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SONICS & MATERIALS, INC.

ULTRASONIC PROCESSOR

Evaluation Kit – #VC4030

Operation Manual



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1. WARRANTY

Your Ultrasonic Processor is warranted and backed by the manufacturer for a period of 12 months 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.

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. 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 good will, 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 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.

- 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 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.
- 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.
- NEVER immerse the entire converter in liquids of any kind or let condensed moisture or liquid drip into the converter.
- NEVER grasp an activated horn or touch the tip of a vibrating probe. It can cause severe burns and tissue damage.
- NEVER hold or clamp the converter by the front driver (titanium section). Support the converter by clamping around the black converter housing only.
- Inspect high frequency cable for cracks in the protective outer jacket. Do not bend the cable past 90 degrees.
- Do not operate unit with a damaged cable. Doing so may cause serious injury.

Symbols



Caution, Risk of electric shock, Hazardous voltage.




Caution, Risk of danger. Refer to User Manual.

3. SPECIFICATIONS

Power Supply			
	Part #PS-VC4030-100	Part # PS-VC4030-110	Part # PS-VC4030-220
Input Voltage	85 VAC – 110 VAC @ 50/60 Hz	108 VAC – 132 VAC @ 50/60 Hz	198 VAC – 264 VAC @ 50/60 Hz
Rated Current	2.4 Amps max.	2.4 Amps max.	1.2 Amps max.
Fuse Rating	3 Amps Slow Blow	3 Amps Slow Blow	1.6 Amps Slow Blow
Weight	7 lbs. (3.2 Kg)		
Dimensions	8"W x13.75"L x 5.75"H 203mm x 349mm x 146mm		
Output Voltage	380 VRMS (max.)		
Output Frequency	40 KHz		

Converter #CV307	
Weight	0.32 lbs. (0.14kg)
Dimensions	3.7" L x 1.25" Dia. (94mm x 32cm)
Materials	Aluminum and titanium

Environmental	
Pollution Degree	2
Installation Category	II
Operating Limits	<p>Temperature: 41 - 104°F (5 - 40°C) Relative Humidity 10 - 95% (Non Condensing) Altitude: 6,651 ft. (2000 m)</p>
Shipping/Storage	<p>Temperature: 35 -120 °F (2 - 49 °C) Relative Humidity 10 - 95% (Non Condensing) Ambient Pressure Extremes: 40,000 ft. (12,192 m)</p>
Restriction of Hazardous Substances (ROHS)	
Other	For indoor use only

4. PRINCIPLES OF OPERATION

The ultrasonic power supply transforms AC line power to a 40 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 converter/transducer 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 sonication 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.

Relationship of Amplitude and Wattage

Ultrasonic power is measured in watts. Amplitude is a measurement of the excursion of the tip of the converter/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, a converter/horn operating in air (not touching an object) can display as little as 0-1 watts at various amplitude settings. Touch the converter/horn against an object and it will immediately display a higher wattage draw to overcome the load, yet it will maintain the current amplitude setting.

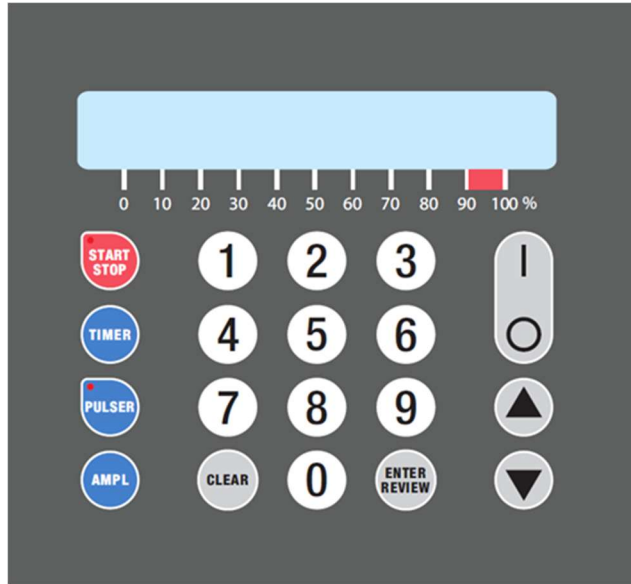
The speed/cruise control on an automobile, can, to a certain extent, be compared to an ultrasonic processor. The speed/cruise control is designed to ensure that the vehicle maintains a constant rate of travel. As the terrain elevations change, so do the power requirements. The cruise control senses these 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 sample, regardless of these changes in load. As the resistance to the movement of the converter/horn increases (unit is pressed against a sample vessel), additional power will be delivered from the power supply to converter/horn, to ensure that the excursion at the tip remains constant.

5. DESCRIPTION OF COMPONENTS / FUNCTIONS OF CONTROLS

FRONT PANEL	
I	Switches the main power on.
0	Switches the main power off.
TIMER	Press TIMER and enter total processing time.
PULSE	Set PULSE on/off time to reduce heat gain.
<u>ENTER</u> <u>REVIEW</u>	Used to enter the amplitude and time settings. And to review all screens.
CLEAR	Clears the preceding entry.
AMPL	Controls the amplitude (intensity) of vibration at the probe tip. 40-100% is the active amplitude range for this unit.
▲ ▼ 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. Press the <u>ENTER/REVIEW</u> key twice to display AMPLITUDE CONTROL , then depress the ▲ or ▼ key as required.
<u>START</u> <u>STOP</u>	Starts or stops the ultrasonics. In the STOP mode the red indicator goes off.
REAR PANEL	
Footswitch Connector	Connects to the footswitch cable.
Converter Cable Connector (Output)	Connects to the converter.
Power Supply Connector	Connects to the electrical line cord and encases the fuse(s).

FRONT OF UNIT

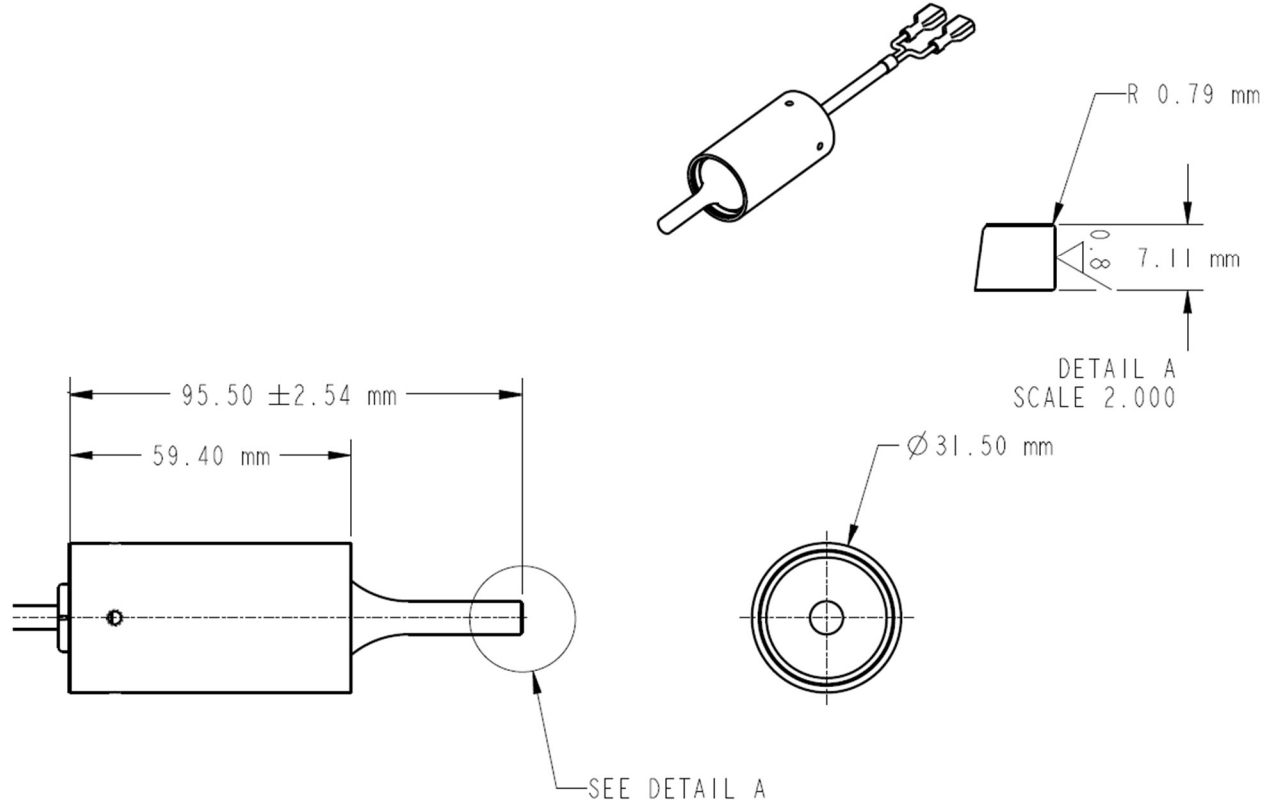


REAR PANEL DETAIL



CV307 CONVERTER

Note: alternative converters may be used with this unit.



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 ordered. For power requirements, check the label on the back of the unit.

Should it become necessary to convert the unit for different voltage operation see the Addendum.

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. SETUP

POWER SUPPLY SETUP

1. Plug the converter cable into the back of the power supply.
2. Plug the female end of the electrical line cord into the receptacle on the back of the power supply and the plug into an electrical outlet.

CONVERTER MOUNTING

1. Secure the converter in a fixture for optimum use. It can be hand-held for initial testing and proof of concept.
2. If using a laboratory stand, mount the converter assembly using a clamp.



Note: The converter can contact the sample vessel from either the side or bottom depending on your application requirements. Contact us for assistance with mounting formats.

7.1. SAMPLE PROCESSING AND OPTIMIZATION

The VC4030 Evaluation kit is used to determine application feasibility and the most appropriate settings for sample processing applications. There are many variables that can have an effect on the outcome of ultrasonic processing with this device. The primary variables in achieving good ultrasonic processing are detailed below.

When completing feasibility studies and optimization tests please record values for each of these parameters. It is especially important to record the range of values for each parameter that results in appropriate processing of your sample. This information will provide enable us to recommend the most efficient ultrasonic PCB and converter model for your final product/application.

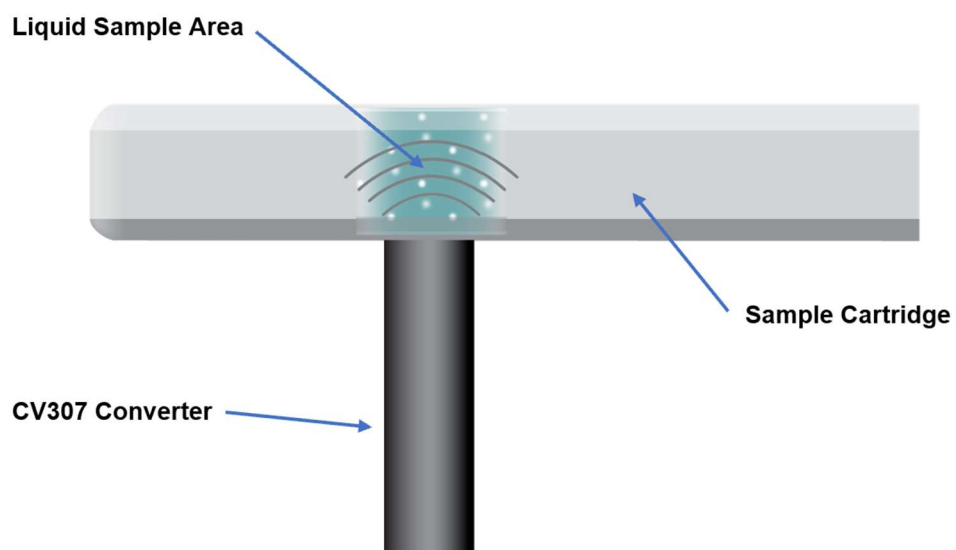
1. **Amplitude** – the peak to peak distance which the converter/probe face travels in the axial direction when ultrasonics is energized. Amplitude is adjustable and the CV307 can achieve approximately 21um at 100%. This unit should be operated between **40-100%** amplitude. If you require lower amplitude, alternative converters are available.
2. **Contact Force** – the force applied to the converter or the sample vessel. Higher force may transfer more energy but could also damage the vessel. Different combinations of Amplitude and Force should be tested.
3. **Contact Area** – the mating surface between the sample vessel and the converter face.
4. **Duration** – the time that ultrasonics is energized and processing the sample. It is recommended to energize the ultrasonics for a minimum of 1 second, and maximum of approximately 30 seconds continuously. Longer processing times are possible depending on the amount of force used against the sample vessel. Contact us to discuss appropriate processing times for your application.
5. **Sample volume/concentration** – smaller sample volumes and/or lower concentrations may require shorter processing durations when compared with the same sample type of larger sample volumes and/or higher concentrations.
6. **Sample type** – Some samples are more difficult to process than others, empirical testing is required.
7. **Vessel shape** – For indirect methods of sonication (touching the probe to a vessel), the probe face should have as much contact as possible with the surface of the vessel containing the liquid sample. See example on page 13. Note: a flat probe should not be used against a round tube. For direct methods of sonication (probe in the liquid), the appropriate vessel shape that allows good mixing of the entire sample volume will result in more efficient sample processing.
8. **Vessel materials** – Softer plastics (such as polypropylene) absorb some of the ultrasonic energy and may not perform as well as a more rigid plastic. Polycarbonate or a similar material, may be a better option for some applications. Vessel wall thickness will also impact processing efficiency. Plastic membranes can also be evaluated.

Note: All the factors listed above should be discussed and evaluated before testing begins.

VC-4030 with Sample Cartridge Example



Closeup of probe contacting cartridge from underneath



8. OPERATION

Note: This unit should only be used at amplitude settings 40% - 100%.

Press the **I** key. The screen will display 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 amplitude selected (e.g. 40%). 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.

Note: The minimum amplitude setting for this configuration is 40%.

The screen will display:

Time - : --: --

<i>NOTE: To clear an incorrect entry press the CLEAR key.</i>
--

1. The Ultrasonic Processor is now ready for continuous operation. To energize the ultrasonics, press the **START** key. 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.
2. To increase or decrease the amplitude in small increments when the ultrasonics is on, depress the **AMPL** to display Amplitude Setting on the screen, then depress the **▲** or **▼** key, as required.

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 minute processing time, the elapsed time will be 2 minutes - if the ON and OFF Pulse cycle is set for 1 second ON and 1 second 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: 10 Sec: 00

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

Time 0:10:00

Pulse -- -- Ampl 40 %

PULSER: Ultrasonics generates heat. Pulsing ultrasonics on and off helps to prevent heat build-up in temperature sensitive samples. 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

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

The screen will display:

Pulse on 05 sec

Pulse off -- sec

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

The screen will display:

Pulse on 05 sec

Pulse off 05 sec

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

The screen will display:

Time 0:10:00

Pulse 05 05 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.

- Selected amplitude:
e.g. Amplitude 40%
- Selected processing time and elapsed processing time:
e.g. Set 0:10:00 Time 0:05:00
- Selected pulsing cycle and actual pulsing cycle:
e.g. Pulse 05 05 / 05 00
- 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.*)
- Elapsed time since processing was initiated:
e.g. Elapsed time 0:05:00

9. MAINTENANCE

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

- A. 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. Make certain the cable always has slack and is never tensioned. **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.**
- B. The power supply and converter case may be cleaned using an acid-free cleaning solution (e.g. glass cleaner). The titanium front driver can be cleaned using isopropyl alcohol.

10. TROUBLESHOOTING

The most probable causes for malfunction are listed below:

- A. A connector or cable is damaged.
- B. The unit was plugged into an electrical outlet that provides a different voltage from that required. See *Electrical Requirements*.
- C. The convertor and/or probe has been dropped.
- D. A fuse(s) has failed. If a fuse(s) has failed, proceed as follows:
 - 1. Turn the unit off by depressing the **OFF** 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).

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 **OFF** key to switch the unit off, and the **ON** key to switch the unit back on.

If the problem persists after inspecting all of these, please contact Customer Service.

11. RETURN OF EQUIPMENT

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

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

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

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

RMA # -----

Sonics & Materials

53 Church Hill Rd.

Newtown, CT 06470

Important

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

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

12. SAFETY CERTIFICATION FORM

Items being returned:

Please check only one item below:

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

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

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

Authorization

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

Print name: _____ RA # _____

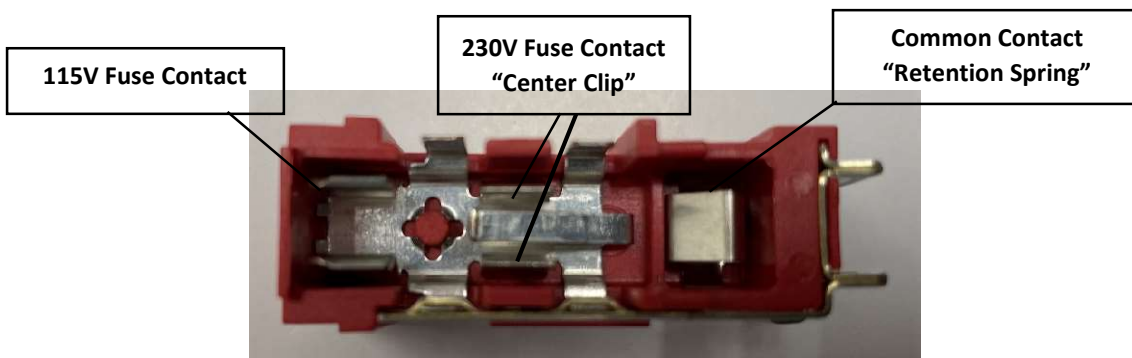
Signature: _____ Date: _____




13. ADDENDUM (CHANGING UNIT VOLTAGE)

Tools and parts required:

- Quantity 2 of 115V fuse, part number: 835-00035
or
- Quantity 2 of 230V fuse, part number: 835-00030
- Small flathead screwdriver
- Pliers

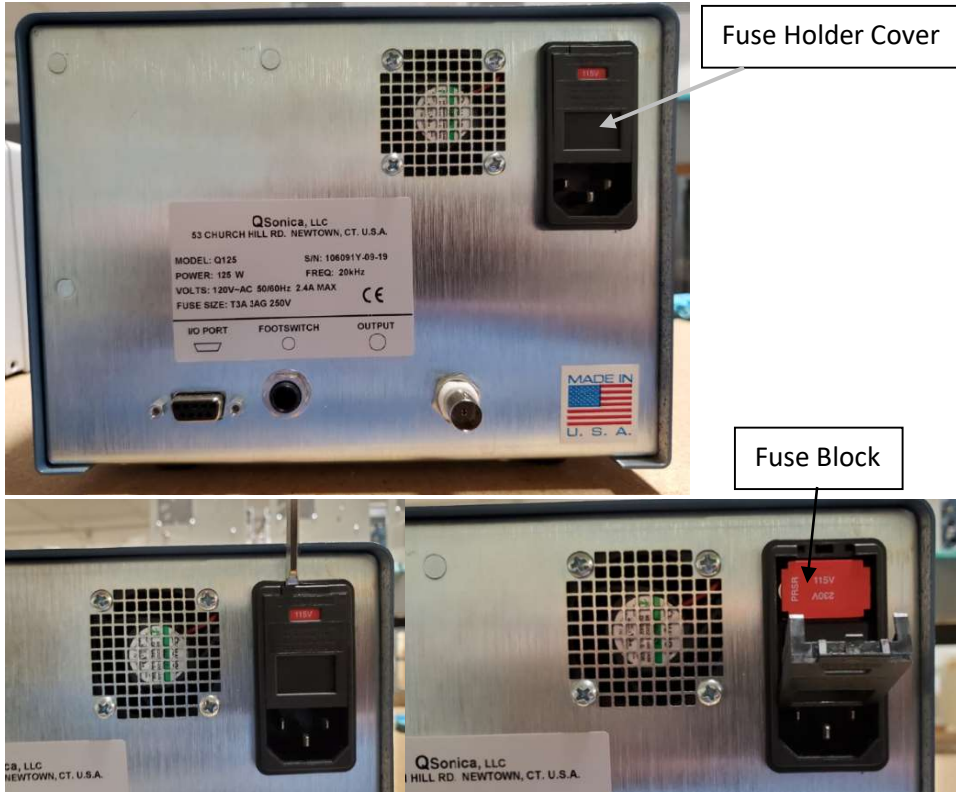
Description of parts:



EMPTY	115V FUSE POSITION	230V FUSE POSITION
		

Conversion instructions:

1. Ensure that the power cord is not connected to the electrical outlet.
2. Open the fuse holder cover using a small flat head screwdriver to open the black plastic module.



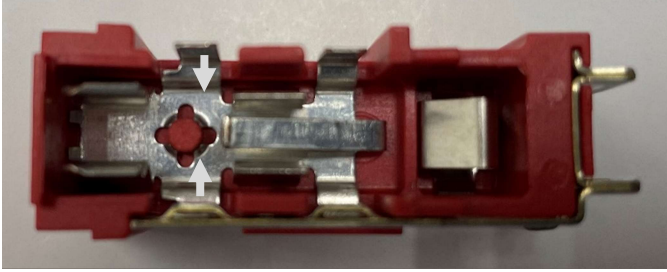
3. Use the screwdriver to pull out the red fuse block from its housing.



4. To convert from 220/240V to 100/115V, replace the two 1.6 Amp fuses with 3 Amp slow blow fuses. See the picture above for 230V proper fuse position.

To convert from 100/115V to 220/240V replace the two 3 Amp slow blow fuses, with 1.6 Amp fuses. some adjustment of the center clip may be needed. Before inserting the

fuses, using a pair of small pliers, compress the 2 wings of the center clip slightly so that the 220V fuse size fits securely.)



5. Rotate the red fuse holder 180° from its original position, and reinsert it into its housing. For 100/115V operation the voltage displayed on top should be 115.



For 220/240V operation the voltage displayed on top should be 220.



6. Change the electrical power cord as required.
7. Clearly note on the label or back of the unit that the voltage has changed. For an updated label please contact your sales representative.