



SONICS.com[®]
SONICS & MATERIALS, INC.

ULTRASONIC PROCESSOR

Part No. VC505

OPERATION MANUAL



Sonics & Materials, Inc.
53 Church Hill Road
Newtown, CT 06470 USA
Phone: 203.270.4600
info@sonics.com
www.sonics.com

TABLE OF CONTENTS

| | |
|--|-----------|
| 1. WARRANTY | 3 |
| 2. WARNINGS | 4 |
| 3. SPECIFICATIONS | 5 |
| 4. PRINCIPLES OF OPERATION | 7 |
| 5. DESCRIPTIONS OF COMPONENTS / FUNCTIONS OF CONTROLS | 9 |
| 5.1. VC505 FRONT PANEL | 9 |
| 5.2. VC505 REAR PANEL | 9 |
| 5.3. FUNCTIONS OF KEYS CONTROLS & CONNECTORS | 10 |
| 5.4. CONVERTER CLAMPING | 12 |
| 6. PREPARATION FOR USE | 13 |
| 7. OPERATING INSTRUCTIONS | 14 |
| 7.1. CAUTION | 14 |
| 7.2. SETUP | 15 |
| 7.3. OPERATION | 16 |
| 8. TECHNIQUES FOR OPTIMIZING RESULTS | 19 |
| 9. MAINTENANCE | 21 |
| 9.1. PROBE MAINTENANCE | 21 |
| 9.2. ATTACHING AND DETACHING PROBES AND MICROTIPS | 22 |
| 9.3. SYSTEM CLEANING INSTRUCTIONS | 23 |
| 10. TROUBLESHOOTING | 24 |
| 10.1.OVERLOAD CONDITION | 24 |
| 11. RETURN OF EQUIPMENT | 25 |
| 11.1.SAFETY CERTIFICATION FORM | 26 |
| 12. CONVERTER COOLING | 27 |

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. (See page 5 for specifications.) Do not place the power supply within a Fume Hood.
- Hearing protection is highly recommended. It is recommended that a sound abating enclosure or ear protection be used when operating the Ultrasonic Processor
- 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 allow a horn/probe to vibrate in air.
- 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.
- Avoid touching the bottom or sides of a sample vessel with an activated probe. It may crack or shatter the glass or melt the plastic. Use glassware that is free from cracks or chips.
- 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 ultrasonic processing only by using the START/STOP key.

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 | 10 Amps max. 6.3 Amps max. |
| Fuse Rating | 12 Amps Slow Blow 6.3 Amps Slow Blow |
| Weight | 16 lbs. (6.8 Kg) |
| Dimensions | 8"W x 15.25"L x 8.5"H 203 mm x 387 mm x 216 mm |
| Output Voltage | 1000 VRMS (max.) |
| Output Frequency | 20 kHz |

| Converter | |
|------------------|---|
| Weight | 2 lbs. (900 g) |
| Dimensions | 7.25" L x 2.5" Dia. (183 mm x 63.5 mm) |
| Materials | Aluminum Alloy |

| Standard ½" Horn | |
|-------------------------|---|
| Weight | 0.75 lbs. (340 g) |
| Dimensions | 5.375" L x .5" Dia. (136 mm x 13 mm) |
| Materials | Titanium Alloy |

| Environmental | |
|--|--|
| Pollution Degree | 2 |
| Installation Category | II |
| Operating Limits | Temperature: 41 - 104°F (5 - 40°C) Relative Humidity 10 - 95% (Non Condensing) Altitude: 6,651 ft. (2000 m) |
| Shipping/Storage | Temperature: 35 -120 °F (2 - 49 °C) Relative Humidity 10 - 95% (Non Condensing) Ambient Pressure Extremes: 40,000 ft. (12,192 m) |
| Restriction of Hazardous Substances (ROHS) |  |
| Relative humidity | Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity to 40°C |
| 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. As you increase the amplitude setting the ultrasonic processing intensity will increase within your sample.

In liquid, the rapid vibration of the tip causes cavitation - the formation and violent collapse of microscopic bubbles. The collapse of thousands of cavitation bubbles releases tremendous energy in the cavitation field. The erosion and shock effect of the collapse of the cavitation bubble is the primary mechanism of fluid processing.

The probe tip diameter dictates the amount of sample that can be effectively processed. Probes with smaller tip diameters deliver high intensity ultrasonic processing, but the energy is focused within a small, concentrated area. Larger tip diameters can process larger volumes, but offer lower intensity.

The choices of a power supply and horns/probes are matched to the volume, viscosity and other parameters of the particular application. Horns/probes are available for both direct and indirect ultrasonic processing. The frequently asked questions (FAQ) section has more information on this subject.

Please consult with a product specialist for assistance with selecting a probe for your application.

Relationship of Amplitude and Wattage

Ultrasonic processing power is measured in watts. Amplitude is a measurement of the excursion of the tip of the probe (probe is also known as a horn).

Some ultrasonic processors have a wattage display. During operation, the wattage displayed is the energy required to drive the radiating face of a probe, at that specific amplitude setting against a specific load, at that particular moment. For example, the unit experiences a higher load when processing viscous samples than when compared to aqueous samples.

The speed/cruise control on an automobile, can, to a certain extent, be compared to an ultrasonic processor. The speed/cruise control is designed to ensure that the vehicle maintains a constant rate of travel. As the terrain elevations change, so do the power requirements. The cruise control senses these requirements and automatically adjusts the amount of power delivered by the engine in order to compensate for these ever changing conditions. The greater the terrain rate of incline and greater the resistance to the movement of the vehicle, the greater the amount of power that will be delivered by the engine to overcome that resistance and maintain a constant speed.

The ultrasonic processor was designed to deliver constant amplitude to your liquid sample regardless of these changes in load (much like the vehicle's cruise control described above). As a liquid is processed, the load on the probe will vary due to changes in the liquid sample (i.e.

viscosity, concentration, temperature, etc.). As the resistance to the movement of the probe increases (increased load on the probe), additional power will be delivered by the power supply to ensure that the excursion at the probe tip remains constant. The displayed wattage readings will vary as the load changes; however, the amplitude will remain the same.

The resistance to the movement of the probe determines how much power will be delivered to maintain amplitude. For example, a ½" probe at 100% amplitude will require approximately 5 watts to operate in air. The amplitude of this probe is approximately 120um. Insert the probe in water and the wattage reading will increase to approximately 90 watts. The wattage required to operate the probe will increase as the load increases but the amplitude remains the same.

The amplitude control allows the ultrasonic vibrations at the probe tip to be set to any desired level. Although the degree of cavitation/ultrasonic energy required to process the sample can readily be determined by visual observation, the amount of power required cannot be predetermined. A sensing network continuously monitors the output requirements, and automatically adjusts the power to maintain the amplitude at the preselected level. The greater the resistance to the movement of the probe due to higher viscosity, deeper immersion of the probe into the sample, larger probe diameter or higher pressure, the greater the amount of power that will be delivered to the probe. Setting the amplitude control to its maximum will not cause the maximum power rating of the unit to be delivered to the sample. The maximum power that the Processor is capable of delivering will only be delivered when the resistance to the movement of the probe is high enough to draw maximum wattage.

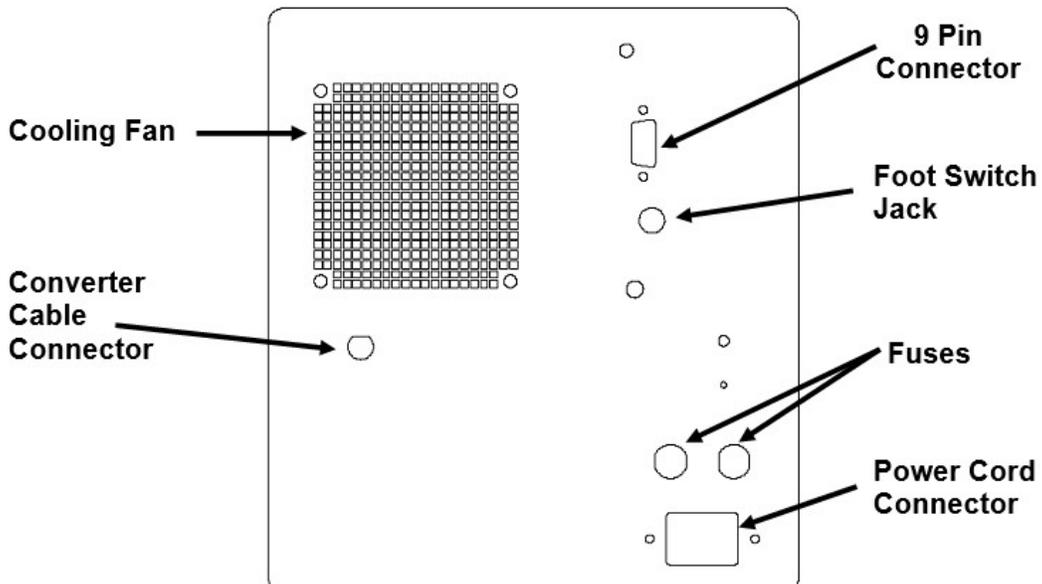
It is the intensity of cavitation that measures the effectiveness of the ultrasonic processing not the total power applied to the system. Intensity is directly related to the amplitude of the radiating face of the tip or probe. It is amplitude that must be provided, maintained, and monitored. The unit provides controlled amplitude under varying load conditions in order to give reproducible results.

5. DESCRIPTIONS OF COMPONENTS / FUNCTIONS OF CONTROLS

5.1. VC505 FRONT PANEL



5.2. VC505 REAR PANEL

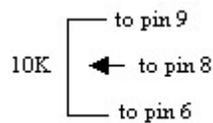


5.3. FUNCTIONS OF KEYS CONTROLS AND CONNECTORS

| FRONT PANEL | |
|--------------------------------------|---|
| LCD display | <p>Displays prompts and control parameters including:</p> <ul style="list-style-type: none"> • Amplitude selected • Output power delivered to the probe in watts • Selected duration of processing • Actual processing time • Elapsed time • Pulse on/off duration • Accumulated amount of energy in Joules delivered to the probe |
| 0 – 9 key | Input digits. |
| CLEAR key | Clears the preceding entry. |
| ENTER REVIEW key | Enters data into the program and selects various parameters for display on the LCD display |
| TIMER key | Used with the numeric keys to set the duration of ultrasonic application – from 1 second to 9 hours, 59 minutes, 59 seconds. |
| PULSER key | Used with the numeric keys to set the pulse mode. The ON cycle and OFF cycle can be set independently from 1 second to 59 seconds. Red indicator lights when pulser is in the OFF portion of the cycle. |
| START/STOP key | Starts or stops 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 connector (IO Port) | Connects to external actuation device and enables power and frequency monitoring. |
| Footswitch Connector | Connects to the footswitch cable. |
| 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 an 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.



5.4. CONVERTER CLAMPING

Improper clamping can damage the system and void the warranty. Using a sound enclosure (part #830-00427) or stand (part #830-00459) will ensure a proper fit.



Proper Clamping



Improper Clamping



Sound Enclosure 830-00427



Stand & Clamp 830-00459

6. 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.

7. OPERATING INSTRUCTIONS

7.1. CAUTION

- Do not operate the power supply unless it is connected to the converter.
- Never allow liquid to spill into the converter.
- Do not allow a microtip to vibrate in air for more than 10 seconds.
- Do not allow the vibrating microtip to contact anything but the sample.
- Never place a washer between the probe and the converter.
- Never apply grease to the mating surfaces or threads of the converter or microtip.
- 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.
- Overheating will damage the converter. If continuous operation for more than 15 minutes is required, see Section 12 for converter cooling instructions.
- The converter should remain near room temperature at all times. The sample liquid temperature should not exceed **60°C (140°F)**. If either of these temperature limits are reached, shut the system off and allow it to cool.
- Replaceable tip probes (1/2" – 1" diameter) are made for use with water based samples only. If the liquid being processed is an organic solvent or any liquid with a lower surface tension than water, always use a solid tip probe. Solid tips can be used with any type of liquid.



7.2. SETUP

1. Connect the power cord into the receptacle on the rear of the ultrasonic processor.
2. Make sure the unit is switched off. Plug the electrical line cord into the electrical outlet.
3. If the optional foot switch is used, insert the plug into the jack located on the rear panel.
4. **For best results, it is critical to use the appropriate size and type of accessory to process your sample.** If you are not sure that you have the proper probe for your sample volume, please refer to the product brochure or call for assistance.
5. **Horns/Probes must be properly tightened.** Depending on the accessories purchased, often the probe and the flat tip are attached to the converter at the factory. **Check the tightness of the probe and flat tip by using the wrench set.** Please refer to images in the Maintenance section of this manual. A loose probe or tip may cause damage to the power supply circuitry or parts of the converter and probe. A loose probe may also show a fluctuation in wattage readings. **Always use the wrenches supplied with the unit.**
6. If you will be using a microtip or extender, remove the flat tip on the end of the replaceable tip probe, then attach the microtip or extender in its place.
7. **Microtips must be used in pulse mode to prevent overheating** - which could potentially crack the tip. See page 16 for Microtip Limits and contact us with questions.
8. Horns and probe tips wear after normal usage. Using a severely worn probe tip can damage internal power supply components.
9. If using a laboratory stand, mount the converter /probe assembly using a clamp. Be sure to secure the clamp to the upper section of the converter housing only. Never secure the clamp to any other portion of the converter/probe assembly. If you are using an acoustic enclosure mount the converter properly in the converter collar.
10. Connect the converter cable to the power supply and then to the top of the converter. Push the connectors in and turn the chrome rings clockwise $\frac{1}{4}$ turn to secure the connectors.
11. If the application requires long processing times, we recommended chilling the sample and pulsing processing. If processing for over 15 minutes, the converter may get warm and require cooling with dry, compressed air. **See converter cooling instructions in the Section 12.**

7.3. OPERATION

START UP: Press the **ON** key. The screen will display the power rating of the Ultrasonic Processor and the following control parameters.

| | |
|-----------------|-----------|
| Time - : --: -- | |
| Pulse -- -- | Ampl -- % |

AMPLITUDE: Desired amplitude must be set in order for the Ultrasonic Processor to be operational. The other control parameters – Time and Pulse - do not have to be set for continuous operation. **AMPL** displays the percentage of amplitude that was previously selected. To set the amplitude at 40%, when the ultrasonics is off, press the **AMPL** key and the numeric keys for a 40% reading on the screen, and then press the **ENTER/REVIEW** key. (*Pressing the **AMPL** key and the **▲** or **▼** key for a reading of 40% and then pressing the **ENTER/REVIEW** key, will also achieve the same result.*)

Note: The minimum amplitude setting is 20%.

The screen will display:

| | |
|-----------------|-----------|
| Time - : --: -- | |
| Pulse -- -- | Ampl 40 % |

WARNING

Microtip Amplitude Setting Limits

When working with a microtip, do not operate the equipment beyond the maximum amplitude limits listed below. **Ignoring this caution will void the tip warranty.**

| | <u>Size</u> | <u>Maximum Amplitude</u> |
|-------------------|-------------|--------------------------|
| Tapered Microtip: | 1/16" (2mm) | 40% |
| | 1/8" (3mm) | 40% |
| | 1/4" (6mm) | 75% |

1. Immerse the probe approximately halfway into the sample. If the probe is immersed to an insufficient depth, air will be injected into the sample causing the sample to foam. Also ensure that the probe tip is not touching the wall of the sample vessel.
2. 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.*

3. 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.
4. Be sure to use the fittings provided, for the top of the Converter, for air cooling if necessary. Circulate clean dry compressed air through the Converter to cool the Converter during use. See manual addendum for more information.

TIMER: In the pulsed mode, the processing time will be different from the elapsed time because the processing time function monitors and controls only the ON portion of the duty cycle. For example, for 30 minute processing time, the elapsed time will be 1 hour if the ON and OFF pulse cycle is set for 10 seconds on and 10 seconds off.

1. To set the processing time, press the **TIMER** key.

The screen will display:

Time Setting
Hrs: - Min: -- Sec: --

2. Using the numeric keys, set the processing time as required, for example:

Time Setting
Hrs: 0 Min: 30 Sec: 00

3. Press the **ENTER/REVIEW** key. The screen will display:

Time 0:30:00
Pulse -- -- Ampl 40 %

PULSER: Ultrasonics generates heat. Pulsing ultrasonics on and off helps to prevent heat build-up in temperature sensitive samples. In addition, pulsing may enhance processing by allowing the material to settle back under the probe after each burst. The ON and OFF pulse duration can be set independently from 01 second to 59 seconds. During the OFF portion of the cycle, the red indicator on the **PULSE** key will illuminate. If the OFF portion of the cycle exceeds three seconds, a cautionary message - Sonics in OFF Cycle - will warn the operator against touching the ultrasonic probe.

1. To set the pulser, press **PULSE** key.

The screen will display:

Pulse on __ sec
Pulse off __sec

2. Using the numeric keys, set the ON portion of the cycle, then press the **ENTER/REVIEW** key.

The screen will display:

Pulse on 10 sec
Pulse off __ sec

3. Using the numeric keys set the OFF portion of the cycle, then press the **ENTER/REVIEW** key.

The screen will display:

Pulse on 10 sec
Pulse off 10 sec

4. Press the **ENTER/REVIEW** key.

The screen will display:

Time 0:30:00
Pulse 10 10 Ampl 40 %

On Cycle
Off Cycle

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) Selected processing time and elapsed processing time:
e.g. Set 0:30:00 Time 0:15:00
- c) Selected pulsing cycle and actual pulsing cycle:
e.g. Pulse 10 10 / (actual time)
- d) 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 / XXX Joules
- e) Elapsed time since processing was initiated:
e.g. Elapsed time 0:15:00

8. TECHNIQUES FOR OPTIMIZING RESULTS

Probe Size vs. Sample Volume

Selecting the proper size probe is a critical factor when processing a sample. The sample volume to be processed must correlate with the tip diameter. Each probe has a recommended sample volume range. This range may overlap with other probes. For example, the 1/2" probe can process approximately 20-250ml. Depending on the type of sample, you may be able to process a little less than 20ml or more than 250ml. Depending on the vessel size and shape, the 1/2" probe may have difficulty fitting inside a 20ml volume and a 1/4" microtip may be a better option. Many factors must be considered when selecting the appropriate probe for your application.

Small volumes require a small tip to fit inside the sample tube. Small tips (or microtips) are recommended for processing samples inside small, thin vessels and never samples larger than 50ml. Microtips are high intensity and made for short processing times. Using a microtip for long time periods will generate a considerable amount of heat. Microtips should be used in pulse mode to reduce heat buildup.

Larger volumes require a larger probe for effective processing. For example, a 1" probe will process 1 liter much faster than a 3/4" probe. Using the proper size probe will not only reduce the processing time but increase the lifespan of the probe. The addition of a stir bar can greatly aid processing of large samples. A probe should not be used to process a volume larger than indicated on the chart unless the application is reviewed and approved by a Sonics representative.

While there is no absolute sample volume range for any probe/horn, below is a general guideline to follow. Processing volumes are application specific. Contact us for more details.

| Tip Diameter | Processing Volume Range |
|-----------------|-------------------------|
| 1/16" (2mm) | 0.2ml - 5ml |
| 1/8" (3mm) | 1ml - 15ml |
| 3/16" (5mm) | 5ml - 20ml |
| 1/4" (6mm) | 10ml - 50ml |
| 1/2" (12mm) | 50ml - 250ml |
| 3/4" (19mm) | 100ml - 500ml |
| 1" (25mm) | 200ml - 1,000ml |
| 1" with booster | 500ml - 2,000ml |

Vessel Shape and Size

A narrow vessel is preferable to a wide vessel. The ultrasonic energy is generated from the tip and is directed downward. As a sample is processed, the liquid is pushed down and away in all directions. If the vessel is too wide, it will not mix effectively and some sample will remain untreated at the periphery. The probe should never touch the sides or bottom of the vessel.

How to prevent foaming (small sample issue)

Foaming is a problem that often occurs with samples volumes below 1ml. The cause of foaming is generally 3 issues: amplitude is too high for a small volume, tip is too large for the volume, or the tip is not inserted to a proper depth.

Tip Depth

The depth of the probe within the liquid is an important issue. If the probe is too close to the surface of the liquid, it can create foam. If the probe is too deep, it may process against the bottom of the vessel and not effectively processing the sample. The sample must flow freely below the tip in order to be mixed effectively. Without effective mixing you cannot ensure the entire sample volume will pass below the tip and become processed.

The probe should be submerged approximately halfway into the liquid, but there are exceptions. Before processing actual samples, it is recommended to test the probe in a vessel filled with water to observe the ultrasonic energy and the flow pattern of the liquid. During this test you can adjust the probe's depth until you see adequate mixing and movement of the water.

Viscosity Limitations

Viscous solutions and highly concentrated liquids can be difficult to process. If the liquid is so thick that it will not pour or circulate easily, it is too thick and cannot be processed effectively.

Keeping Samples Cool

A byproduct of ultrasonic processing is heat generation. Sample temperature will increase over time with ultrasonic processing and must be controlled. To minimize temperature elevation, use the pulse mode feature in the power supply's programming. Additionally, the sample vessel can be immersed in ice or an ice-salt-water-alcohol bath, or by using a water-jacketed processing vessel with cold water circulation during processing to help control temperature.

See website for more details and additional information:

www.sonics.com

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. If this is not possible, contact your Customer Service Representative to obtain a longer cable.

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 horn assembly. The sides and end of the probe must **never** be allowed to come in contact with anything but the solution. When using a probe, the stress resulting at the point of contact with the vessel could cause the probe to fracture.

Proper care of the probe is essential for dependable operation. The intense cavitation will, after usage for period of time, cause the tip to erode, and the power output to decrease. The smoother and flatter the tip, the more power will be transmitted into the sample. The cavitation may also cause the probe to loosen over time or the threaded connection to accumulate debris. **Note: A loose probe will usually generate a loud piercing or squealing sound.**

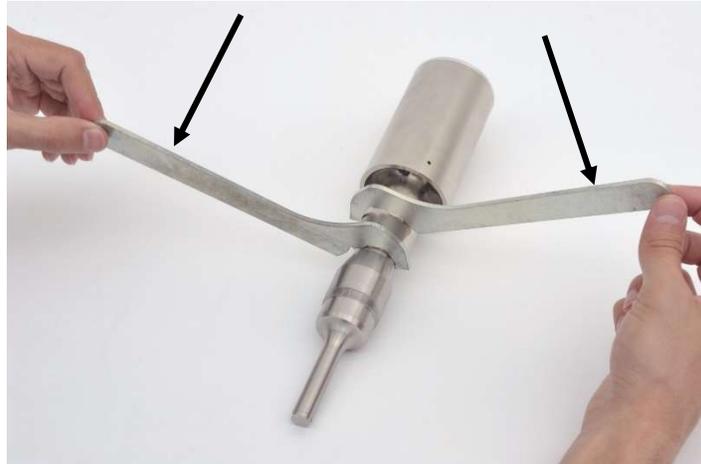
For that reason, it is recommended that a preventative maintenance schedule be adopted to examine the unit at regular intervals. The schedule should depend on frequency of use. Weekly maintenance schedules are recommended for units used frequently or monthly for those used infrequently. The tip must be examined for excessive wear and to 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.

When excessive wear (corrosion/pitting of the probe tip) is detected the probe should be replaced with a new one.

WARNING: Hand-tightening probes onto the converter is not sufficient; properly tighten them with the appropriate Wrench Set. See below the steps for attaching and detaching microtip probes:

9.2. ATTACHING AND DETACHING PROBES AND MICROTIPS

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. Hold the converter horizontally and 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. Reattach probe to converter. Screw the probe back onto the converter and tighten with the wrench set provided.



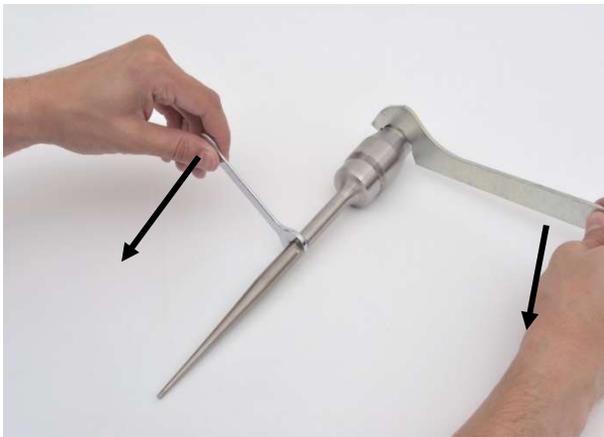
5. The tips on replaceable tip probes can be removed for cleaning and/or replacement. When replacing probes or probe tips, always clean the threaded mating surfaces of the converter and probe. Use alcohol and a cotton swab to remove any debris on the threading of the tip or probe. If the replaceable tip loosens during processing, be sure to remove the tip for cleaning and inspect the threading on the tip and probe. Call the manufacturer for assistance if the threading is chipped or damaged in anyway.



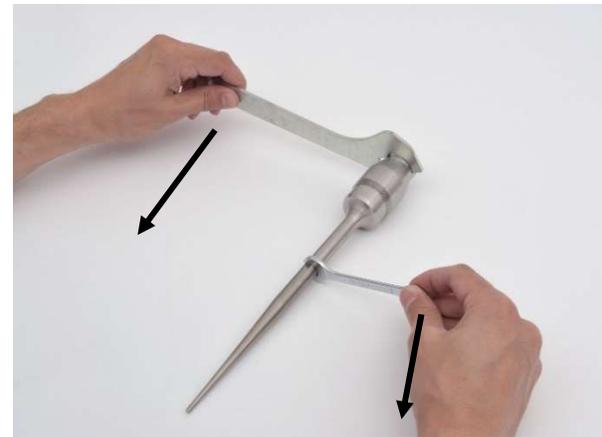
Replacement Tip Removal



Replacement Tip Tightening



Microtip Removal



Microtip Tightening

Note: When tightening a microtip, the tip must not be in contact with the work surface. Always have the tip extending off of the table or work surface to minimize stress to the tip.

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

Your Ultrasonic Processor was designed to provide you with years of safe and dependable service. Nevertheless, because of component failure or improper usage, the possibility does exist that it might not perform as it should, shut down or stop working all together. The most probable causes for malfunction are listed below and should be investigated.

- The system is overheating.
- 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 horn, probe, booster or microtip is not tightened properly with the wrenches provided.
- The converter and/or microtip may have been dropped.
- A microtip being operated is damaged or worn past its useful life.
- A fuse(s) has failed.

10.1. 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.

Most faults can be solved by cleaning all mating and threaded surfaces using isopropyl alcohol and properly re-assembling tightly together using the appropriate wrenches.

Note: If the display freezes, switch Off main power, wait 5 seconds and switch back On.

Note: If you touch Start and processing does not occur, switch Off main power, wait 5 seconds and switch back On.

If the problem persists after reviewing each of the 6 items above, please contact Customer Service or complete a repair form on the Sonics website at www.sonics.com.

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. Include date of purchase, model number and serial number.

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.



11.1. 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: _____

12. CONVERTER COOLING

Continuous processing will cause both the probe and sample temperature to increase. The heat will transfer up to the converter. If the converter overheats, the internal crystals can crack and the entire converter will require replacement. Converter damage due to overheating is not covered under warranty.

Cooling the sample by submerging the beaker or tube in ice will help to cool the probe and converter. If you have an application that requires greater than 15 minutes of continuous processing (at high amplitude), there is potential for the probe/converter assembly to increase in temperature.

The general rule is that if the converter is warm to the touch, it should be cooled. In addition to cooling the sample, you must cool the converter with compressed air. Each converter has 2 threaded ports for air cooling. 10 psi of dry, clean (5 micron filtered) air is required. One port is attached to the air source and the other port remains open as a vent.

Converter Cooling Setup:

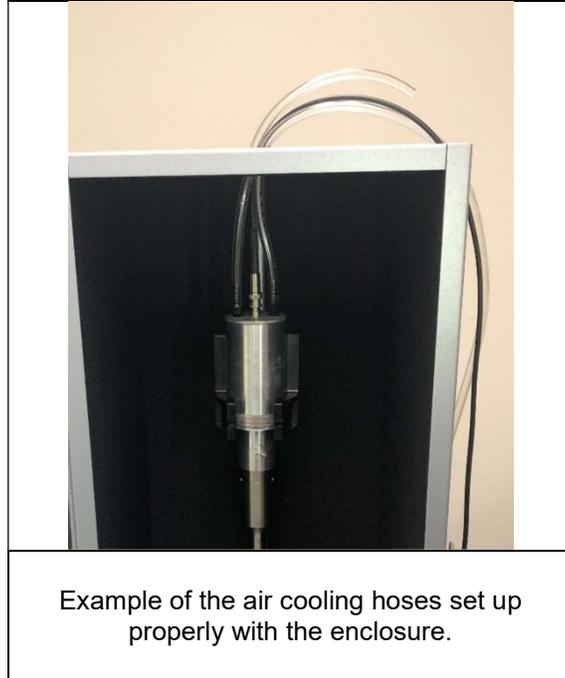
The following setup instructions shall be followed when converter cooling is required. The converter is shipped without the air cooling fittings exposed. Follow the instructions below to attach the air cooling hose to the converter.

| Step | Description | Reference |
|------|--|---|
| 1 | The converter is shipped without the air inlet and outlet connections exposed. |  |
| 2 | Position the converter with the label facing up and feel for the holes under the label. Use a razor to expose both holes (threaded ports) as shown. Note: The converter has 2 threaded ports for air cooling. One port is attached to the air source and the other port remains open as a vent. |  |
| 3 | Attach the supplied barb fittings to BOTH threaded ports. Note: Hose barb fittings are included with the converter (replacement hose barbs are part #859-00067). |  |

| Step | Description | Reference |
|------|--|--|
| 4 | <p>Attach a clean, dry, regulated compressed air source to one of the 1/4" Air Cooling hose barbs.</p> <p>Note: The compressed air should be oil free and filtered with a 5 micron filter.</p> |  |
| 5 | <p>A 2nd hose must be attached to the 2nd fitting.</p> <p>This hose will exhaust the air from the converter outside of the enclosure.</p> |  |
| 6 | <p>The exhaust hose only needs to exit the top of the enclosure by at approximately 8 inches or more.</p> |  |

COOLING AIR REGULATION AND ADJUSTMENT

Adjust the regulated compressed air until the gauge indicates 10 ± 1 PSIG (approximately 3 to 4 CFM). The compressed air will flow into the converter and out through the outlet barb. **Verify the compressed air is flowing out from the exhaust tube upon each use.**



If you do not have a continuous duty air compressor we can offer a portable and reliable alternative. Please contact us with questions.