially cylindrical in shape. This type of applicator is referred to as a collimating applicator.

## Applicator Label:

Each Rich-Mar applicator is labeled to provide the user with information on its applicable parameters. The following abbreviations are used on the label.

Gen: The Rich-Mar ultrasonic generator for which the applicator is intended.

f: The operating frequency in MHz for the applicator.

Area: The effective radiating area of the applicator in square centimeters.

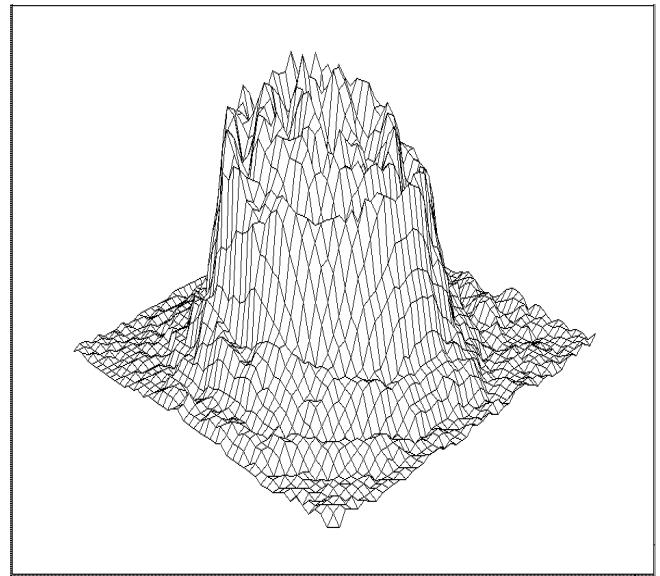
BNR: The Beam Nonuniformity Ratio.

Type: Coll-means collimating applicator.

## Near Field/ Far Field:

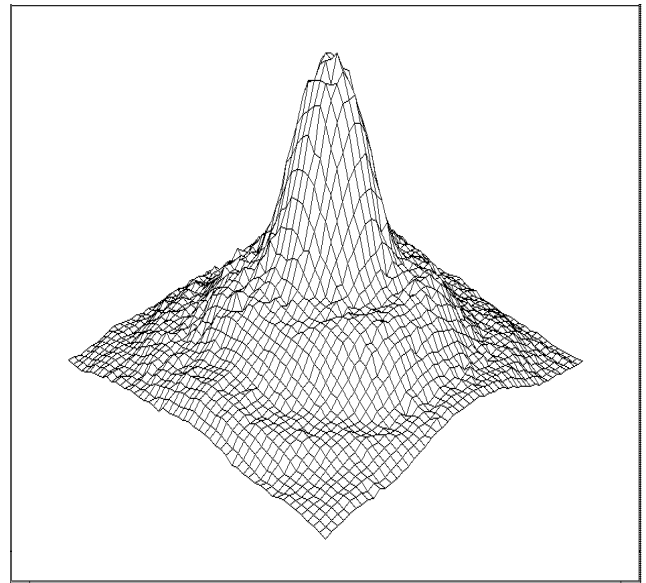
If measurements are made of the sound intensity along the central axis of the beam produced by the applicator, the intensity distribution shows maxima and minima near the applicator and then a gradual decline beyond the last maximum intensity.

The “interference” or “near field” is the area in the ultrasound beam extending from the applicator surface to the location of the most distant intensity maximum. In this area, maxima and minima of intensity are located close to each other. This is the area in which most therapeutic application occurs. This is shown in the following figure measured 0.5cm from the transducer face.



**Near Field Distribution**

Beyond this point, the beam has a more uniform intensity and is called the “far field”. Below is shown the far field distribution at 16cm from the transducer face.



**Far Field Distribution**

The preceding descriptions apply for radiation emitted into the equivalent of an infinite medium of distilled, degassed water at 30°C and with line voltage variations in the range of +/-10% of the rated value

## Transducer Parameters and Tolerances:

The Rich-Mar ultrasound units operate at frequencies of either 1MHz or 3MHz +/- 10%. The effective radiating areas (ERA) of the transducers are ten, five,

or two square centimeters, depending upon the size of the transducer being used. The tolerance for the ERA is +/-25% on the 2 and 5 square centimeter transducers. The tolerance for the 10 square centimeter transducers is +0. -25%. The Beam-Nonuniformity-Ratio (BNR) of any Rich-Mar transducer is 5.5:1 or less.

**100% Mode**

When operated in the 100% mode, the generator produces a non-interrupted sinusoidal waveform of one or three MHz. The peak power and average power are therefore the same.

The error in indication of radiated power in intensity for the continuous mode does not exceed +/- 14% allowing for a 6% error in the wattmeter, which equals +/- 20%.

**Pulsed Mode**

When operated in the pulsed mode, the generator produces a square-wave burst of sinusoidal waveform of 1MHz or 3MHz of 2.5 milliseconds in duration. Depending upon the Rich-Mar model of therapeutic ultrasound in use, the duty cycle can be chosen between 5% and 95% duty. This then implies the repetition rate is selectable between 20 and 380 pulses per second. (This is computed by taking the inverse of the duty cycle  $1/380 = .95$ ,  $1/20 = .05$ ). The tolerance for the pulsed mode is +/- 20%.

See the following chart for second comparison on %Duty cycle to pulses.

% Duty Cycle (Indicated on front panel of device)	Pulses/Second
5	20
10	40
15	60
20	80
25	100
30	120
35	140
40	160
45	180
50	200
55	220
60	240
65	260
70	280
75	300
80	320
85	340
90	360
95	380

The error in indication of radiated power in intensity for the pulsed mode does not exceed +/-14% allowing for an allowable 6% error in the wattmeter, which equals +/-20%.

**Timer Accuracy**

The Food and Drug Administration requires that the treatment timer accuracy is to within 0.5 minutes for the preset duration of emission for settings less than five minutes, to within 10% of the preset duration of emission for settings from five to ten minutes, and to within one minute of the preset duration of emission for settings greater than ten minutes.

**Ratio of Temporal Peak to Temporal Average (Rtpa):**

The ratios of temporal peak to temporal average intensities (Rtpa) will vary with the pulse rate of the device. Depending upon the Rich-Mar model of therapeutic ultrasound in use, the duty cycle can be chosen between 5% and 95% duty.

The Rtpa is calculated in the following manner:

$Rtpa = (1/Duty):1$

Example 5% duty = .05 (min. duty, max. Rtpa)

$Rtpa = (1/.05):1$

$Rtpa = 20:1$

Example 95% duty = .95 (max. pulsed duty, min. Rtpa)

$Rtpa = (1/.95):1$

$Rtpa = 1.05:1$

See the following chart for %Duty cycle to Rtpa comparison.

% Duty Cycle (Indicated on front panel of device)	Rtpa
5	20:1
10	10:1
15	8.33:1
20	5:1
25	4:1
30	3.33:1
35	2.86:1
40	2.5:1
45	2.22:1
50	2:1
55	1.82:1
60	1.66:1
65	1.54:1
70	1.43:1
75	1.33:1
80	1.25:1
85	1.18:1
90	1.11:1
95	1.05:1

The Rtpa tolerance does not exceed +/- 20%.

The temporal maximum intensity for each duty cycle as well as the 100% modulation is whatever is indicated on the meter.

The temporal average intensity for each duty cycle will be the meter indication multiplied by the percentage duty cycle.

Temporal Average = (Duty) x (Meter Indication)

Example, 5 Watts, 35% Duty

Temporal Average = .35 x 5 Watts = 1.75 Watts

The Spatial Average Intensities for each of these setting will be divided by the transducer's Effective Radiating Area (ERA)

Spatial Average = (Temporal Average)/(ERA)

Example, 5 Watts, 35% Duty, 5cm<sup>2</sup> Transducer

Spatial Average = (1.75 Watts)/(5cm<sup>2</sup>) = 0.35 Watts/cm<sup>2</sup>

The pulse width (On time) of all Rich-Mar therapeutic ultrasound devices is 2.5 milliseconds (mS). The time between pulses (Off time) in milliseconds is calculated as follows:

Pulse width (On time) = 2.5mS

Off time = [2.5-2.5(%Duty cycle)]/(%Duty cycle)

Where %Duty cycle is represented as a decimal.

Please see the following example for computing the Off time for a 10% Duty cycle:

Off time=[2.5-2.5(0.10)]/(0.10)=22.5 milliseconds.

### **Additional Technical Notes:**

The peak power is the same in the pulsed modes as in the 100% modulated mode.

Unless otherwise stated, all technical parameters are accurate within +/- 20%.

When in the pulse modes the unit is still generating therapeutic heat, although it is an amount reduced by a factor directly related to the duty cycle. The pulse rates are used to allow the practitioner to treat areas of bony prominences without creating periosteal pain. The line leakage is tested in both the forward and reverse polarities to be less than 50 microamperes exceeding all standards for medical devices in this class.

The device is designed to meet or exceed UL Standards 544 for medical devices and the Canadian Standards Association (CSA No. 125).

**APPENDIX B**  
**PARTS LIST**

## Therasound 3 Series Parts List

### Therasound 3.1, 3.4, and 3.5

Rich-Mar Part No.	Part Name	Description	Qty/Board
0600	#4 SOLDER LUG	GROUND STRAP	2
0704	#4 x 1/4" SPACER	DISPLAY MOUNTING	4
0712	6-32 x 1/2"	MAIN BOARD (GROUND) MOUNTING SPACER	1
0730	PLASTIC SPACER	MAIN BOARD MOUNTING	4
3269	10FNNZ	10 SELF LOCKING	2
3510	SMITH 2182	FEET	4
3745	NEW STYLE RIGHT BAIL	HAMMER	1
3797	THERASOUND 3 SERIES		1
4161	AMP 640440-2	FAN CONNECTOR (.1" 2PIN FEMALE)	2
4183	640433-3	TRANSFORMER CONNECTOR (.156" 3 PIN FEMALE)	1
4200	640440-6	LEAD CONNECTOR (.1" 6 PIN FEMALE)	1
4251	26 PIN HEADER	RIBBON CABLE CONNECTOR	2
4804	TS2.5, TM3C/3P FAN		1
4806	FAN GUARD		1
5008	SLOW BLOW 1 AMP		1
5516	6097 PIN JACK (KEYSTONE)	COMBINATION	1
5905	GREEN LED	UA ACTIVE	1
5911	ME-352-0002 LED HOLDER		1
7403	5cm CRYSTAL & DIAPHRAGM		1
7840	PSOSXSOO (US500, 750, 1000)	CORCOM POWER ENTRY MODULE (AC SWITCH & FUSE)	1
8341	FD7-36 MAGNATEK	TRANSFORMER	1
8694	THERMISTOR		1
9112	FEMALE SPADE CONNECTOR		4
9116	NP-07-GY (NUT FOR MS 9115)	TRANSDUCER STRAIN RELIEF MOUNTING	1
9150	AT-40 SPEAKER		1
9161	KEYSTONE 7623 3/16" CLIP	STRAIN RELIEF FOR TRANSFORMER WIRES	1
9171	7721-3PPS #4 WASHER		4
9182	THERMALLOY 53-77-4 SIL PAD		4
9186	THERMALLOY 7721-7PPS		4
9843	AC CORD/US 500/750/1000		1

### Therasound 3.1 only

Rich-Mar Part No.	Part Name	Description	Qty/Board
2679	US 500 MAIN BOARD		1
2680	US 750/1000 FRONT PANEL BOARD		1
6352	US 500 FRONT PANEL		1

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### Therasound 3.1 only

Rich-Mar Part No.	Part Name	Description	Qty/Board
6361	THERASOUND 3.1 PANEL LABEL		1
7436	US500 3.1 5cm		1
9139	RB14-250F DISCONNECT		1

### Therasound 3.4 only

Rich-Mar Part No.	Part Name	Description	Qty/Board
2680	US750/1000 FRONT PANEL BD.		1
2684	US1000/750 MAIN BOARD		1
6359	US 750		1
6363	THERASOUND 3.4 PANEL LABEL		1

### Therasound 3.5 only

Rich-Mar Part No.	Part Name	Description	Qty/Board
2680	US 750/1000 FRONT PANEL BD.		1
2684	US1000/750 MAIN BOARD		1
6364	THERASOUND 3.5 PANEL LABEL		1
7402	2cm CRYSTAL & DIAPHRAGM		1
7440	US 1000 3.5 HH		1

### Reference Designator(s)

Reference Designator(s)	Part Number	Description	Qty/Board
(U1)(U2)(Q1)(q2)	4880S	HEATSINK, HARDWARE KIT, TO220	4
(U1-U2) (Q1-Q2)	HS5221	HEATSINK, BAR, R'M CUSTOM, TO220	2
(U14)	821574-1	SKT, 44-PIN PLCC, TIN	0
(U5)	2-640463-1	SKT, 8-PIN DIP, TIN, .100	1
(U5)	58010B00000	HEATSINK, IC CLIPON, DIP8	1
C1 C2 C3 C5 C6	C1812C104MIRAC	CAP, CER, 0.1uF,100V, 20%, X7R, 1812	5
C10	ECE-A1JU221	CAP, ALUM, 220uF, 63V, 20%, RADIAL	1
C11	ECE-A1HU331	CAP, ALUM, 330uF, 50V, 20%, RADIAL	1
C12 C14 C15 C16 C19 C22	C0805C104M5RAC	CAP, CER, 0.1uF, 50V, 20%, X7R, 0805	16
C23 C26 C29 C31 C33 C37			
C40 C42 C7 C8			
C13	C0805C102M5RAC	CAP, CER, 0.001uF, 50V, 20%, X7R, 0805	1
C17	593D476X0020E2T	CAP, TANT, 47uF,20V, 20%, E-SIZE	1
C18	ECH-S1272JZ	CAP, PPS, 2700pF,100V, 5%, RADIAL	1
C20	595D686X0025R2T	CAP, TANT, 68uF, 25V, 20%, R-SIZE	1

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Reference Designator(s)	Part Number	Description	Qty/Board.
C21 C24	ECA-1HFQ330	CAP, ALUM, 33uF, 50V, 20%, RADIAL	2
C25	T322A275K010AS	CAP, TANT, 2.7uF, 10V, 10%, AXIAL	1
C27	ECH-S1561JZ	CAP, PPS, 560pF, 100V, 5%, RADIAL	1
C28	C0805C561MR5AC	CAP, CER, 560pF, 50V, 20%, X7R, 0805	1
C30	595D107X9016C2T	CAP, TANT, 100uF, 16V, 10%, C-SIZE	1
C30	595D107X0016C2T	CAP, TANT, 100uF, 16V, 20%, C-SIZE	1
C32 C34	ECE-A1CU220	CAP, ALUM, 22uF, 16V, 20%, RADIAL	2
C35	T491B106K006AS	CAP, TANT, 10uF, 6V, 10%, B-SIZE	1
C36	593D227X0010E2T	CAP, TANT, 220uF, 10V, 20%, E-SIZE	1
C38 C39	C0603C220M5RAC	CAP, CER, 22pF, 50V, 20%, X7R, 0603	1
C4	ECE-A1JU471	CAP, ALUM, 470uF, 63V, 20%, RADIAL	1
C41	T491A474M020AS	CAP, TANT, 0.47uF, 20V, 20%, A-SIZE	1
C9	ECE-A2AU471	CAP, ALUM, 470uF, 100V, 20%, RADIAL	1
D1 D2 D3 D6	S1JB	DIO, GLASS PASS, 600V, 1A, D0214	4
D10 D11 D4 D8	I10BQ040	DIO, SCHOTTKY, 40V, 1A, SMB	4
D12 D13 D9	LL4148	DIO, 1N4148, 75V, .15A, S0D-80	3
D14	BZX84C5VIZ	DIO, ZENER, 5.1V, 250mA, 5%, SOT23	1
D5	KBU4J	RECTIFIER, FULL-WAVE BRIDGE	1
D7	LN1251C	LED, RED, J-TYPE, SMT	1
F1	60R110	FUSE, PTC RESETTABLE	1
F2	60R075	FUSE, PTC RESETTABLE	1
J1	71912-126	HDR, 26-PIN DUAL ROW, EJECT/LATCHING, .100	1
K1 K2	DS2E-S-DC12V	RELAY, DPDT, 12V, 2A, PCMOUNT	2
L1	CTM22997	INDUCTOR, WITH TAP COIL, 13.0uH	1
L2	PE-53827S	INDUCTOR, POWER	1
L3	PE-53819S	INDUCTOR, POWER	1
L4	CCTM15399	INDUCTOR, WITH TAP COIL, 4.84uH,	1
P1 P2 P7	640456-2	HDR, 2-PIN, VERTICAL FRICTION LOCK, .100	3
P3	640445-3	HDR, 3-PIN, VERTICAL FRICTION LOCK .156	1
P5 P6	RL359	HDR, RCA JACK, 3-PIN	2
P8	1-640456-0	HDR, 10-PIN, VERTICAL FRICTION LOCK, .100	1
PCB	SET02D	PCB, RM US1000 SERIES MAIN BOARD	1
Q1 Q2	IRL520N	FET, N-CH, POWER, TO-220-UP	2
Q3	ZVP3306FTA	FET, P-CH, SOT23	1



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Reference Designator(s)	Part Number	Description	Qty/Board
Q4 Q5		FET, N-CH. ENHANCEMENT MODE, SOT23-GSD	1
R1	ERJ-14RSJR10U	RES, 0.1, 1/4W, 5%, 1210	1
R10 R12	CRCW0805-1004FRT1	RES, 1M, 1%, 1/10W, 100V, 0805	2
R11 R9	CRCW0805-0020		2
R13	CRCW0805-1103FRT1	RES, 110K, 1%, 1/10W, 100V, 0805	1
R14 R17 R18 R19 R20 R22	CRCW0805-1002FRT1	RES, 10K, 1%, 1/10W, 100V, 0805	13
R29 R30 R31 R37 R39 R5 R8			
R15 R40	CRCW0805-1001FRT1	RES, 1K, 1%, 1/10W, 100V, 0805	2
R16	CRCW0805-4991FRT1	RES, 4.99K, 1%, 1/10W, 100V, 0805	1
R2	CRCW0805-8871FRT1	RES, 8.87K, 1%, 1/10W, 100V, 0805	1
R21 R32	CRCW0805-2002FRT1	RES, 20K, 1%, 1/10W, 100V, 0805	2
R23 R6 R7	CRCW0805-1003FRT1	RES, 100K, 1%, 1/10W, 100V, 0805	3
R24	CRCW0805-3013FRT1	RES, 301K, 1%, 1/10W, 100V, 0805	1
R25	CRCW0805-3741FRT1	RES, 3.74K, 1%, 1/10W, 100V, 0805	1
R26	CRCW0805-2211FRT1	RES, 2.21K, 1%, 1/10W, 100V, 0805	1
R27 R36	CRCW0805-0000JRT1	RES, 0 OHM, 5%, 1/10W, 100V, 0805	2
R28 R35	TBD		
R3	CRCW0805-1960FRT1	RES, 196, 1%, 1/10W, 100V, 0805	1
R33	CRCW0805-1005FRT1	RES, 10M, 1%, 1/10W, 100V, 0805	1
R34	CRCW0805-5761FRT1	RES, 5.76K, 1%, 1/10W, 100V, 0805	1
R38	CRCW0805-4700FRT1	RES, 470, 1%, 1/10W, 100V, 0805	1
R4	CRCW0805-1000FRT1	RES, 100, 1%, 1/10W, 100V, 0805	1
RP1 RP3 RP5	BCN164A102J7	RES NET, ISOLATED, 1K, 8-PINS	3
RP2 RP4 RP6 RP7	BCN164A103J7	RES NET, ISOLATED, 10K, 8-PINS	4
RP8	BCN164A471J7	RES NET, ISOLATED, 470, 8-PINS	1
RT1 RT2	ERT-D2FGL202S	THERMISTOR, NTC, 2.0K, RADIAL	2
T1	PE-5762	TRANSFORMER, GATE DRIVE	1
U1 U2	LM317HVT	IC, REG, VOLTAGE - ADJUSTABLE, TO-220-UP	2
U10	LT1491CS	IC, OP AMP, SO14	1
U11	LM2594M-12	IC, VOLTAGE REG, SWITCHING, 12V, SO8	1
U12	LM2594M-5.0	IC, VOLTAGE REG, SWITCHING, 5V, SO8	1
U13	74HCT9046AD	IC, PLL WITH BANDGAP CONTROLLED VCO, SO16	1
U14	AT89C52-12JC	IC, MCU, 8-BIT WITH 8K FLASH, 128 RAM, 12MHZ, PLCC44	1
U15	AT25010-10SC	IC, EEPROM, 1K, SPI SERIAL CMOS, SO8	1

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Reference Designator(s)	Part Number	Description	Qty/Board.
U16 1	ISPLS1101G-60LT	IC, CPLD, ISP, 64K GATES, TQFP44	
U17	ICL7660CBA	IC, VOLTAGE CONVERTER, DC-DC, SO8	1
U18	TDA7052ATD	IC, AMP, 1W AUDIO WITH DC VOLUME CONTROL, SO8	
U3 U4	OPA445AU	IC, OP AMP, HIGH VOLTAGE, SO8	2
U5	EL7222CN	IC, FET DRIVER, DIFFERENTIAL, DIP8	1
U6	TLC1541CDW	IC, ADC, 11-CH, 10-BIT, SO20W	1
U7	TLC5620CD	IC, DAC, QUAD 8-BIT, SERIAL INTERFACE, SO14	1
U8	TC74HC273AFN	IC, OCTAL D-TYPE FF CR, SO20W	1
U9	AD8402AR100	IC, DIGITAL POT, DUAL, 100K, SO14	1
V1	EZJ-S2VB223Z	VARISTOR, 6VCD, 25A, W/EMI, 0805	1
Y1	ECS-110.5-20-5P	CRYSTAL, 11.059MHz, 20pF, SMT	1