SONICS.com®
SONICS & MATERIALS, INC.

# ULTRASONIC ATOMIZER

## Part No. VCX134ATA

# OPERATION MANUAL


Rev. 11-21

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# 1. WARRANTY

Your Ultrasonic Processor is warranted and backed by the manufacturer for a period of 3 years from the date of shipment against defects in material and workmanship under normal use as described in this instruction manual. During the warranty period, the manufacturer will, at its option, as the exclusive remedy, either repair or replace without charge for material and labor, the part(s) which prove to be defective, provided the unit is returned to us properly packed with all transportation charges prepaid.

Ultrasonic probes are guaranteed against defects for a period of one year from date of shipment. A defective probe will be replaced once without charge, if failure occurs within the warranty period. Wear resulting from cavitation erosion is a normal consequence of ultrasonic processing, and is not covered by this warranty.

The manufacturer neither assumes nor authorizes any person to assume for it any other obligations or liability in connection with the sale of its products. The manufacturer hereby disclaims any warranty of either merchantability or fitness for a particular purpose. No person or company is authorized to change, modify, or amend the terms of this warranty in any manner or fashion whatsoever. Under no circumstances shall the manufacturer be liable to the purchaser or any other person for any incidental or consequential damages or loss of goodwill, production, or profit resulting from any malfunction or failure of its product.

This warranty does not apply to equipment that has been subject to unauthorized repair, misuse, abuse, negligence or accident. Equipment which, shows evidence of having been used in violation of operating instructions, or which has had the serial number altered or removed, will be ineligible for service under this warranty.

All probes are manufactured to exacting specifications and are tuned to vibrate at a specific frequency. Using an out-of-tune probe will cause damage to the equipment and may result in warranty nullification. The manufacturer assumes no responsibility for probes fabricated by another party or for consequential damages resulting from their usage.

The aforementioned provisions do not extend the original warranty period of any product that has either been repaired or replaced by the manufacturer.

# 2. WARNINGS

**Please read the manual in its entirety. Necessary instruction and guidance are provided to help ensure the successful operation of this device. Observe the following:**

- High voltage is present in the power supply, converter and high frequency cable. There are no user-serviceable parts inside any of these devices. Do NOT attempt to remove the power supply cover or converter case.
- Do NOT touch any open cable connections on the unit while the power is turned ON.
- Do NOT operate power supply with converter disconnected from high voltage cable. High voltage is present in the cable and may pose a shock hazard.
- Do NOT attempt to disconnect the converter high voltage cable while the unit is running.
- The power supply must be properly grounded with a 3-prong plug. Test electrical outlet for proper grounding prior to plugging in unit.
- Install the ultrasonic power supply in an area free from excessive dust, dirt, explosive or corrosive fumes and protected from extremes in temperature and humidity. Do not place the power supply within a Fume Hood.
- NEVER immerse the converter in liquids of any kind, or let condensed moisture or liquid drip into the converter.
- NEVER grasp an activated probe or touch the tip of a vibrating probe. It can cause severe burns and tissue damage.
- NEVER hold or clamp the converter by the front driver or by the probe itself. This can cause permanent damage to the system. Support the converter by only clamping around the converter housing (upper portion).
- Do NOT allow the tip of a vibrating horn or probe to touch the counter top or any other hard surface. It could damage the probe, overload the power supply, or damage the surface.
- Turn OFF the power switch, unplug the power supply and disconnect the power cord from the back of the power supply before attempting to replace the fuses.
- Inspect high frequency cable for cracks in the protective outer jacket.
- Do not operate unit with a damaged cable. Doing so may cause serious injury.
- In case of AC power loss, wait 3 minutes minimum before reapplying power.
- Do not turn off Main power switch while running a probe. Stop sonication only by using the START/STOP key
- Never operate the power supply unless it is connected to the converter.
- Never secure anything to the probe.
- Never allow an atomizing probe to vibrate in air for more than 10 seconds without liquid flowing through it.

**Symbols**


Caution, Risk of electric shock, Hazardous voltage.


Caution, Risk of danger. Refer to User Manual.

# 3. SPECIFICATIONS

| **Power Supply** | | |
|---|---|---|
| Input Voltage | 100 VAC – 132 VAC @ 50/60 Hz | 198 VAC – 264 VAC @ 50/60 Hz |
| Rated Current | 2.4 Amps max. | 1.2 Amps max. |
| Fuse Rating | 3 Amps Slow Blow | 1.6 Amps Slow Blow |
| Weight | 10 lbs. (4.5 Kg) | |
| Dimensions | 9.75” W x13" L x 4.75" H<br>248mm x 330mm x 121mm | |
| Output Frequency | 40 KHz | |

| **Converter (CV249)** | |
|---|---|
| Weight | 0.75 lbs. (0.34Kg) |
| Dimensions | 4.75" L x 1.25" Dia.<br>(12.0cm x 3.1cm) |
| Cable | 5 ft. |
| Materials | Aluminum Alloy |

| **Environmental** | |
|---|---|
| Pollution Degree | 2 |
| Installation Category | II |
| Operating Limits<br><br><br><br>Shipping/Storage | Temperature: 41 - 104ºF (5 - 40ºC)<br>Relative Humidity 10 - 95% (Non Condensing)<br>Altitude: 6,651 ft. (2000 m)<br><br>Temperature: 35 -120 ºF (2 - 49 ºC)<br>Relative Humidity 10 - 95% (Non Condensing)<br>Ambient Pressure Extremes: 40,000 ft. (12,192 m) |
| Restriction of Hazardous Substances (ROHS) | RoHS Compliant Directive 2002/95/EC |
| Relative humidity | Maximum relative humidity 80% for temperatures up to 31ºC decreasing linearly to 50% relative humidity to 40ºC |
| Other | For indoor use only |

**The Power Cord supplied with the ultrasonic processor must be used**. If the 220V plug is not configured to match the wall receptacle, a properly grounded universal AC socket adapter must be added.

Important: Universal adapters do not convert voltage or frequency. Manufacturer is not responsible for damage caused by the use of an improper power cord or adapter. Transformers are not recommended.

**WEEE Statement**

This product contains electrical or electronic materials. The presence of these materials may, if not disposed of properly, have potential adverse effects on the environment and human health. Presence of this label on the product means it should not be disposed of as unsorted waste and must be collected separately. As a consumer, you are responsible for ensuring that this product is disposed of properly. To find out how to properly dispose of this product contact Customer Service.

# 4. PRINCIPLES OF OPERATION

The ultrasonic power supply transforms AC line power to a 20 KHz signal that drives a piezoelectric converter/transducer. This electrical signal is converted by the transducer to a mechanical vibration due to the characteristics of the internal piezoelectric crystals.

The vibration is amplified and transmitted down the length of the horn/probe where the tip longitudinally expands and contracts. The distance the tip travels is dependent on the amplitude selected by the user through the keypad.

The ultrasonic vibrations are intensified by the probe and focused at the tip where the atomization takes place. The liquid travels through the converter and the probe, and spreads out as a thin film on the atomizing surface of the probe. The oscillating probe tip disintegrates the liquid into micro-droplets, and ejects them to form a gentle, low velocity spray.

Unlike conventional atomizing nozzles that rely on pressure and high velocity motion to shear a fluid into small drops, the ultrasonic atomizer uses only low ultrasonic vibrational energy for atomization. The liquid can be dispensed to the atomizing probe (nozzle) by either gravity or a small low-pressure metering pump, and atomize continuously or intermittently. The rate at which the liquid is atomized depends, within limits, solely on the volume that is being delivered onto the atomizing surface, and the frequency. The amount of material atomized can be as little as 2 µl/sec.

A wide variety of coatings, chemicals, lubricants, and particulate suspensions can readily be atomized. However, factors such as viscosity, miscibility, and solid content deserve consideration. For optimum atomization, the viscosity should be under 500 cps and the solid concentration kept below 30%. Because the atomization process depends on setting a liquid film into motion, typically the higher the viscosity – the lower the flow rate, and the more difficult the application. The atomization of liquids containing long-chained polymer molecules is problematic, even in diluted form, due to the highly cohesive nature of the material. In many cases, mixtures with particulates can be atomized, because the solids are simply carried along in the drops. The low transport velocity of the liquid through the probe permits even abrasive slurries to be processed with negligible erosion of the passageway. Compared with conventional pressurized nozzles, the feed channel running through the probe and exit orifice are relatively large, and practically impossible to clog.

Drop size is primarily a function of frequency, and the higher the frequency, the smaller the drop diameter. The median drop size at 40 kHz is 50 microns. Atomizing probes are one-half wavelength long tools that act as mechanical transformers to increase the amplitude of vibration generated by the converter. They are fabricated from high grade titanium alloy Ti-6Al-4V because of its high tensile strength, good acoustical properties at ultrasonic frequencies, high resistance to corrosion, low toxicity, and excellent resistance to cavitation erosion.

## 5. OPERATING SUGGESTIONS

The liquid to be atomized flows through the entire converter, via a barbed port on the back of the converter, and then the connected probe. It is recommended that plastic tubing chemically compatible with the liquid to be atomized be used to connect the liquid delivery system to the converter. Because soft tubing can easily expand and contract, making it difficult to accurately control the flow of the liquid in critical applications, tubing elasticity should be given consideration in intermittent applications where the flow will be rapidly interrupted. When the atomized volume is critical, it can be beneficial to reverse the pump flow to prevent any overspray.

Delivery systems such as valve-less metering pumps, syringe pumps or gear pumps are best suited for atomization because their dispensation is steady and uniform. Valve-less metering pumps and syringe pumps are recommended for critical applications. Peristaltic and piston pumps produce a pulsating flow which is detrimental for many atomizing applications. They can however give satisfactory performance when used in conjunction with pulse dampening devices. Gravity feed systems could be considered for non-critical applications. Pressure reducing regulators should be used when working with high pressure delivery systems.

Optimum atomization can only be obtained by empirically adjusting the amplitude and flow rate. Typically the greater the flow rate, the greater the amplitude required. However, consideration should be given not to set the amplitude too high in order to prevent uneven atomization and probe cavitation. With very small volumes, a point is reached where the flow rate is so low that inconsistent erratic atomization will take place.

Always energize the ultrasonics before starting the flow of liquid, and always terminate the liquid flow prior to de-energizing the ultrasonics. Keeping the probe energized for more than 10 seconds without liquid flowing through it will cause the probe to overheat, adversely affecting the atomizing process. When it is necessary to atomize a liquid intermittently, it is best to keep the ultrasonics on, and cycle on and off the liquid flow to the probe.

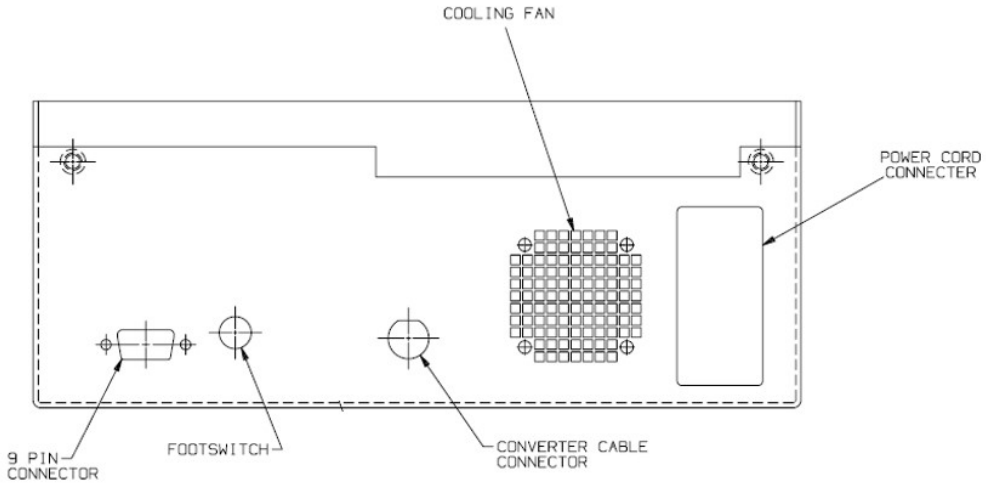
Because the droplets typically drift downward at low velocity under the influence of gravity, the probe should be mounted with tip facing downward, and air disturbances kept to a minimum.

Do not operate the probe when the ambient temperature or temperature of the liquid exceeds 140°F (60° C).

# 6. DESCRIPTIONS OF COMPONENTS / FUNCTIONS OF CONTROLS

## 6.1. VCX134ATA FRONT PANEL


## 6.2. VCX134ATA REAR PANEL



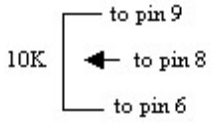
## 6.3. FUNCTIONS OF KEYS CONTROLS AND CONNECTORS

| FRONT PANEL | |
|---|---|
| LCD display | Displays prompts and the following control parameters:<br>• Amplitude selected<br>• Amount of output power delivered to the probe in watts, and as a percentage of 130 watts.<br>• Accumulated amount of energy in Joules delivered to the probe. |
| CLEAR key | Clears the preceding entry. |
| ENTER REVIEW key | Used to enter the amplitude selected, and view amplitude, power, and energy |
| START/STOP key | Starts or stops the ultrasonics. In the STOP mode, the red indicator goes off. |
| **I** key | Switches the main power on. |
| **0** key | Switches the main power off. |
| AMPL | Controls the amplitude of vibration at the probe tip. |
| ▲ ▼ key | Used with the AMPL key when the unit is on stand-by to set the amplitude of vibration at the probe tip. Also used to increase or decrease the amplitude in small increments while the unit is running. To accomplish this task, depress the ENTER/REVIEW key twice to display AMPLITUDE CONTROL, then depress the ▲ or ▼ key as required. |
| **REAR PANEL** | |
| 9 pin D-sub analog output connector (IO Port) | Connects to external actuation device, and enable power and frequency monitoring. |
| Footswitch Connector | Connects to the footswitch cable. |
| Converter Cable Connector (Output) | Connects to the converter. |
| Power Supply Connector | Connects to the electrical line cord and encases the fuse(s). |

**9-PIN D-SUB CONNECTOR**

| Pin No. | Description |
|---|---|
| 1 | Not connected |
| 2 | Not connected |
| 3 | Not connected |
| 4 | Enables connection to a frequency counter. |
| 5 | Enables connection to external power monitor (5 mv = 1 watt) |
| 6 | Ground |
| 7 | Energizes the ultrasonics when connected to ground. |
| 8 and 9 | Enables the intensity to be remotely adjusted using an external 10k potentiometer. |

*NOTE: To vary the intensity remotely using a variable DC power supply (0-5V) instead of a 10 K potentiometer, connect positive to pin 8 and negative to pin 6.*



## 6.4. CONVERTER CLAMPING

Improper clamping can damage the system and void the warranty.

**Proper Clamping**

**Improper Clamping**

## 6.5. ATOMIZER PROBES

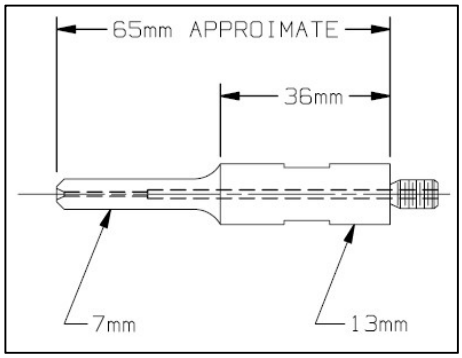



***Figure 1** - 630-0667 Narrow Spray (Up to 30 ml/min)*

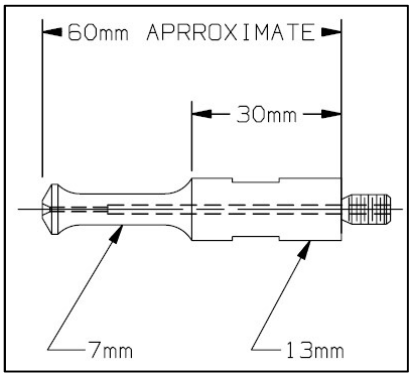



***Figure 2** - 630-0668 Wide Spray (Up to 50 ml/min)*

Probe(s) are not included and must be ordered separately.

# 7. PREPARATION FOR USE

## INSPECTION

Prior to installing the Ultrasonic Processor, perform a visual inspection to detect any evidence of damage which might have occurred during shipment. Before disposing of any packaging material, check it carefully for small items.

The Ultrasonic Processor was carefully packed and thoroughly inspected before leaving our factory. The carrier, upon acceptance of the shipment, assumed responsibility for its safe delivery. Claims for loss or damage sustained in transit must be submitted to the carrier.

If damage has occurred, contact your carrier within 48 hours of the delivery date. DO NOT OPERATE DAMAGED EQUIPMENT. Retain all packing materials for future shipment.

## ELECTRICAL REQUIREMENTS

The Ultrasonic Processor requires a fused, single phase 3-terminal grounding type electrical outlet capable of supplying 50/60 Hz at 100 volts, 115 volts, 220 volts, or 240 volts, depending on the voltage option selected. For power requirements, check the label on the back of the unit.

**WARNING**

For your personal safety, do not, under any circumstances, defeat the grounding feature of the power cord by removing the grounding prong.

## INSTALLING THE ULTRASONIC PROCESSOR

The Ultrasonic Processor should be installed in an area that is free from excessive dust, dirt, explosive and corrosive fumes, and extremes of temperature and humidity. If processing flammable liquids use an approved fume hood and do not place the power supply in the fume hood.

When positioning the unit, be sure to leave adequate space behind the unit so that all connections can be easily disconnected.

# 8. OPERATING INSTRUCTIONS

## 8.1. CAUTION

- Do not operate the power supply unless it is connected to the converter.
- Do not allow the vibrating probe to contact any object.
- Never place a washer between the probe and the converter.
- Never apply grease to the mating surfaces or threads of the converter or probe.
- Should it become necessary to remove a probe, use the wrenches supplied. Never attempt to remove the probe by twisting the converter housing, as this may damage the electrical connections within the housing.

***Note:*** *The temperature of the converter front area (where the probe/horn attaches) should never exceed* ***60°C (140°F)****. If this temperature is reached, shut the system off and allow to cool.*

## 8.2. SETUP

1. Plug the electrical line cord into the electrical outlet. If the unit is already on, as indicated if the display lights up, depress the **O** key.

2. If the optional foot switch is used, insert the plug into the jack located on the rear panel.

3. Probes must be properly tightened. If the converter and probe assembly is not already assembled; screw the probe onto the converter and using the wrenches provided and tighten securely. Check the tightness of an already assembled probe by using the wrench set. Please refer to images in the Maintenance section of this manual for tightening instructions. A loose probe may cause damage to the power supply circuitry or parts of the converter and probe. Always use the wrenches supplied with the unit.

4. Connect the converter cable to the power supply.

## 8.3. OPERATION

Press the **I** key. The screen will display the power rating of the Ultrasonic Processor and the following control parameters.


**AMPLITUDE:** Desired amplitude must be set in order for the Ultrasonic Processor to be operational. AMPL displays the amplitude selected (e.g. 40%). To set the amplitude at 40% when the ultrasonics is off, press the AMPL key and the up and down arrow keys for a 40% reading on the screen, and then press the ENTER/REVIEW key.

Note: The minimum amplitude setting is 20%.

The screen will display:

| Time - : --: -- |
|---|

*NOTE: To clear an incorrect entry press the CLEAR key.*

1. The Ultrasonic Processor is now ready for continuous operation. To energize the ultrasonics, press the START key or the footswitch. To de-energize the ultrasonics, press the STOP key or release the footswitch. If the Time or Pulse functions must be used, refer to the appropriate paragraphs below.

   ***Note**: The START key and footswitch are mutually exclusive. If the process is initiated by the START key, the footswitch becomes inoperative. If the process is initiated by the footswitch, the STOP key becomes inoperative.*

2. To increase or decrease the amplitude in small increments when the ultrasonics is on, depress the AMPL to display Amplitude Setting on the screen, then depress the ▲ or ▼ key, as required. Since the amplitude required is application dependent and subject to the volume and composition of the sample, it is recommended that the amplitude be selected through experimentation, by increasing or decreasing the level of intensity as needed to properly process the sample to achieve desired results.

3. Once ultrasonics have been turned on, turn on your liquid source or pump.

**REVIEW:** The REVIEW function provides a "window" on the process by displaying various operating parameters without process interruption. Pressing the ENTER/REVIEW key repeatedly during processing will consecutively display the following information.

a) Selected amplitude:
   e.g. Amplitude 40%

b) Amount of power in watts and accumulated amount of energy in JOULES delivered to the probe. (Note: *The amount of energy displayed will be only for one cycle. Initiating a new cycle will reset the display to zero.)*
   e.g. 20 watts 0000000 Joules

c) Elapsed time since processing was initiated:
   e.g. Elapsed time 0:05:00

# 9. MAINTENANCE

It is recommended to periodically inspect the unit, both visually and physically, to ensure optimum and safe performance. This inspection should be scheduled as a routine maintenance procedure, done with the unit power OFF and with the unit unplugged from the AC power source.

Long exposure to acids or caustics results in corrosion of metal parts or components. Check the power supply, converter, and cables periodically for any signs of rust or discoloration. If discoloration is found, move the unit away from the source of the contaminant.

Examine the condition of the high voltage cable that attaches the converter to the power supply. Inspect the wire insulation for damage, such as wear, burning from hot plate contact or breakage from extended use or rough handling. In general use, the cable assembly should not be used to carry the converter or pull it toward the user. Make certain the cable always has slack and is never tensioned. If necessary, move the power supply or converter assembly closer to one another to accomplish this. **WARNING: Do not use a cable with broken end connections, exposed wires or frayed insulation. High voltage is present in the cable and will pose a shock hazard. Do not touch the converter assembly until the power switch is off and the unit is unplugged.**

## 9.1. PROBE MAINTENANCE

Ultrasonic processors create high intensity vibration which puts stress on the converter and probe assembly. The sides or end of the probe must not touch any objects or surfaces.

Proper care of the probe is essential for dependable operation.

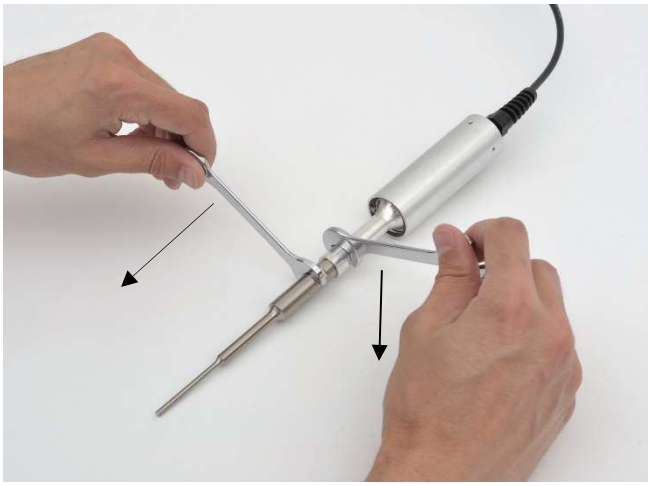
**Note:** *A loose probe will usually generate a loud piercing or squealing sound.*

For that reason, **it is recommended that a preventative maintenance schedule be adopted to examine the unit at regular intervals.** The schedule should depend on frequency of use. Weekly maintenance schedules are recommended for units used frequently or monthly for those used infrequently. Ensure that the threaded connection is clean and attached properly to the converter. Use a cotton swab and alcohol (i.e. ethanol, isopropyl, etc.) to clean the threaded mating surfaces.

**WARNING:** Probes must be properly tightened with the appropriate Wrench Set.

## 9.2. ATTACHING AND DETACHING PROBES

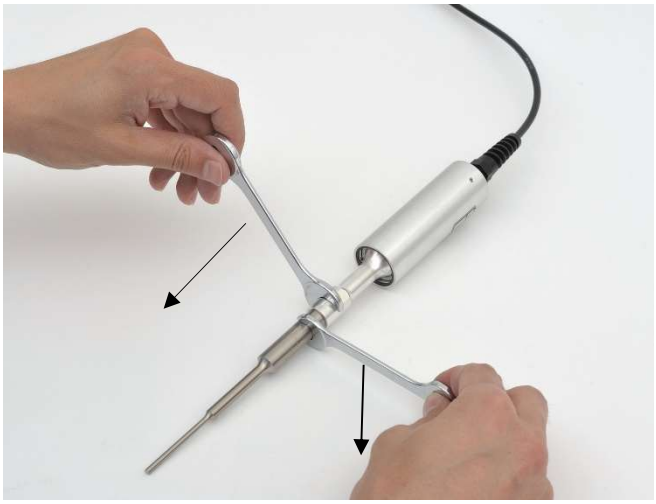
1. Disconnect probe from converter. Use the wrench set provided with the system.



2. Clean threaded stud. Use alcohol and a cotton swab to remove any debris on the threading of the connecting stud. Allow the alcohol to dry completely.

3. Clean threading in converter. Use alcohol and a cotton swab to remove any debris on the threading. Do not allow liquid to drip into converter. Allow the alcohol to dry completely.

4. Re-attach probe to converter. Screw the probe back onto the converter and tighten with the wrench set provided.



### 9.3. SYSTEM CLEANING INSTRUCTIONS

The power supply and converter may be cleaned using an acid-free cleaning solution (i.e. glass cleaner).

Probes should be cleaned using isopropyl alcohol. Probes are made from titanium and can be autoclaved. (The converter is an electrical part and cannot be sterilized in this manner). Before each procedure, place the probe tip in water or alcohol and turn the power on for a few seconds to remove residue. The tip also can be sterilized using alcohol with the power on.

## 10. TROUBLESHOOTING

The most probable causes for malfunction are listed below and should be investigated.

- A connector or cable is damaged.
- The unit was plugged into an electrical outlet that provides a different voltage from that required. See *Electrical Requirements.*
- The probe is not tightened properly with the wrenches provided.
- The converter and/or probe has been dropped.
- A probe being operated is damaged.
- A fuse(s) has failed. If a fuse(s) has failed, proceed as follows:

    1. Turn the unit off by depressing the **O** key, and disconnect the line cord from the electrical outlet.
    2. Open the fuse holder cover using a small screwdriver, and pull out the red fuse holder from its housing.
    3. Replace the fuse(s).
    4. Reconnect the line cord to the electrical outlet, press the **I** key and set the amplitude to 100. With the probe in air and no liquid flowing through it, the wattmeter should read below 10 watts. If the reading exceeds 10 watts, press the **O** key, and disconnect the probe from the converter.

**OVERLOAD CONDITION**

If the Ultrasonic Processor stops working, and an OVERLOAD indication is displayed on the screen, check for possible causes as outlined in the above paragraph, then press the **O** key to switch the unit off, and the **I** key to switch the unit back on.

***If the problem persists after inspecting all of these, please contact Customer Service for additional assistance or to replace a damaged part.***

## 11. RETURN OF EQUIPMENT

It is suggested that an Ultrasonic Processor in need of repair be sent back to the factory.

In order to receive prompt service, contact your Customer Service Representative before returning any instrument.

**You must obtain a Return Authorization Number (RMA) prior to returning the instrument.**

Care should be exercised to provide adequate packing to insure against possible damage in shipment. The Ultrasonic Processor should be sent to the address below with all transportation charges prepaid and return of shipment indicated.

RMA # -------
Sonics & Materials, Inc.
53 Church Hill Road
Newtown, CT 06470  USA

**Important**
The user must certify that the ultrasonic processor and/or the accessories returned for repair are free of any biohazardous or radioactive material and are safe for handling. Please complete the "Safety Certification" form on the next page and send it in with your equipment.

***Do not return any equipment unless such a certification can be made.***

## 12. SAFETY CERTIFICATION FORM

Items being returned:

_____

_____

_____

_____

_____

Please check only one item below:

___ The equipment was never used or exposed to any radiological, biological or chemical agents and is safe to handle, use or dispose of.

___ The equipment was used but not in conjunction with or exposed to any radiological, geological or chemical agents and is safe to handle, use, or dispose of.

___The equipment was used in conjunction with or exposed to radiological, biological, or chemical agents and has been decontaminated, rendering it safer for handling, use, or disposal.

**Authorization**
By accepting authorization to return the equipment listed above, the undersigned assumes all responsibility and liability for radiological, biological and chemical decontamination. Delivery of the equipment can be refused if necessary documentation is not provided or where it is determined that the equipment has not been properly decontaminated. If it is determined that the equipment was not properly decontaminated, the Authorized Repair Facility reserves the right to bill the customer for any and all costs associated with the decontamination and/or appropriate disposal of the equipment. In the event the equipment has been exposed to radiological contamination, the signature of the Radioactive Safety Officer is required.

Print name: _____ RMA # _____

Signature: _____ Date: _____