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# USER'S GUIDE

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## AUTOTUNE SERIES ULTRASONIC ATOMIZER

**130 Watt Model**  
20 kHz & 40 kHz

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## WARRANTY

Your Ultrasonic Atomizer is warranted and backed by the manufacturer for a period of **three 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 atomization, and is not covered by this warranty. Because of the chemically aggressive nature of some liquids, the warranty does not cover damages caused by any liquids which are chemically incompatible with the atomizing probe.

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.

## **IMPORTANT SAFEGUARDS**

### **READ BEFORE INSTALLING OR USING THE EQUIPMENT**

Your Ultrasonic Atomizer has been designed with safety in mind. However, no design can completely protect against improper usage, which may result in bodily injury and/or property damage. For your protection and equipment safeguard, observe the following warnings at all times, read the operating instructions carefully before operating the equipment, and retain this instruction manual for future reference. If the Ultrasonic Atomizer is used in a manner contrary to that specified in this instruction manual, the protection features designed into the unit may be impaired.

- When mounting the probe, always clamp the converter housing. Never clamp the probe.
- High voltage is present in the power supply. Do not remove the cover. Refer all servicing to qualified service personnel.
- To avoid electric shock, disconnect the electrical power cord before removing the cover prior to servicing.
- Never operate the power supply unless it is connected to the converter.
- Never secure anything to the probe.
- Never touch a vibrating probe.
- Never allow an atomizing probe to vibrate in air for more than 10 seconds without liquid flowing through it.
- Air cool the converter when the liquid temperature exceeds 100° C, and when working at high intensity for more than 30 minutes.

## GENERAL INFORMATION

The ultrasonic power supply converts 50/60 Hz line voltage to high frequency electrical energy at 20 kHz or 40 kHz (20,000 or 40,000 cycles per seconds), depending on the model. This high frequency electrical energy is transmitted to the piezoelectric transducer within the converter, where it is changed to mechanical vibrations. The ultrasonic vibrations are intensified by the probe and focused at the tip where the atomization takes place. The liquid travels through the probe, and spreads out as a thin film on the atomizing surface. The oscillating 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. Typically, the higher the frequency, the lower the processing capability. The amount of material atomized can be as little as 2  $\mu\text{l}/\text{sec}$ . 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. 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 50 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 uncloggable. Drop size is primarily a function of frequency, and the higher the frequency, the smaller the drop diameter. The median drop size at 20 kHz is 100 microns, and 60 microns at 40 kHz.

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. Because the frequency dictates the length of the probe high frequency nozzles are smaller, produce smaller drops, and have lesser flow capacity than nozzles operating at lower frequencies.

## SECTION 1 – INSTALLATION

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### INSPECTION

Prior to installing the Ultrasonic Atomizer, 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 Atomizer 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.

Should it become necessary to convert the unit for different voltage operation, proceed as follows.

1. Ensure that the power cord is not connected to the electrical outlet.
2. Open the fuse holder cover using a small screwdriver.
3. Pull out the red fuse holder from its housing.
4. To convert from 100/115V to 220/240V replace the two 3 Amp slow blow fuses, with two 1.6 Amp fuses.
5. To convert from 220/240V to 100/115V reverse the procedure above.
6. Rotate the fuse holder 180° from its original position, and reinsert it into its housing. For 100/115V operation the voltage displayed should be 115. For 220/240V operation the voltage display should be 220.
7. Change the electrical power cord as required.



#### WARNING

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



### CAUTION










Operating the equipment with voltages different from those specified, or with voltages with high power transients, will cause components within the power supply to fail.

## 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.

## SECTION II – OPERATION

### FUNCTIONS OF KEYS, CONTROLS, INDICATORS, AND CONNECTORS

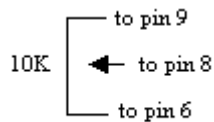
FRONT PANEL	
LCD screen	Displays prompts and the following control parameters: <ul style="list-style-type: none"><li>• Amplitude selected</li><li>• Amount of output power delivered to the probe in watts, and as a percentage of either 100 watts or 130 watts.</li><li>• Accumulated amount of energy in Joules delivered to the probe.</li></ul>
 Key	Clears preceding entry.
 Key	Used to enter the amplitude selected, and view amplitude, power, and energy
 Key	Starts or stops the ultrasonics. In the STOP mode the red indicator goes off.
 Key	Switches the main power on.
 Key	Switches the main power off.
 Key	Controls the amplitude of vibration at the probe tip.
 Key	Used with the <b>AMPL</b> 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 <b>ENTER/REVIEW</b> key twice to display AMPLITUDE CONTROL, then depress the  or  key as required.

FUNCTIONS OF KEYS, CONTROLS, INDICATORS, AND CONNECTORS (cont.)

<b>REAR PANEL</b>	
9 pin D-sub connector	Connects to external actuation device, and enable power and frequency monitoring.
Footswitch jack	Connects to the footswitch cable.
Coax connector	Connects to the converter.
Power module	Connects to the electrical line cord and encases the fuse(s).

**9-PIN D-SUB CONNECTOR**

<b>Pin No.</b>	<b>Description</b>
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. <i>See below</i>




**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.

## PREPARATION FOR USE

### CAUTION

Do not operate an Ultrasonic Atomizer that has been in a very cold or hot environment for a prolonged period of time. Wait until it has reached room temperature.

1. Plug the electrical line cord into the electrical outlet, if the unit is already on; depress the  key.
2. If the optional footswitch is used, insert the plug into the jack located on the rear panel. Make sure that the plug is inserted forcefully all the way in.
3. If the converter / probe assembly is not already assembled; using the wrenches provided, screw **securely** the probe into the converter.

### CAUTION

Never place a washer between the probe and the converter.  
Never apply grease to the mating surfaces or threads of the converter, probe, replaceable tip or microtip.

4. Mount the converter / probe assembly in a laboratory stand, secure the clamp to the upper section of the converter housing only. **Do not secure the clamp to the probe.**
5. Connect the converter cable to the power supply.

### NOTE

Should it become necessary to remove a probe, use the wrenches supplied. If the probe has been attached to the converter for a long period of time it might be necessary to use a vise. Be sure the vise has soft jaws or other means to prevent scratching. Secure the wide diameter portion of the probe in the jaws of the vise. Never grip the converter in the vise. Using a wrench, twist the converter off the probe. Never attempt to remove the probe by twisting the converter housing, as this may damage the electrical connections within the housing.

## SECTION III – OPERATING SUGGESTIONS

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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.

For optimum performance, the diameter of the plastic tubing connecting the inlet side of the delivery system should be larger than the diameter of the tubing used to connect the delivery system to the converter.

Delivery systems such as valveless metering pumps, syringe pumps or gear pumps are best suited for atomization because their dispensation is steady and uniform. Valveless 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. The probe should be energized only when there is liquid flowing through it, and for no more than 10 seconds after dispensation of the liquid. 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. Always energize the ultrasonics before starting the flow of liquid, and always terminate the liquid flow prior to de-energizing the ultrasonics. 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.

Do not operate the probe when the ambient temperature or temperature of the liquid exceeds 158°F (70° C).

## SECTION IV – USING THE ULTRASONIC ATOMIZER

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### CAUTION

- Do not operate the ultrasonic power supply unless it is connected to the converter
- High voltage is present in the power supply – do not operate with the cover removed.

**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 **▲ ▼** key for a 40% reading on the screen, and then press the **ENTER/REVIEW** key.

The screen will display:



AMPL 40 %

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.

To increase or decrease the amplitude in small increments when the ultrasonics is on, depress the **ENTER/REVIEW** key twice to display AMPLITUDE CONTROL on the screen, then depress the **▲** or **▼** key, as required.

### NOTE

To clear an erroneous entry press the **CLEAR** key.

### 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.

**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.

**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 **|** key to switch the unit back on.



1. Press the **|** key. The screen will display the power rating of the Ultrasonic Processor, and AMPL.

AMPL \_\_ \_\_%

2. Turn the liquid delivery system on.

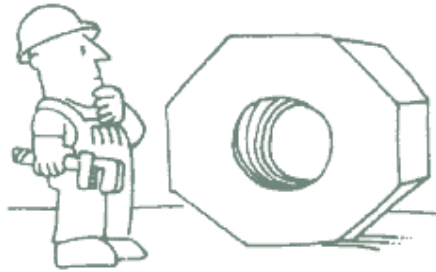
**NOTE**

For the majority of atomizing applications, low amplitude will atomize the sample better than high amplitude.

3. Empirically determine the best flow rate / amplitude combination.
4. If a footswitch or remote actuation device is used, depress the  switch to turn the ultrasonics off, plug in the footswitch or remote actuation device into the footswitch jack, and depress the  switch again to turn the ultrasonics back on. Depressing the footswitch, or closing the contact on the remote actuation device connected to the footswitch jack, will energize the ultrasonics.

## SECTION V – SERVICE INFORMATION

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### OVERLOAD CONDITION

Your Ultrasonic Atomizer 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 due to an overload condition or that it will stop working all together. The most probable causes for malfunction are listed below and should be investigated.

- The unit was plugged into an electrical outlet that provides a different voltage from that required. See *Electrical Requirements*.
- The probe is not secured properly.
- 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 (out of the sample), the wattmeter should read below 10 watts. If the reading exceeds 10 watts, press the **O** key, and disconnect the probe from the converter.
  5. Press the **I** key. If the wattmeter reads below 10 watts, the probe has failed or is out of tune due to excessive erosion, and should be replaced, if the wattmeter reads above 10 watts, either the converter or power supply has failed and the complete Ultrasonic Processor should be returned for repair.

## **RETURN OF EQUIPMENT**

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

In order to receive prompt service; always contact the factory before returning any instrument. Include date of purchase, model number and serial number. For instruments not covered by the 3-year warranty, a purchase order should be forwarded to avoid unnecessary delay. Care should be exercised to provide adequate packing to insure against possible damage in shipment. The Ultrasonic Atomizer should be sent to the "Service Department" with all transportation charges prepaid and return of shipment indicated.

Please obtain a *Return Authorization Number* prior to returning the instrument.

### **IMPORTANT**

**I CERTIFY THAT THE ULTRASONIC ATOMIZER AND / OR ACCESSORIES RETURNED FOR REPAIR ARE FREE OF ANY BIOHAZARDOUS OR RADIOACTIVE MATERIAL AND ARE SAFE FOR HANDLING.**

**DO NOT RETURN ANY EQUIPMENT UNLESS SUCH CERTIFICATION CAN BE MADE.**