
USER'S GUIDE

AUTOTUNE SERIES HIGH INTENSITY ULTRASONIC PROCESSOR MICROPROCESSOR CONTROLLED 1500 WATT MODEL WITH HIGH VOLUME FLOW CELL

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The Ultrasonic Processor and High Volume Flow Cell supplied with this instruction manual are constructed of the finest material and the workmanship meets the highest standards. Both units have been thoroughly tested and inspected before leaving the factory and when used in accordance with the procedures outlined in this manual, will provide you with many years of safe and dependable service.

WARRANTY

Your Ultrasonic Processor is warranted for a period of three years from the date of shipment against defects in material and workmanship under normal use as described in the 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.

Wear resulting from cavitation erosion is a normal consequence of ultrasonic processing, and is not covered by this warranty.

This warranty is in lieu of any other warranties, either express, implied, or statutory. 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 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.

The probe within the High Volume Flow Cell is manufactured to exacting specifications and is 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 Processor 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 Processor is used in a manner contrary to that specified in this instruction manual, the protection features designed into the unit may be impaired.

- Make sure the Ultrasonic Processor is properly grounded via a 3-prong outlet.
- 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, except at the nodal point (point of no activity).
- Never touch a vibrating probe.
- Air-cool the converter with dry compressed air.
- Hearing protection is highly recommended. It is recommended that a sound abating enclosure or ear protection be used when operating the Ultrasonic Processor.



WARNING or CAUTION
Where you see this alert symbol and **WARNING** or **CAUTION** heading, strictly follow the warning instructions to avoid personal injury or equipment failure.



SECTION I – INSTALLATION

INSPECTION

Prior to installing the Ultrasonic Processor and the High Volume Flow Cell, 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 equipment was thoroughly inspected and carefully packed 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 220 volts, or 240 volts.



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.

SECTION II – OPERATION

PRINCIPLES OF ULTRASONIC DISRUPTION

The ultrasonic power supply converts 50/60 Hz line voltage to high frequency electrical energy. This high frequency electrical energy is transmitted to the piezoelectric transducer within the converter, where it is changed to mechanical vibrations. The vibrations from the converter are intensified by the probe, creating pressure waves in the liquid. This action forms millions of microscopic bubbles (cavities) which expand during the negative pressure excursion, and implode violently during the positive excursion. This phenomenon, referred to as cavitation, creates millions of shock waves in the liquid, as well as elevated pressures and temperatures at the implosion sites. Although the cavitational collapse lasts but a few microseconds and the amount of energy released by each individual bubble is minimal, the cumulative effect causes extremely high levels of energy to be released into the liquid.

FUNCTIONS OF KEYS, CONTROLS, INDICATORS, AND CONNECTORS

FRONT PANEL	
Screen	<p>Displays prompts and the following control parameters:</p> <ul style="list-style-type: none"> • Amplitude selected • Output power delivered to the probe in watts, and as percentage of the total power • Selected duration of processing • Actual processing time • Elapsed time • Set and read temperature • Pulse duration • Accumulated amount of energy in Joules delivered to the probe.
0 – 9 key	Input digits.
CLEAR key	Clears preceding entry.
ENTER/REVIEW key	Enters data into the program, and selects various parameters, for display on the LCD screen.
TIMER key	Used with the numeric keys to set the duration of ultrasonic application – from 1 second to 9 hours, 59 minutes, 59 seconds.
TEMP* key	Used with the numeric keys to set the high temperature limit – from 1°C to 99°C. Red indicator lights when the temperature limit has been reached.
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.
ENERGY* key	Used to set the ENERGY SETPOINT
START/STOP key	Starts or stops the ultrasonics. In the STOP mode the red indicator goes off.
PAUSE key	Suspends operation. Red indicator lights when the processing cycle is interrupted.
SAVE/RECALL key	Used with the numeric keys to assign a number to a program and store that program in memory. Up to 9 programs (1-9) can be stored. Also used to recall any of 9 stored programs.
AMPL key	Controls the amplitude of vibration at the probe tip.
I key	Switches the main power on.
O key	Switches the main power off.
 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 AMPL key to display the percentage of amplitude previously selected, then depress the  or  key as required.

**These keys should not be used when working with the High Volume Flow Cell.*

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

REAR PANEL	
Footswitch jack	Connects to the footswitch cable.
Coax connector	Connects to the converter.
Electrical line cord	Connects to the 220/240V electrical outlet
Temperature probe jack	Connects to the optional temperature probe


PREPARATION FOR USE

NOTE

The High Volume Flow Cell is recommended only for the treatment of low viscosity samples, which do not require extended exposure to ultrasonics. Because the residence time within the cell is relatively short, it might be necessary to recirculate the sample.

CAUTION

Do not operate an Ultrasonic Processor 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, switch the unit off by depressing the  key.
2. If the optional footswitch is used, insert the footswitch plug into the jack located on the rear panel. Make sure that the plug is inserted all the way in.
3. Screw the booster into the converter and secure forcefully with the spanner wrenches provided.

CAUTION

Never place a washer between the converter, booster or probe. Never apply grease to the mating surfaces or threads of the converter, booster or probe.

4. Ensure that the High Volume Flow Cell is completely drained out of any liquid.
5. Using the spanner wrenches provided, forcefully secure the booster to the High Volume Flow Cell probe.
6. Connect the converter cable to the power supply.
7. Connect either one of the air fittings on top of the converter to a source of dry compressed air.

USING THE ULTRASONIC PROCESSOR

The speed control on an automobile, can, to a certain extent, be compared to an Ultrasonic Processor. The speed control is designed to maintain the vehicles rate of travel constant. As the terrain changes, so do the power requirements. The speed 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.

The Ultrasonic Processor is designed to deliver constant amplitude. As the resistance to the movement of the probe increases, additional power will be delivered by the power supply to ensure that the excursion at the probe tip remains constant. Using a more powerful power supply will not deliver more power into the liquid. Rather, it is the resistance to the movement of the probe that determines how much power will be delivered into the sample.

The AMPLITUDE control allows the ultrasonic vibrations at the probe tip to be set to any desired level. Although the degree of cavitation 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 to 100% will not cause the maximum power that the power supply is capable of delivering, to be delivered to the sample. For example, with the 1500 watt Ultrasonic Processor, the maximum power that the power supply is capable of delivering will only be delivered when the resistance to the movement of the probe is high enough to draw 1500 watts.

PUMP RECOMMENDATION

For consistency, the liquid should be fed to the flow cell at a constant pressure. Centrifugal pumps and gear pumps are preferred over peristaltic or piston pumps, as they will not create pressure fluctuations.

CAUTION

Do not operate the power supply unless it is connected to the converter.

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

TIME __:__:__	TEMP __ °C
PULSE _ _ _ _	AMPL __ %

AMPLITUDE: The amplitude is the only parameter that 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. Press the **AMPL** key and the **▲** or **▼** key for a reading of 40%, then depress the **ENTER/REVIEW** key.

The screen will display:

TIME __:__:__	TEMP __ °C
PULSE _ _ _ _	AMPL 40%

The Ultrasonic Processor is now ready for continuous operation. To energize the equipment, press the **START** key or the footswitch. To de-energize the equipment, press the **STOP** key or release the footswitch. If the Time or Pulse* functions must be used, refer to the appropriate paragraph(s) below.

To increase or decrease the amplitude in small increments when the equipment is on, depress the **AMPL** key to display the percentage of amplitude that was previously selected, then depress the **▲** or **▼** key, as required.

NOTE

Any combination of functions can be selected in any order. To clear an erroneous entry press the **CLEAR** key.

* Should not be used when working with the High Volume Flow Cell.

NOTE

If the **START** key is pressed and the time limit has not been set, processing will remain uninterrupted until the **STOP** key is depressed.

If the **START** key is pressed and the time limit has been set, processing will remain uninterrupted until the set time limit expires, or the **STOP** key is pressed – whichever occurs first.

If a footswitch is used, and the time limit has not been set, processing will remain uninterrupted as long as the footswitch is depressed.

If a footswitch is used, and the time limit has been set, processing will remain uninterrupted until the time limit expires or the footswitch is released – whichever occurs first.

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.

1. Using the fittings on top of the converter, circulate dry compressed air through the converter to cool the converter.
2. Depress the **START** key.

NOTE

The probe within the High Volume Flow Cell is tuned to vibrate at a specific frequency. If the resonant frequency of the probe has changed, due to cavitation erosion or fracturing, a minimum reading will not be obtained. If an overload condition exists, or if minimum reading cannot be obtained (less than 20%) when the flow cell is empty or when using a probe without the flow cell and the probe is in air (out of the sample), check the instrument without the probe to determine if the probe has failed or is out of tune. If minimum reading is obtained using the converter without the probe, the probe is defective and should be changed.

A loose probe will usually generate a loud piercing sound.

Refer to Section III if an overload condition exists.

3. With the liquid flowing through the High Volume Flow Cell, adjust the pressure within the cell and the amplitude so as to achieve a 50% reading on the power monitor bar graph. If the liquid is discharged into an open container or a low-pressure line, the pressure can be increased by reducing the flow rate with a valve on the discharge side. Unless absolutely necessary do not operate the power supply continuously with the amplitude set above 90%.

4. Using the ▲ or ▼ keys, increase or decrease the amplitude as required.
5. Process the material at different flow rates, while maintaining the pressure constant.
6. Evaluate the sample.
7. If the sample is overprocessed or has overheated, reduce the amplitude. Since the amplitude required is application dependent and subject to the composition of the sample, it is recommended that the amplitude be selected empirically by increasing or decreasing the level of intensity as required as the sample is being processed.

NOTE

When working with a temperature-sensitive sample, it might be necessary to circulate the sample through a coiled tube immersed in a salted ice bath to compensate for the temperature elevation that may take place during processing.

When working with high viscosity material, it is recommended that (if possible) the viscosity be reduced as much as possible prior to processing.

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 1 hour processing time, the elapsed time will be 2 hours if the ON and OFF cycle are set for 1 second. To set the processing time, press the **TIMER** key.

The screen will display:

Time Setting
Hrs: __ Min: __ Sec: __

Using the numeric keys, set the processing time as required:

Time Setting
Hrs: 5 Min: 30 Sec: 25

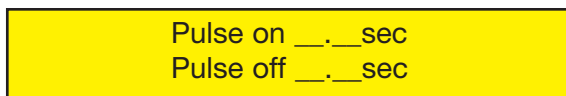
Press the **ENTER/REVIEW** key. The screen will display:

TIME 5:30:25	TEMP __ °C
PULSE _ _ _ _	AMPL 40%

* Should not be used when working with the High Volume Flow Cell.

PULSER:* The pulse function is not used when working with the High Volume Flow Cell, but can be used when processing a batch with a probe. By inhibiting heat build-up in the sample, the pulse function enables safe treatment of temperature sensitive samples at high intensity. In addition, pulsing enhances 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 1 second to 59 seconds. During the OFF portion of the cycle, the red indicator on the **PULSER** key will illuminate. If the OFF portion of the cycle exceeds three seconds, a cautionary message – CAUTION – PROBE ON STANDBY – will warn the operator against touching the ultrasonic probe. To set the pulser, press the **PULSER** key.

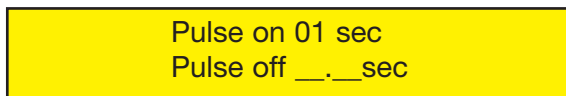
The screen will display:



Pulse on __. __sec
Pulse off __. __sec

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

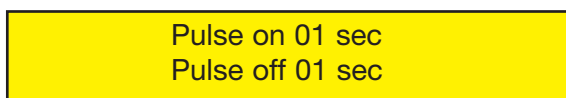
The screen will display: e.g.



Pulse on 01 sec
Pulse off __. __sec

Using the numeric keys set the OFF portion of the cycle.

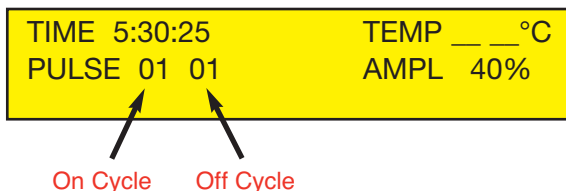
The screen will display: e.g.



Pulse on 01 sec
Pulse off 01 sec

Press the **ENTER/REVIEW** key.

The screen will display:



TIME 5:30:25 TEMP __. __°C
PULSE 01 01 AMPL 40%

On Cycle Off Cycle

* Should not be used when working with the High Volume Flow Cell.

TEMPERATURE:* The temperature function prevents overheating of the sample by continuously monitoring the sample temperature, and terminating the ultrasonics when the temperature reaches a predetermined setpoint. The ultrasonics is automatically reinstated when the temperature drops below the setpoint. If the temperature of the sample must be monitored and/or controlled, insert the optional temperature probe forcefully into the small jack on the rear panel, immerse the temperature probe in the sample and press the **TEMP** key.

The screen will display:

Probe Temperature 27°C
Temperature Setpoint __°C

Using the numeric keys set the high temperature limit (setpoint).

The screen will display:

Probe Temperature 27°C
Temperature Setpoint 35°C

Press the **ENTER/REVIEW** key.

The screen will display:

TIME 5:30:25 TEMP 35°C
PULSE 01 01 AMPL 40%

**Should not be used when working with the High Volume Flow Cell.*

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) Set processing time and elapsed processing time:

e.g., Set 5:30:25 Time 0:57:03

c) Selected pulsing cycle, and actual pulsing cycle:

e.g., Pulse 01 / 01

d) Amount of power in watts, and accumulated amount of energy in JOULES delivered to the probe:

e.g., 20 watts 0000000 Joules*

e) Elapsed time since processing was initiated:

e.g., Elapsed time 1:27:33

NOTE

The amount of energy displayed will be only for one cycle. Initiating a new cycle will reset the display to zero.

**The number of Joules displayed is dependent on the watts being drawn and the processing time.*

ENERGY SETPOINT:* The energy setpoint continuously monitors the amount of energy in Joules (watts-seconds), that is being delivered to the probe, and terminates the ultrasonics when the energy level reaches a predetermined setpoint. To set the energy setpoint, press the **ENERGY** key.

The screen will display:

Energy Setting
 __, ____, ____ Joules

Using the numeric keys, set the energy setpoint.

The screen will display:

Energy Setting
 600000 Joules

Press the **ENTER/REVIEW** key.

The screen will display:

TIME 5:30:25 TEMP ____°C
 PULSE 2.5 : 1.0 AMPL 40%

SAVE/RECALL

SAVE: The save function retains in memory up to 9 (1-9) control parameters under a storage identification (ID) number. To store the parameters under an ID number, press the **SAVE/RECALL** key.

The screen will display:

*RECALL JOB
 SAVE JOB

Press the key one more time.

The screen will display:

RECALL JOB
 *SAVE JOB

Press the **ENTER/REVIEW** key.

The screen will display:

S# T__:__:__ T____°C
 P____ E____,____,____ A____%

Using the 1-9 numeric keys, enter the ID number.

The screen will display:

S6 T__:__:__ T____°C
 P____ E____,____,____ A____%

Press the **ENTER/REVIEW** key.

The screen will display:

S6 TIME 5:30:25 TEMP ____°C
 PULSE 2.5 : 1.0 AMPL 40%

* Not used when working with the High Volume Flow Cell.

RECALL: The recall function can retrieve from memory any of 9 stored control parameters for verification or usage. To retrieve any parameters press the **SAVE/RECALL** key.

The screen will display:

```
*RECALL JOB
SAVE JOB
```

Press the **ENTER/REVIEW** key.

The screen will display:

```
R# T_:_: _ T_ °C
P _ _ _ E _ , _ _ , _ _ A _ _ %
```

Using the 1-9 numeric keys, enter the ID number.

The screen will display:

```
R4 T_:_: _ T_ °C
P _ _ _ E _ , _ _ , _ _ A _ _ %
```

Press the **ENTER/REVIEW** key.

The screen will display:

```
R4 TIME 5:30:25      TEMP _ _ °C
PULSE 2.5 : 1.0     AMPL 40%
```

Note: To review all the information that has been stored, press all the numeric keys consecutively.

SECTION III – SERVICE INFORMATION



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 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 the one required. See *Electrical Requirements*.

The probe, booster, or High Volume Flow Cell is not secured properly.

A fuse(s) has failed.

1. Set the AMPLITUDE to 50, and press the **I** and the **START/STOP** key. With the flow cell empty of any liquid, or the probe in air (out of sample), the wattmeter should read below 20 watts. If the reading exceeds 20 watts, press the **START/STOP** key, and disconnect the probe from the booster.
2. Press the **START/STOP** key to restart the equipment. If the wattmeter reads below 20 watts, the probe has failed or is out of tune due to excessive erosion, and should be replaced. If the wattmeter reads above 20 watts, either the converter, booster, or power supply has failed and the Ultrasonic Processor and High Volume Flow Cell should be returned for repair.
3. If the Ultrasonic Processor stops working due to an overload condition as indicated on the display, press the **O** key, investigate and remedy the problem, then press the **I** key to restart the equipment.

RETURN OF EQUIPMENT

It is suggested that if a unit is in need of repair, both the Ultrasonic Processor and the High Volume Flow Cell be sent back to the factory.

In order to receive prompt service; always contact the factory before returning any equipment. Include date of purchase, model number and serial number. For equipment not covered by the 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 equipment should be sent to the "Service Department" with all transportation charges prepaid and return of shipment indicated.

Please obtain a *Return Authorization Number (RA#)* prior to returning the instrument.

SAFETY CERTIFICATION FORM*

Federal law prohibits the transfer of equipment or products contaminated with radiological, biological or chemical waste residue. Sonics requires that each customer certify one of the statements on page 17. Prior to returning any equipment, please make a copy of the form on page 17, fill in the form and send it back with the equipment being returned.

**This form must accompany any equipment that is being returned for repair.*

SONICS 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. Sonics reserves the right to refuse delivery of the equipment without necessary documentation or where we determine they have not been properly decontaminated. Sonics reserves the right to bill the customer for any and all costs associated with the decontamination and/or disposal of the equipment we determine was not properly decontaminated. In the event the equipment has been exposed to radiological contamination, the signature of the Radioactive Safety Officer is required.

Print name: _____ RA # _____

Signature: _____ Date: _____