

RICH-MAR THERASOUND 2.5 ULTRASOUND OPERATION HANDBOOK AND MANUAL



Part # MN 2430

Rev. D

Batch 004

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.

TABLE OF CONTENTS

Therasound 2.5 Warranty.....	4
Ultrasound Indications for Treatment.....	5
Ultrasound Contraindications & Warnings.....	5
Introduction.....	6
Therasound 2.5 Operation.....	6
Opening Screen.....	6
Set-Up Screen.....	6
Treatment Screen.....	7
Adjusting Intensity.....	7
Pausing/Changing Treatment Time.....	7
Stopping a Treatment.....	7
Ultrasonic Output Diagnostic Feature.....	7
Combining Therasound 2.5 with Stimulation.....	7
Ultrasound Calibration & Tuning Procedure.....	9
Trouble Shooting.....	10
Therasound 2.5 Specifications.....	10

Appendix A

Ultrasound Technical Information

Appendix B

Therasound 2.5 Parts List

Appendix C

Therasound 2.5 Schematics

LIMITED WARRANTY

This equipment is sold under an exclusive three-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 three 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 unrepairable damage may occur to the transducer in an unloaded state.

Introduction

The Rich-Mar Therasound 2.5 is the product of dedication to research and development. The Therasound 2.5 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 2.5. The simple control of the unit allows the user to master the unit's vast capabilities quickly and easily.

User Interface

The main controls for the Therasound 2.5 are the buttons labeled, "Set/Enter," "Start," and "Stop/Clear". These buttons work in conjunction with the control dial to operate all aspects of the unit.

AC Power Switch

This switch will turn the unit on and off. The power switch is located on the rear left side of the unit. "I" represents the on position and "O" represents the off position.

Screen

The screen will display all treatment information. Depending upon the screen mode in use, information shown will include the name of the treatment, the soundhead and frequency in use, the intensity in both watts and w/cm², the duty cycle, the treatment mode, and the treatment time.

Set/Enter Button

This button performs a multitude of tasks and allows the user to change and set treatment parameters.

Start Button

This button will start a treatment or resume treatment after adjusting intensity or when a treatment is paused.

Stop/Clear Button

This button will pause or stop a treatment in progress. If pressed again it will return to the opening screen.

Control Dial

The control dial will allow the user to select a treatment or alter treatment parameters. This dial can be used to scroll through general parameter options when making changes. These controls are displayed on the panel illustration below.

Therasound 2.5 Operation

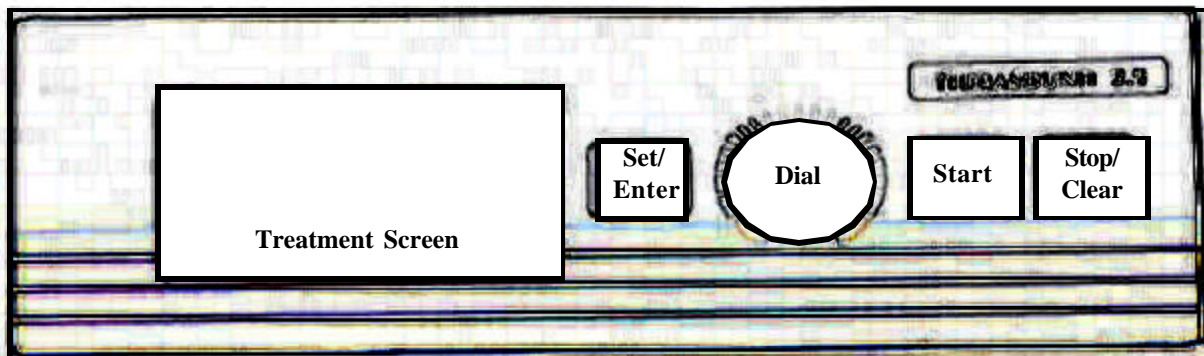
When the Therasound 2.5 is powered on, the opening screen will appear

Opening Screen

The lower half of the opening screen will display four treatment boxes with treatment information shown above. By turning the dial, different treatment boxes can be highlighted with treatment parameters displayed. To use one of these treatments, highlight the corresponding treatment box and press start. The treatment screen will then appear. To program one of the treatment boxes, highlight the desired box and press the set/enter button. The set-up screen for that treatment box will then appear.

Set-Up Screen

The set-up screen will display all of the current



treatment parameters, which can be changed by using the dial to highlight the parameter to be changed and pressing set/enter. Then use the dial to scroll through parameter options. Once the desired change has been made, press the set/enter button again to save the change. Changes can be made to the name of the treatment, the soundhead and frequency, the intensity (preset an intensity level or select the manual mode to set intensity before each treatment), the duty cycle (continuous or pulsed outputs), and the treatment time.

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

Treatment Screen

If the selected treatment has a pre-set intensity, begin treating the patient right away.

If the selected treatment is in manual mode, flashing zeros will appear above the WATTS and W/CM² indicators. The manual mode allows the intensity to be set prior to starting a treatment. Turn the dial to the desired intensity level which will be displayed in both watts and w/cm². Once completed, press the set/enter button or the start button and the treatment time will begin.

To Adjust Intensity

To increase or decrease the intensity during a treatment, press the set/enter button. The output will continue but the treatment time will pause and the intensity indicators (watts and w/cm²) will flash. Adjust the intensity with the dial until the desired level is reached and press either set/enter or start to resume the timer.

To Pause or Change Treatment Time

To pause a treatment or change treatment time, press the stop/clear button. Time is adjustable from one to 30 minutes. The mode indicator will change from TREAT to PAUSE. Also note that the treatment time is paused and flashing. Use the dial to adjust the time and press set/enter or start to resume treatment.

To Stop a Treatment

To stop a treatment, press the stop/clear button once to pause and press stop/clear again to clear the treatment and return to the opening screen.

Remember to always keep the soundhead moving during any ultrasound treatment.

CAUTION: Do not operate the soundhead in an unloaded condition (without a coupling lotion and patient contact). This can cause the transducer to get very hot and may cause unreparable damage to the transducer.

NOTE: When administering an ultrasound treatment, be sure that treatment area of the patient has an ample quantity of Rich-Mar lotion or gel as a coupling medium. The quantity and quality of the coupling medium used has a direct bearing on the amount of ultrasonic energy transmitted to the treatment area.

Ultrasonic Output Diagnostic Feature

The Therasound 2.5 is equipped with an ultrasonic output failure diagnostic feature. During the course of a treatment, the message “CAL” will occasionally appear or flash intermittently. This is normal for the device and probably does not indicate a problem.

If the display on the Therasound 2.5 presents a solid “CAL” reading in one or more of the ultrasonic output modes, this most likely indicates no ultrasonic output at that particular frequency. A solid “CAL” message may signify a failed crystal, transducer cable, or a problem in the RF generator.

To positively identify failure, Rich-Mar recommends that the user place water on the transducer face and activate the ultrasound for each transducer at each frequency. The water should cavitate (bubble) if the device is outputting.

Combining Ultrasound with Rich-Mar Stimulation

The Rich-Mar Therasound 2.5 ultrasound is 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. Notice that there are two receptacles on the Therasound. One is for a banana type lead and the other is for a pin-type lead.

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.

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.

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

Annual Ultrasound Calibration Check

1. Place the transducer to be tested in an Ohmic UPM-30 wattmeter, or equivalent.
2. Set up an ultrasound treatment to activate the transducer at either 1MHz or 3MHz and 100% duty cycle.
3. Increase the intensity to maximum.
4. If the 2cm transducer is being tested, it should be emitting at least 3.2 and no more than 4.8 watts. The 5cm transducer should emit at least 9 and no more than 11 watts. If this is not the case, perform the full calibration procedure listed in the following section.

Crystal Preparation

1. While depressing the Set/Enter and the Stop/Clear buttons simultaneously, turn the system power on to access the factor calibration mode.
2. Clamp the transducer being calibrated into the ultrasound wattmeter.
3. Select one of the transducer and frequency buttons located in the bottom half of the display.
4. If the transducer or portions of the RF Generator have been changed, go through the crystal peaking procedure. Otherwise, skip to step 6 in Crystal Peaking Procedure.

NOTE: Before and after each adjustment is made, the Set/Enter button must be activated.

Crystal Peaking Procedure

1. Select "XDCR" bar and adjust to appropriate head and frequency by rotating the encoder knob.
 2. Select the "VOLTS" bar. Adjust the reading to 10.0 volts.
 3. Select the "FREQ" bar. While observing the wattmeter adjust the frequency setting until the maximum power reading is measured by the watt meter.
 4. Advance the frequency 5 kHz for the 2cm transducer, 10 kHz for the 5cm transducer. Record this setting on the "Calibration Parameters" chart on the following page. (For example, on the 2cm transducer, if the frequency of maximum output is .938MHz then set the frequency to .943MHz. For the 5cm transducer, if the frequency of maximum output is .938MHz then set the frequency to .948MHz.)
 5. Select the "CORR" bar.
 6. While observing the wattmeter, increase the volts setting until the appropriate watt reading is measured. Record this on the "Calibration Parameters" chart.
- NOTE: 4 watts for the 2cm and 10 watts for the 5cm.
7. Repeat the calibration procedure for the remaining transducer and frequency combinations.
 8. After all transducers and frequencies combination have been set, press Stop/Clear to return the unit to treatment mode.

Therasound 2.5 Ultrasound Calibration Parameters

2cm - 1MHz _____ MHz _____ Volts
2cm - 3MHz _____ MHz _____ Volts

5cm - 1MHz _____ MHz _____ Volts
5cm - 3MHz _____ MHz _____ Volts

Cal. at Volts: 10.0 Volts

NOTE: When resetting calibration parameters, the Cal. at Volts setting must be set to 10.0 Volts.

Sterilizing Recommendations

To disinfect the soundhead between therapy treatments, Rich-Mar recommends using TransAll Ultrasound Disinfectant. OSHA addresses the need for prudent infection control (OSHA Instruction CPL 2-2.44C) to include decontamination of equipment between patients.

Trouble-Shooting

Rich-Mar Corporation takes pride in its Technical Support Hotline: 1-800-762-4665. 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 2.5.

1.) A flashing “CAL” signal appears. It is possible that the ultrasound output is irregular. Turn the device on 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 as the transducer may overheat and damage the unit.

For further assistance, please call 1-800-762-4665 and a technical support staff member will help diagnose the problem.

2.) Although this will rarely occur, if the machine seems to “hang up” or if the display seems odd at all, turn the machine off for a moment and then turn on again.

Therasound 2.5 Specifications

Dimensions: 11"W x 9.75"D x 2.75"H

Weight: 10 lbs.

Power Input: 110 VAC, 60Hz or
220 VAC, 50Hz

Output: 0-2 w/cm²

Soundheads

ERA: 2cm² and 5cm²

Frequencies: 1MHz & 3MHz

BNR: 5.5:1 maximum

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.

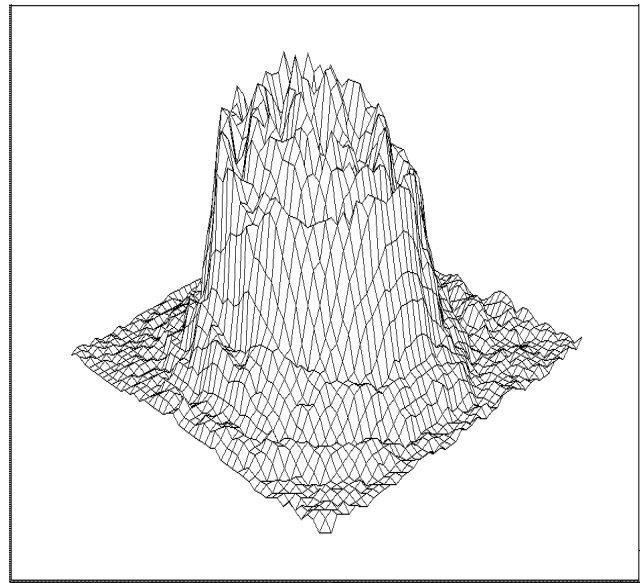
BNR: The Beam Nonuniformity Ratio.

Type: Coll-means collimating applicator.

Near Field/ Far Field

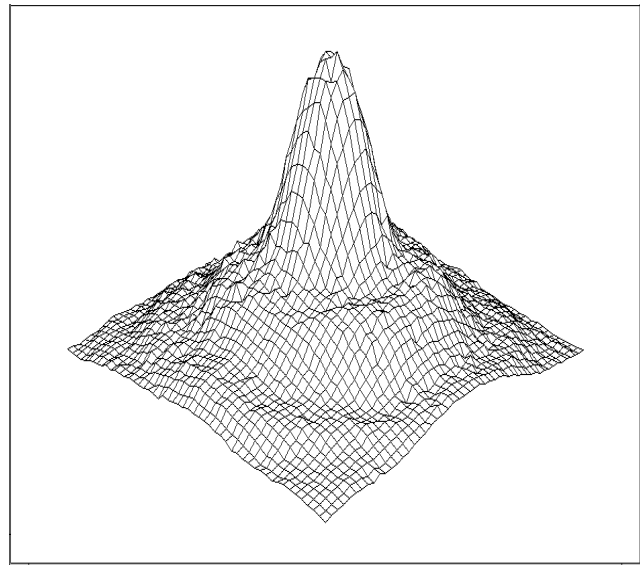
If measurements are made of the sound intensity along the central axis of the beam produced by the applicator, the intensity distribution shows maxima and minima near the applicator and then a gradual decline beyond the last maximum intensity.

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.

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) for 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)	R t p a
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, 5cm² Transducer

Spatial Average = (1.75 Watts)/(5cm²) = 0.35 Watts/cm²

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:

$$\text{Pulse width (On time)} = 2.5\text{mS}$$

$$\text{Off time} = [2.5 - 2.5(\% \text{Duty cycle})] / (\% \text{Duty cycle})$$

Where %Duty cycle is represented as a decimal.

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

$$\text{Off time} = [2.5 - 2.5(0.10)] / (0.10) = 22.5 \text{ milliseconds}$$

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 2.5 Parts List

Reference Designator(s)	Part Name	Description	Qty/Board
(TO-220 HEAT SINK)	DMF-50427	DISPLAY, GRAPHIC, 128x64	1
(TO-220 HEAT SINK)	4880S	4x1/4 SCREW, TAPPING	2
(TO-3 HEAT SINK)	6-32x1/2 MS-PAN-PH SS	MOUNTING KIT, TO220	1
(TO-3 HEAT SINK)	6-FLAT-W. SS	SCREW, MACH PH PAN 6-32 X 1/2, SS	2
(TO-3 HEAT SINK)	6-HEX NUT SS	WASHER, FLAT #6, STAINLESS STEEL	4
(TO-3 HEAT SINK)	6-SPLT-LK-W. SS	NUT, HEX 6-32, STAINLESS STEEL	2
(TO-3 HEAT SINK)	53-03-2	WASHER, LOCK SPLIT #6, STAINLESS STEEL	2
(U1)	6354B-2	INSULATION PAD, T-03, THERMAL-SIL	1
(U10,U13)	2-641599-1	HEAT SINK, TO-3	1
(U11)	821551-1	SOCKET, IC 14 PIN	2
(U2)	2-641600-1	SOCKET, PLCC, 52 PIN	1
(U2,U3,U6)	14R-CBS-1.75x2.25x.4	SOCKET, IC 16 PIN	1
(U3)	HS-PAD-01	BOX, SHIELDING, PCB MOUNT	1
(U3,U4,U8,U15,U16)	2-640463-1	HEAT SINK, GAP PAD, 8-PIN DIP, .125" Thick	1
(U6,U14)	821575-1	SOCKET, IC 8 PIN	5
(U7)	6398B	SOCKET, PLCC, 44 PIN	2
C1	CAP-AL-100uF,63V	HEAT SINK, TO-220, SHORT	1
C12,C36	T322A105K025AS	CAP, AL, 100 uF, 63V, RADIAL, ±20%	1
C19	CAP-CER-120pF,100V	CAP, TANTALUM 1uF, 25V AXIAL, ±10%	2
C2,C14,C7,C18	CAP-AL-22uF,63V	CAP, CERAMIC 120pF, AXIAL, 100V ±5%	1
C22	C410C224M5U5CA	CAP, AL, 22 uF, 63V, RADIAL, ±20%	4
C24	CAP-AL-2200uF,16V	CAP, AL, 2200 uF, 16V, RADIAL, ±20%	1
C25,C26	CAP-AL-1000uF,63V	CAP, AL,1000 uF, 63V, RADIAL, ±20%	2
C27,C28	CAP-AL-1000uF,50V	CAP, AL,1000 uF, 50V, RADIAL, ±20%	2
C3,C5,C9,C10,C11,C13,C20, C21,C23, C29,C30,C32-C34, C37-C41,C43,C45,C31,C35	CAP-CER-0.1uF,50V	CAP, CERAMIC .1uF, AXIAL, 50V ±20%	21
C4,C6,C15,C16	CAP-CER-22pF,100V	CAP, CERAMIC 22pF, AXIAL, 100V ±5%, NPO	2
C42	CAP-CER-0.01uF,50V	CAP, CERAMIC .01uF, AXIAL, 50V ±20%, X7R	4
C44	CAP-CHV-0.47uF,100V	CAP, CERAMIC .47uF, AXIAL, 50V ±20%	1
C7,C8	CAP-AL-220uF,16V	CAP, AL, 220 uF, 16V, RADIAL, ±20%	1
D1,D2,D4	CAP-CHV-0.1uF,100V	CAP, CERAMIC .1uF, AXIAL, 100V ±20%, X7R	2
D3,D5	1N4005	DIODE, 5 AMP 100V	3
D6	11DQ04	DIODE, SCHOTTKY, 60V	2
D7,D12	1N4148	DIODE, SIGNAL	1
D8-D11	LS3360-KN	LED, RED, PCB MOUNT, SMALL	2
	KBU4J	DIODE BRIDGE, FULL WAVE RECTIFIER	4

Therasound 2.5 Parts List, Cont.

Main Board (Part name 2669)		Part Name	Description	Qty/Board
J1-J5	Reference Designator(s)	RL359	JACK, PHONO, 3-PIN, PC-MOUNT	5
P10		640445-2	HEADER, SINGLE ROW 2 PIN, POLARIZED,	1
P2		640454-2	HEADER, SINGLE ROW 2 PIN, POLARIZED, .1	1
P3		RF-WIRE-01	WIRE, RF DECK CONTROL	1
P5		103185-4	HEADER, 1x4 PIN UNSHIELDED, .100	1
P6		640454-4	HEADER, SINGLE ROW 4 PIN, POLARIZED, .1	1
P7		2-103185-0	HEADER, SINGLE ROW 20 PIN	1
P9		640445-4	HEADER, SINGLE ROW 4 PIN, POLARIZED,	1
PCB		RM 4413-168 Rev C	PCB, THERA SOUND 2.5 (was ULTRA MINI)	1
Q1,Q2		VN0104N3	TRANSISTOR, MOSFET, N-CHANNEL,2 Amp	2
R1,R2		RES-MF-806K	RES, MF 806K 1/4W 1%	2
R10		RES-MF-61.9K	RES, MF 61.9K 1/4W 1%	1
R13		RES-MF-200K	RES, MF 200K 1/4W 1%	1
R14		RES-MF-487K	RES, MF 487K 1/4W 1%	1
R15		RES-MF-2.94K	RES, MF 2.94K 1/4W 1%	1
R16,R23,R24,R28		RES-MF-1K	RES, MF 1K 1/4W 1%	4
R17		RES-MF-243	RES, MF 243 1/4W 1%	1
R19		RES-MF-5.62K	RES, MF 5.62K 1/4W 1%	1
R20		RES-MF-1M	RES, MF 1M 1/4W 1%	1
R21		RES-MF-715K	RES, MF 715K 1/4W 1%	1
R22		RES-MF-8.45K	RES, MF 8.45K 1/4W 1%	1
R26		RES-MF-10M	RES, MF 10M 1/4W 1%	1
R3,R12,R25,R27,R29,R31, R34-R37,R39,R40		RES-MF-10K	RES, MF 10K 1/4W 1%	12
R30		RES-MF-402	RES, MF 402 1/4W 1%	1
R38		RES-MF-20K	RES, MF 20K 1/4W 1%	1
R4,R5,R11		RES-MF-100K	RES, MF 100K 1/4W 1%	3
R41-R44		RES-MF-20	RES, MF 20 1/4W 1%	4
R6,R9,R18,R32,R33		RES-MF-4.75K	RES, MF 4.75K 1/4W 1%	5
R7		RES-MF-13.7K	RES, MF 13.7K 1/4W 1%	1
R8		RES-MF-2.1K	RES, MF 2.1K 1/4W 1%	1
RP1,RP3		RESNET-BSIP10-10K	RES, SIP NETWK 10k, BUSSED, 10 PIN	2
RP2		RESNET-BSIP10-1K	RES, SIP NETWK 1k, BUSSED, 10 PIN	1
SP1		AT-40	SPEAKER, 100, .15W, PC-MOUNT	1
T1		CTM32795	TRANSFORMER, CUSTOM,AM-17772	1
T2		CTM33295	TRANSFORMER, PCB	1
U1		LM317HVK	IC, REGULATOR, HIGH VOLTAGE OUTPUT -	1

Therasound 2.5 Parts List, Cont.

Main Board (Part name 2669)

Reference Designator(s)	Part Name	Description	Qty/Board
U10	74HC14-DIP14	IC, INVERTER, SCHMIDT,DIP14	1
U11	MC68HC11E1CFN	IC, μ CONTROLLER, HCMOS,-40/+85°C	1
U12	MC34064P	RESET IC FOR HC11, SO8	1
U13	TLC5620-DIP14	IC, DAC, QUAD 8-BIT SERIAL	1
U14	PSD312-15J	IC, PROGRAM μ C PERIPHERAL, -0/+70° C	1
U15	LF412AACN-DIP8		1
U16	TDA7052A-DIP8	IC, AUDIO AMP, 1W, W/ DC VOL	1
U2	74HC4046-DIP16	IC, VCO/PLL,DIP16	1
U3	EL7212-DIP8	IC, FET DRIVER, DUAL,DIP8	1
U4	OPA445-DIP8	IC, OP AMP, HIGH VOLTAGE,DIP8	1
U5	LM337LZ	IC, REGULATOR, -ADJUSTABLE, TO92	1
U6	PLS11016-60LJ	IC, CPLD, 2000 GATES, 44 PIN, 0/+70° C	1
U7,U9	LM2941T	IC, REGULATOR, ADJUSTABLE OUTPUT	2
U8	TLC2262-DIP8		1
Y1	ATS49-08.000	CRYSTAL, 8.000 MHZ, LO PROFILE	1

Chassis (Part name 0170)

Rich-Mar Part No.	Part Name	Description	Qty/Board
3763		THERASOUND CHASSIS	1
9800	4880-03M-GG	AC CORD	1
3745		NEW STYLE RIGHT BAIL (HAMMER)	1
4804		TS 2.5 FAN	1
4215	4-102978-0	DISPLAY CONNECTOR PINS	.5
3755	2S0055011ASSY	CORD WRAP	1
7801		ON/OFF AC ROCKER SWITCH	1
9114		BLACK STRAIN RELIEF FOR AC CORD	1
4169	AMP 640433-4	4 PIN .156 AMP CONNECTOR (AC SWITCH)	1
4167	AMP 640440-4	4 PIN .1 AMP CONNECTOR (MEMBRANE SWITCH EXTENSION & ENCODER POT)	3
5001	HTB-341	FUSE HOLDER	1
5008		SLOW BLOW 1 AMP	1
9139	RB14-250F	DISCONNECT GROUND STRAP SPADE TERMINALS	2
6522	500EN-206P-C2	ENCODER POT	1
9143	1815H BEAU	DISPLAY MOUNTING HARDWARE	1
4163	AMP 640433-2	2 PIN .156 AM CONNECTOR (AC CORD)	1
4161	AMP 640440-2	2 PIN .1 AMP CONNECTOR (FAN)	1

Therasound 2.5 Parts List, Cont.

Chassis (Part name 0167) Rich-Mar Part No.	Part Name	Description	Qty/Board
9834		RA-RA CABLE ASSEMBLY RF DECK TO MAIN BOARD INTERFACE CABLE	4
5516	6097	PIN JACK (KEYSTONE) COM BINATION JACK	1
5720	PT-3-S	ENCODER KNOB	1
5926	SEIKO G-1216BIN000	DISPLAY	1
9830	WI2039	20 POSITION HARNESS DISPLAY FLAT RIBBON CABLE	1
6345	47-222	THERAMINI 2 PANEL	1
3269	10FNNEZ	10 SELF LOCKING BAIL MOUNTING HARDWARE	2
4130	MTSW-130-11-T-S740	MEMBRANE SWITCH EXTENSION CONNECTOR PINS	.3
3510	SMITH 2182	FEET	4
0727		#2x1/16" SPACER DISPLAY MOUNTING HARDWARE	4
7471	2-004 N-70	O-RING DISPLAY MOUNTING HARDWARE	8
0723	SMITH 8320	MAIN BOARD MOUNTING SPACER	13
9116	NP-07-GY	NUT FOR MS 9115 SOUNDHEAD STRAIN RELIEF	1
7488		HAMMERHEAD W/OUT TRANSDUCERS	1
2669		THERASOUND 2.5 MAIN BOARD	1
2664		7.7 DECK BOARD (1MHZ SIDE)	1
2665		7.7 DECK BOARD (3MHZ SIDE)	1
7402		2cm CRYSTAL & DIAPHRAGM	1
7403		5cm CRYSTAL & DIAPHRAGM	1
9308		STACKED RF DECK	1
1904		16oz. BOTTLE OF LOTION	1
3775		THERASOUND 2.5 PORT COVER	1
7679		THERASOUND FCC LABEL	1
7681		TS 2.5 INTRUC. LABEL (GREEN)	1
7651	T33364	RM LOGO STICKER LABEL	1
7669		HAMMERHEAD SOUNDHEAD LABEL	1
6349		TS 2.5 PANEL LABEL	1
7620		WARNING 1 AMP FUSE LABEL	1
7603		WARNING (T760S) ACCESSORY LABEL	1

APPENDIX C
SCHEMATICS