



**ULTRASONIC POWER
CORPORATION**

**Ultrasonic Cleaning Tank and Generator systems
with "Vibra-Bar" Transducer Modules**



Ultrasonic Power Corporation™

**239 E. Stephenson Street
Freeport, IL 61032, U.S.A.
Phone: 815-235-6020 • 1-800-575-0168
Fax: 815-232-2150**

Email: sonic@upcorp.com

www.upcorp.com

Le manuel est disponible en français sur demande.

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Congratulations,

You have just purchased the best Ultrasonic cleaning system available to the market today. We here at Ultrasonic Power Corporation™ take pride in our products and our ability to provide you, our customer the best quality service available. Please take some time to familiarize yourself with this manual and all aspects of the system configuration prior to start-up. We know that your Ultrasonic Power Corporation™ cleaning system will serve you for years to come. Thank You again for selecting Ultrasonic Power Corporation for your cleaning needs.

Sincerely,

The Ultrasonic Power Family

Please read the entire manual. This manual gives you the education and special skill required to operate the system at its peak performance.

This manual describes the 5300 series generator. Deviations for the 5200 series and the 5400 series are as noted in the body of the text.

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Warnings

Warning Symbols



Danger

The DANGER symbol means that failure to follow this safety statement WILL result in personal injury or death.



Warning

The WARNING symbol means that failure to follow this safety statement MIGHT result in personal injury or death.



Caution

The WARNING symbol means that failure to follow this safety statement MIGHT result in personal injury or property damage.



High Voltage

The HIGH VOLTAGE symbol means that failure to follow this safety statement MIGHT result in personal injury or death.

SAFETY PRECAUTIONS

The following *safety precautions* should be observed when operating or servicing this equipment.



WARNING: Utilize this equipment with accordance to the manual and good safety practices. Failure may result in poor equipment performance, personnel injury or death, or equipment damage.



WARNING: USE ONLY WATER OR WATER-DETERGENT MIX IN CLEANING CHAMBER. NEVER USE FLAMMABLE SOLVENTS (FIRE OR EXPLOSION COULD RESULT) OR CARBON TETRACHLORIDE (PRODUCES TOXIC FUMES).



CAUTION: Never use ultrasonic cleaning console as a sink. Under no circumstances should waste water be poured into it as the water could overflow the drain and damage delicate components.



CAUTION: Incorrect voltage can damage the generator. Do not operate the equipment unless the correct voltage is available. Contact the proper authority about necessary changes at the wall receptacle.



CAUTION: Never operate unit without at least 12 inches of water in the cleaning chamber. Failure to observe this precaution could damage the equipment.



WARNING: ALWAYS DISCONNECT ALL POWER TO THE SYSTEM PRIOR TO PERFORMING PREVENTATIVE MAINTENANCE WITHIN THE COMPARTMENTS. ELECTRICAL SHOCK CAN CAUSE SERIOUS INJURY OR DEATH.



WARNING: Do not operate this equipment for other than its intended use. The system is intended for cleaning components with water and an aqueous, non-flammable, detergent.



This generator is designed to operate under an elevation of 2000m (6562 ft)

SAFETY PRECAUTIONS (Continued)



WARNING: EXTREMELY HIGH VOLTAGES, WHICH CAN CAUSE DEATH ON CONTACT, ARE PRESENT IN ELECTRICAL CIRCUITS OF THE SYSTEM. ALWAYS USE THE FOLLOWING PRECAUTIONS WHEN WORKING ON THE EQUIPMENT:

1. DO NOT ATTEMPT TO OVERRIDE SAFETY INTERLOCKS.

2. NEVER REACH ACROSS ANY SYSTEM WHICH HAS NOT BEEN TURNED OFF, THE PLUG PULLED AND HIGH-VOLTAGE CAPACITORS DISCHARGED.

3. WHEN SERVICING LIVE ELECTRONIC EQUIPMENT, ALWAYS WORK WITH ONE HAND IN YOUR POCKET OR BEHIND YOUR BACK AND STAND ON AN INSULATED PAD (e.g., RUBBER). THAT WAY IF YOU GET SHOCKED, THE CURRENT WILL NOT PASS THROUGH YOUR BODY.

4. DON'T CARRY ON CONVERSATION OR PERMIT YOURSELF TO BE DISTRACTED IN ANY MANNER WHILE SERVICING LIVE EQUIPMENT.

5. NEVER SERVICE LIVE EQUIPMENT UNLESS SOMEONE IS IN THE SAME ROOM WITH YOU.

6. NEVER TURN OFF THE MAIN POWER SWITCH IN SOME REMOTE SPOT AND THEN SERVICE EQUIPMENT WITHOUT ALSO PULLING PLUG ON LINE CORD.

7. IN THE EVENT OF SHOCK, ARTIFICIAL RESPIRATION SHOULD BE APPLIED IMMEDIATELY. IF POSSIBLE, BY A PERSON TRAINED IN ADMINISTERING SUCH TREATMENT.



WARNING: ALWAYS DISCHARGE ALL HIGH-VOLTAGE CAPACITORS BEFORE ATTEMPTING ANY SERVICING. DON'T ASSUME THAT THE DISCHARGE FROM A CAPACITOR WILL NOT PRODUCE A SERIOUS SHOCK. THE DISCHARGE FROM A HIGH-CAPACITY, HIGH-VOLTAGE CAPACITOR IS LETHAL!



WARNING: THE TRANSDUCERS CAN BUILD UP A CHARGE, REGARDLESS OF POWER BEING APPLIED, DUE TO MECHANICAL SHOCK OR HEAT OF SOLUTION IN CLEANING CHAMBER. THEREFORE, TO REMOVE SHOCK HAZARD, DISCONNECT TRANSDUCER CABLE AND SHORT THE CABLE TO GROUND BEFORE SERVICING THE GENERATOR. USE CAUTION WHEN WORKING ON THE TRANSDUCER ASSEMBLY.



CAUTION: Failure to reconnect wires in their original positions when replacing components in the system may lead to failure of the system. Carefully note proper arrangement before removing wires from components to be replaced.



This equipment is intended to be utilized indoors in an ambient temperature of 50°F to 95°F.



This system contains one power cord that is required to be attached to a properly rated three wire fusible disconnect with a grounding connection capable of handling twice the rated current. The wires are colored as follows: black - hot / ungrounded, white - return / grounded, green & yellow - protective earth. The system also contains one drain valve for tank content drainage. The drain can be plumbed into a facility drain or remaining unplumbed for added mobility on draining locations.



Approved hearing protection is recommended for use with this system.



Recommend the use of NRTL approved electrical plug for use with this system. Select the appropriate plug for the voltage and current rating of the unit as per the respective national standard. When the plug is installed, make sure the wires are cut so that the protective earth is the last to take the strain. Electrical plugs should be installed only by a certified electrician.

Fuse Schedule

Type	Generator		F1			F2		
	Voltage	Wattage	Volts	Amps	Acting	Volts	Amps	Acting
5300 Generator	120	250	250	4	Fast	250	-	Fast
	120	500	250	8	Fast	250	-	Fast
	120	750	250	8	Fast	250	4	Fast
	120	1000	250	8	Fast	250	8	Fast
	240	250	250	2	Fast	250	-	Fast
	240	500	250	4	Fast	250	-	Fast
	240	750	250	4	Fast	250	2	Fast
	240	1000	250	4	Fast	250	4	Fast
* All fuses have the cartridge style form factor								

Introduction to Ultrasonic Cleaning

Ultrasonic energy exists in a liquid as alternate rarefactions and compressions of the liquid. During rarefaction, small vacuum cavities are formed which collapse, or implode, during compression. This continuing rapid process, called cavitation, is responsible for the scrubbing effect which produces ultrasonic cleaning. Three factors affecting the scrubbing action are the degree of liquid degassing, the ultrasonic frequency and the chemical characteristics of the liquid at specific temperatures.

Degassing is the removal of unwanted air from the liquid. As the cavities form, they fill with the unwanted air forming bubbles, which resist collapse and tend to remain suspended in the liquid. These bubbles act as "shock absorbers," which materially reduce cleaning efficiency. The amount of air can be reduced by periodically switching off, or modulating, the sound energy to permit adjacent bubbles to coalesce, float to the surface, and escape. The type of modulation is important, for the correct balance between degassing and cleaning efficiency must be selected for each cleaning application.

Frequency affects cleaning efficiency by determining the cavity size. Low frequencies generate large but relatively few cavities with high cleaning power. High frequencies generate a great number of small cavities with good penetrating capability. The selection of the correct frequency is difficult, for it varies with each cleaning application. The frequency also affects degassing, with 40 kHz nearly optimum.

Cleaning efficiency is also affected by the chemical and physical characteristics of the liquid. For best cleaning, the liquid must chemically soften the soil, yet maintain effective cavitation and provide the desired characteristics for rinsing and drying the cleaned parts. Ultrasonic cleaning solutions are broadly characterized as aqueous or non-aqueous. Final selection is dependent upon the overall process considerations for the cleaning application.

The ultrasonic energy is created within a liquid by means of transducers, which convert electrical energy into acoustic energy. These transducers are similar in function to a radio speaker except they function at ultrasonic frequencies and transmit acoustic energy to a liquid rather than to air. The transducers consist of vibrating elements (piezoelectric disc) bolted between thick metal plates. The transducers are bonded to the underside of the tanks containing the cleaning liquid or are encased in stainless steel for immersion within a liquid. For reliability, many transducer modules are uniformly distributed over the tank bottom rather than having a single transducer in the center of the tank working very hard.

An electronic generator energizes the transducers. The generator transforms the electrical energy from the wall outlet into a suitable electrical form for efficiently energizing the transducers at the desired frequencies. All ultrasonic cleaning systems consist of the four fundamental components of transducer, generator, container for liquid, and cleaning liquid. The performance and reliability of the system depends upon the design and construction of the transducers and generators. The overall effectiveness of the cleaning is dependent upon the cleaning liquid. The size of the tank is dependent upon the size or quantity of the parts being cleaned. The number of transducers and generators is determined by the tank size. The choice of cleaning liquid depends upon the parts being cleaned and contaminant to be removed.

Versatility of Ultrasonic Power Corporation (UPC) Equipment

UPC manufactures engineered equipment that fulfills the broad spectrum of performance requirements dictated by the various cleaning applications. The varied frequency requirements are met by UPC's "Simultaneous Multi-Frequency™" which provides many frequencies at the same time, thus eliminating the difficulty of choosing a particular frequency for a particular cleaning application.

The exclusive UPC features of "Simultaneous Multi-Frequency™" provide the most versatile equipment available on the market. The UPC "Vibra-Bar®" transducer

module and generator module combine to provide equipment having maximum reliability and simplified field maintenance.

The UPC product line consists of the generator modules and standard "Vibra-Bar®" transducer modules. In addition, immersible transducers can be built to be used within existing installations or where application flexibility is required.

Ultrasonic Power Corporation facilities provide one source for all phases of industrial ultrasonic equipment. All of our products have been designed and developed by UPC engineers and are manufactured by UPC personnel. This experience and ability is available for field assistance on ultrasonic cleaning equipment applications.

"Simultaneous Multi-Frequency™" Versatility

The versatile performance of UPC equipment results from the simultaneous presence of many ultrasonic frequencies - 40 through 90 kHz (and higher) - within the cleaning chamber. The higher frequencies, with their greater penetrating capability, initiate the cleaning by loosening soils in inaccessible areas, such as tapped holes and undercuts. This allows the heavy duty lower frequencies to rapidly and thoroughly complete the cleaning operation. The presence of more than one frequency also reduces the probability of damage to frequency sensitive parts, as it avoids the single strong resonance found in conventional ultrasonic tanks. The cooperating effect of many frequencies insures constantly uniform and thorough cleaning.

"Simultaneous Multi-Frequency™" is accomplished by energizing the patented rectangular "Vibra-Bar®" transducer module at two critical points with active piezoelectric stacks. This causes complex vibrational modes, which creates more than one frequency in the cleaning bath. This is similar to the creation of various resonant frequencies by vibrating a rectangular, rather than circular, drumhead. There is a dominant frequency at the frequency the generator is tuned to, but significant energy is also produced at other higher frequencies.

Another important UPC advantage is the elimination of undesirable standing wave patterns, which are always present in conventional single frequency ultrasonic cleaners. Because of the coexistence of frequencies with many different wavelengths, UPC equipment provides extremely uniform energy distribution throughout the entire fluid volume. So called "dead" spots simply do not exist with UPC ultrasonic equipment. Degassing is also efficient with UPC equipment because of the presence of the dominant frequency.

Power Intensity Control - Versatility

(Not available on 5200 Series)

To further increase the versatility of UPC equipment, an adjustable output power control is on all Model 5300 Series generators. This control, combined with "Simultaneous Multi-Frequency™", extends the equipment cleaning ability to very fragile items such as semiconductor devices, wafers and delicate glass parts. The adjustable output power control provides maximum flexibility over a wide range of cleaning applications. It also maximizes the equipment performance when used for solution degassing.

Modulation Sweep Control - Versatility

(Not available on 5200 Series)

This generator has the ability to perform in a variety of aqueous and semi-aqueous cleaning chemistries. The generator operates at a base tuned frequency and a sweep range of + 2 kHz and - 2 kHz. The sweep rate is how fast the output sweeps within this range. On the front panel of the generator on the right hand side there is a control that controls the sweep rate. (300 Hz to 1000 Hz) Turn clockwise to increase sweep rate. For most aqueous solutions the sweep should be set in the full counter clock-wise position 300 Hz. For more viscous solutions and various hydrocarbon-based

solutions the sweep should be set at full clockwise position 1000 Hz. Certain applications will deviate from these standard sweep rate settings.

Engineered Reliability of UPC Equipment

The fundamental reliability of the UPC line is the result of the design and construction of the patented "Vibra-Bar®" transducer modules and Generator Modules. These standard modules are used throughout the entire product line, thereby eliminating "one time-untried designs." Required production tooling and facilities have been engineered to insure consistent product quality control. Spreading out from the standard module base are system designs and fabrication that are the result of years of specific field experience in ultrasonic cleaning applications.

"Vibra-Bar®" Transducer Module Reliability

The UPC "Vibra-Bar®" transducer module consists of two active piezoelectric stacks which energize at two points. Reliability is obtained by the elimination of any adhesive in the active stack. The active stack consists of a piezoelectric (PZT) element bolted between backing plates. The absence of adhesive means the PZT element is "free" to vibrate or distort in any direction. In other designs, the PZT element is clamped in the stack by means of an epoxy adhesive, which prevented the element from movement in more than one direction. Because of the vibrational patterns and differences between the coefficient of expansion of the piezoelectric element and the clamping metals, the adhesive designs cause stresses to be built up in the element, which in time create cracking and failure. The UPC design eliminates adhesive in the stacks by optically polishing all mating surfaces and employing a single center bolt to provide the required clamping. Resiliency and ability to maintain constant compression under all conditions of vibration and temperature is obtained by the compression washers located under the bolt head. The size of the center bolt is 3/8 of an inch, which is oversized for the application.

The "Vibra-Bar®" transducer module is permanently bonded to the radiating surface by means of a high temperature adhesive. Each stack utilizes only a single PZT element and single center bolt, thus providing increased reliability over designs with several PZT elements and bolts. The PZT element is relatively thin and under compression, which results in a strong structure. The PZT is similar to concrete in that by itself it tends to be brittle, but under compression, it is one of the strongest materials. The PZT, in the UPC designs, is not the normal commercially available formulation. The UPC formulation has special additives to obtain low dissipation, high density, and low porosity, resulting in improved performance, negligible aging and reliability. The PZT element has a Curie temperature above 620° F and during manufacture is heat stabilized and pre-aged at 400°F. The special formulation and pre-aging eliminate any of the previous difficulties with PZT elements, such as changing characteristics after field usage. The field aging of the UPC elements is less than 1 percent.

The acoustical design of the "Vibra-Bar®" transducer module is such that the design is a relatively low "Q" (broad band) device compared to other types of single stack designs. This means that the PZT elements do not have to be critically matched.

Generator Modules Reliability

The reliability of the individual modules is obtained by the simplicity of the design where only a minimum number of components are employed. The UPC design has only about one-third the components of similar competitive designs. Also, the design is such that no critical matching or alignment is required. The design employs all solid-state components, further insuring reliable operation.

Built into the design is automatic frequency/load control, which provides uniform and reliable operations under all conditions of loading. This circuitry is simplified because of the low "Q" characteristics of the "Vibra-Bar®" transducer module design. The frequency of the generator does not have to be critically matched to the transducer.

Therefore, it is relatively easy to detect changes in the load by feedback networks, which can automatically compensate the generator module performance.

Because of the superior reliability, the UPC generators are replacing competitive generators in many installations. UPC engineers can indicate if our generators are suitable for "driving" your particular transducers.

Minimum Diaphragm Erosion Reliability

The greatest factor limiting cavitation amplitude within any ultrasonic cleaning tank is the erosion of the radiating diaphragm. The cavitation causes the surface of the radiating diaphragm to be "etched." This mechanism is affected by the characteristics of the diaphragm as well as by the characteristics of the ultrasonics. Too much etching can render the diaphragm useless within months. With the UPC equipment, high cleaning ability is obtained; yet only a minimum amount of erosion takes place.

Factors affecting erosion are the transducer design, frequency of operation and the type of modulation. The more transducer area bonded to the diaphragm, the lower is the erosion. With the UPC "Vibra-Bar®" transducer module design, there is about three times more area of transducer per PZT active element as compared with other designs. This means that the energy is more uniformly distributed, thus minimizing erosion. Experience shows that higher frequencies erode less than lower frequencies. Consequently, the 40 kHz systems have less erosion than 20 or 28 kHz systems. "Simultaneous Multi-Frequency™" technology is superior to all, because not only is the main tuned base frequency, but the presence of other high frequencies minimizes the erosion effect. Experience also dictates that systems without modulation have greater erosion. The UPC systems have the most advanced type of modulation.

Another factor affecting erosion, and independent of the equipment, is the characteristic of the cavitating liquid. Water solutions erode much more than solvent systems. Also, the higher the temperature of the liquid, the lower the erosion. Since

these factors are out of UPC control, it is necessary to have the transducer guarantee be restrictive and not cover the radiating diaphragm.

Ease of Maintenance of UPC Equipment

The UPC designs have been engineered for reliability, plus the ability for rapid and simplified field maintenance.

The construction of the "Vibra-Bar®" transducer module, which incorporates only a single center bolt and employs no adhesives, permits field replacement of all elements. The only required tool is a torque wrench. The circuit design is such that component replacement is simplified since there is no requirement for critical matching.

The construction of the generator chassis permits easy access to the electronic components. Access is obtained by the removing the four cover screws. To insure continuous production, a whole chassis module may be rapidly interchanged without tools. Only qualified technicians should consider repairing the generator circuit. Dangerous high voltages are present within the generator.

"Vibra-Bar®" Transducer Module Description

The "Vibra-Bar®" transducer module consists of a radiating bar approximately 2" x 5 x 1/2", which is permanently attached to the stainless steel radiating surface by high temperature bonding. Located on the radiating bar are two active piezoelectric stacks. Each stack consists of PZT elements bolted between the radiating bar and "backing plate". One surface of the PZT element is electrically insulated from the Backing Plate by means of an Insulator. The PZT element is specially formulated to obtain low dissipation, high density and low porosity, which results in, improved performance and negligible aging. The element is further stabilized and pre-aged during manufacture at 400°F to insure less than 1 percent field aging. The Curie temperature of the element

is above 620° F. Electrical voltage is applied across the PZT element by means of stainless steel electrodes specifically designed to provide reliable means of attaching wires. All parts in the stack have a center hole to permit clamping by means of the single bolt. All mating surfaces permit clamping by means of the single bolt. All mating surfaces are finely polished which eliminates the need for any adhesives in the stack construction. The absence of stack adhesive permits the PZT disc to be "free" to vibrate and distort in many different planes. Uniform compression on the PZT element is maintained under all operating conditions by means of compression washers under the bolt head. This design results in a rugged construction with long life and efficient operation.

"Simultaneous Multi-Frequency™" is accomplished by driving the radiating bar at the two areas of the active stacks. Each stack is energized by the 40 kHz oscillation from the generator modulated by either the full wave or half wave mode of operation. The absence of any stack adhesive permits the stack to vibrate and resonate not only in the thickness mode, but also in other modes such as circular and transverse. The two point driving of the "Vibra-Bar®" transducer module causes it to resonate and distort in complex modes, which creates more than one frequency in the cleaning tank. This process is similar to the creation of various resonant frequencies by vibrating a rectangular rather than a circular drumhead. If a circular drumhead is vibrated, it will resonate in only a single frequency. The radiating bar being rectangular instead of circular and larger than the driving stacks will resonate in more than one fundamental frequency. It will, in effect, have several fundamental frequencies plus the harmonics of all the fundamental frequencies. A circular transducer will have only a single fundamental frequency. The result in the tank is a dominant frequency of 40 kHz, but additional significant energy is produced at other and higher frequencies in the range of 50-90 kHz, by the distortion of the radiating bar. These other frequencies are in addition to the normal harmonics of the fundamental frequencies.

Generator Module Description

A generator module consists of a narrow profile cabinet. The cabinet has four rubber feet and an 6 foot long power cord. The power cord from the cabinet has a conventional three pronged plug (no plug is sent with a 240V generator). The generator needs to be grounded through the third prong of the power cord or by the use of a conventional grounding lug receptacle plug. Be sure the generator is plugged in the correct AC line voltage.

The Model 5300 (500-watt module) is designed to energize six "Vibra-Bar®" transducer modules (12 piezoelectric stacks) The Model 5300 (250 watt module) is designed to energize three "Vibra-Bar®" (6 piezoelectric stack) transducers. The chassis module contains the fan, (FET) transistors, control circuit, power circuit, and RFI (radio frequency interference) filter circuit.

The circuit is designed to provide a constant output power even as the temperature of the cleaning solution increases. The generator circuit compensates for a wide variety of load conditions. Because of the circuit design, no harm will result if the output of the generator is either "short circuited" or "open circuited" for a short period of time. These conditions can arise in the field if the transducer cable is not connected to the chassis module, or if a short accidentally develops in the transducer cable.

The adjustable power output control is a circuit that determines the power level applied to the transducers. The built in wattmeter circuit monitors the actual power and makes adjustments to keep the power constant regardless of liquid temperature and load in the cleaning bath. The power control circuitry provides the user with a very precise control from zero watts to maximum power. Therefore, the power setting can be tailored to all cleaning applications. Power intensity not available on the 5200 Series generator.

Radio Frequency Interference (RFI) Filter

Generator modules, Model 5300, as supplied by UPC are fitted with radio frequency interference suppression devices.

When installing equipment it is extremely important that the electrical service to the equipment provides a complete electrical ground. This assures RFI suppression and protection against electrical shock.

The RFI filter is located in the bottom portion of the generator case and is isolated from the generator module.

Generator Input Voltage Requirements

If not otherwise specified, the input voltage of the generators will be 120 volts. There are available, as an option, generator modules for operation at 100 and 240 volts AC. The circuit-design is modified to compensate for the optional voltages, thus, if this option is required, it should be specified at time of generator purchase.

Operating Instructions

Operating instructions are provided for generator modules, "Vibra-Bar®" transducer module tanks, immersibles, generators and accessories for the general product line. Before operating, it would be beneficial to read Generator Operating Instructions. This section provides generator information for generator and transducer modules operation.

Generator Operating Instructions

The following operating instructions are to be used for any of UPC's 120V or 240V ultrasonic equipment.

1. Connect the tank coaxial cable, 1/4 turn connector to the rear generator panel MHV connector. If more than six "Vibra-Bar®" transducer modules are on the tank, there will be more than one coaxial cable on the tank. Connect each coaxial cable to the appropriate chassis module.
2. Check generator serial tag for proper power requirements. Plug the generator power cord into an appropriate outlet. **BE SURE RECEPTACLE PROVIDES PROPER ELECTRICAL GROUND.** See Generator Description to obtain amperage requirements for the generator model. Also make sure line voltage matches voltage marked on the serial number plate.
3. Fill tank with cleaning solution. (**DO NOT OPERATE THE SYSTEM WITHOUT LIQUID IN THE TANK**) Push up the front panel toggle switch, to begin cavitation in the tank. The pilot light will come "on". Check to insure the fan behind the front panel is operating so proper cooling is obtained. Air should be drawn into the cabinet.
4. **(5400 Series Only)**
On the front control panel the left control knob is the power intensity control. Turn the control fully clockwise for full output power. To reduce the output power, turn the control counter clockwise. We recommend you operate the system at approximately 80% for most cleaning applications. Experience will determine if more or less power should be used.

5. **(Not available on 5200 Series)**

On the front control panel the right control knob is the sweep rate. Turn clockwise to increase sweep rate. For most aqueous solutions the sweep should be set in the full counter clock-wise position (300 Hz). For more viscous solution of various hydrocarbon-based solution the sweep should be set at full clockwise position (1000 Hz).

6. Place the parts to be cleaned in the tank either in a basket or fixture. Be certain that the cavitating liquid wets all surfaces that are to be cleaned. Tip parts with blind holes to permit air to escape. Ultrasonic cleaning will not take place if air is present, ultrasonic cavitation does not exist in air. After cleaning for the prescribed time, the parts should be rinsed and dried.

7. **(5400 Series Only)**

The transducer status indicator illuminates when the output to the unit is attached and working properly. If the light is not illuminated, check to make sure that the output connector is appropriately connected, the generator is on, and the power is over 20%. If problems still persist, please contact the manufacturer for additional assistance, as a problem may be occurring in the transducer or generator unit.

8. **(5400 Series Only)**

If the generator power module overheats due to blockage of the fan, or other reasons, during operation, the appropriate module indicator illuminates. The indicator will remain illuminated until the generator power is cycled, this is to show that during the process the power output was paused due to over temperature in the generator. Please check to make sure that the fan is operating correctly and that there is not an excessive amount of matter coating the power assembly. Take appropriate measures to remedy these situations.

9. **(5400 Series Only)**

On the rear of the generator is a 15-pin connector used for PLC input and output.

Utilize the table to determine appropriate pin locations and available inputs / outputs.

PLC Pinout for 5400 Series Generator

Pin #'s	Description
1	Sweep Cont.
2	Unused
3	Power Cont.
4	Power Out. (Bott.)
5	Freq. Out. (Bott.)
6	Power Out. (Top)
7	Alarm (Bott.)
8	On/Off (-)
9	Unused
10	Unused
11	Negative Ref.
12	Negative Ref.
13	Freq. Out. (Top)
14	Alarm (Top)
15	On/Off (+)

On / Off - +24V DC

Power Control - 0-10V DC

Sweep Control - 0-10V DC

Power Output - 0-10V DC

Frequency Output - 40 mV for 40 kHz

Alarm Output - Closed contact

WARNING:

1. Do not use flammable or combustible liquids in this any ultrasonic cleaning tank. It is dangerous and a fire or explosion can easily occur due to the combustible vapors that are produce by the ultrasonic action.
2. Although there is no evidence that ultrasonic cavitation will injure hands, it is recommended that the parts be placed in and out of the cavitating solution by use of a basket or by operators wearing heavy rubber gloves. This is also a precaution, for some peoples' skin may be allergic to the chemical solutions.
3. When placing parts in the tank or placing a basket or fixture of parts in the tank, be careful not to scratch the bottom of the tank or the radiating surface of the immersible transducers. Scratches are areas where cavitation erosion can begin and this will reduce the life of the radiating surface.

Preventative Maintenance

The design of UPC equipment eliminates the need for elaborate preventative maintenance procedures. The only recommendation is to periodically remove the chassis module from the cabinet and clean off any dust that has accumulated on the components. The use of a hand vacuum cleaner or fine brush is recommended. Careful use of air pressure may be used to remove dirt from critical areas. Be certain to locate generator to permit free flow of air through the cabinet. Be certain generator is unplugged before removing cover.

"Vibra-Bar®" Transducer Module Troubleshooting

CAUTION - HIGH VOLTAGE

High voltages are present which could be harmful. Only experienced personnel should carry out these measurements.

The "Vibra-Bar®" transducer module consists of a RADIATING BAR (51-01-002), which is permanently bonded to the stainless steel radiating surface by high temperature adhesives. Two active piezoelectric stacks are bolted to this bar by means of two center bolts (51-01-004). Each stack contains two electrodes (51-01-001), one backing plate (51-01-003), and two compression washers (51-01-005). All mating surfaces of these stacks are optically lapped so that no adhesive is required. The center bolt (51-01-004) under 290 to 320 in. lbs. of torque, secures the stack. Since no adhesives are required, the bolt may be loosened and re-tightened to replace components in the field.

If trouble is suspected in the transducer area, an ohmmeter should be used to measure the resistance between the high voltage electrode and the tank ground. This measurement should indicate a high resistance of greater than 5-10 meg. ohms. The

high voltage electrode (51-01-001) is located between the PZT Element (51-01-006) and the white colored insulator (51-01-007). A "short" can be detected by the resistance measurement while an "open" condition can be detected by a capacitance measurement. The capacitance of a single stack should be about 2,000 mmfd. The capacitance of a single "Vibra-Bar®" transducer module will be twice this of 4,000 mmfd., while three "Vibra-Bar®" transducer modules should be about 12,000 mmfd.

A "short" can result from a wire lead to an electrode coming off and arcing. Burning at the fault point will usually evidence this. Also, either electrode may become bent and get too close to the ground or high voltage. If this occurs, "bend" the electrode back into a horizontal plane. If burning has taken place, the defective part should be replaced. A "short" can also exist if moisture forms on the outer surface of the piezoelectric element (PZT). This can cause arcing and cracking of the piezoelectric element, which would then have to be replaced. If the PZT were to crack, it might show up as an "open" circuit rather than a "short."

Another measurement that can be made is the capacitance of the "Vibra-Bar®" transducer modules between the center conductor of the coaxial cable and housing ground. The capacitance of six "Vibra-Bar®" transducer modules should be about 24,000 mmfd. The capacitance of three "Vibra-Bar®" transducer modules should be about 12,000 mmfd. If the capacitance is much greater or much less than this value, it probably indicates trouble PZT stack or the electrode area and the technician should consult the factory.

The following applies to standard ultrasonic cleaning tanks only:

To replace a component, loosen the center bolt, remove the damaged part and replace with a new component. In replacing the component, be certain it is thoroughly clean on all surfaces, for even a "speck" of dirt can cause problems when the bolt is tightened. In replacing electrodes, use only electrodes obtained from UPC. Attachment of the wire to the electrode is critical. Tighten the bolt to 290 in. lbs. Be certain that the positions of all electrodes are at least 1/4" from any other point of assembly to prevent arcing. Also, be certain that the high voltage wires from the electrodes have extra insulation on them and that they do not touch any "ground" surfaces.

Warranty

Ultrasonic Power Corporation VIBRA-BAR transducer modules and the bond to the radiating surface are unconditionally guaranteed not to crack, depolarize, deteriorate or detach from the radiating surface for ten (10) years from date of shipment.

The radiating surface of the transducer is constructed of high quality stainless steel, but wear can result from cavitation erosion or chemical attack. This wear is excluded from the terms of this guarantee.

The Ultrasonic Power Corporation ultrasonic generator is guaranteed to be free from defects in workmanship and materials for a period of two (2) years from initial shipment date.

These guarantees are not applicable to equipment showing abuse, or when equipment has been used other than in accordance with the Manufacturer's instructions. Liability under this guarantee is limited to repair or replacement at Ultrasonic Power Corporation's expense, F.O.B. Ultrasonic Power Corporation service location. The nearest service locations shall be designated by Ultrasonic Power Corporation upon request.

Return of Equipment Policy

Please use the troubleshooting guide before contacting the customer service department. This will help in identifying the specific problem and expedite any repairs that may be needed.

All requests for repairs and replacements parts should be directed to the customer service department at Ultrasonic Power Corporation™, following the outlines procedure below.

1. Call the Customer Service Department at 815-235-6020 or 1-800-575-0168 Monday – Friday 7:00 A.M. to 4:30 P.M. Central Standard Time.
2. Please have the following information ready:
 - A. The make and model of the system.
 - B. The Serial Number of your system (can be found on the serial number plate).
 - C. The specific problem or concern.

If it is determined that the system needs to be returned for repairs, the Customer Service Representative will assign a Return Material Authorization number (RMA). Please maintain this number for your records as this number will be the number for future reference on the system during the repair process.

Packaging

Be sure to package the system so that the shipping process will not cause additional damage to the system.

Ultrasonic Power Corporation™ is not responsible for shipping damage on equipment returned to the repair facility. Damage that occurs from shipping is not covered by the systems warranty.

Important notice

BY RETURNING ANY MATERIAL TO ULTRASONIC POWER CORPORATION™, THE CUSTOMER OR THE CUSTOMER'S AGENT THUS CERTIFIES THAT ANY MATERIALS SO RETURNED, OR HAVE BEEN RENDERED, FREE OF ANY HAZARDOUS OR NOXIOUS AND/OR INFECTIOUS MATTER OR RADIOACTIVE CONTAMINATION AND ARE SAFE FOR HANDLING UNDER NORMAL REPAIR SHOP CONDITIONS. **DO NOT** RETURN ANY MATERIAL, FOR WHICH SUCH CERTIFICATION CANNOT BE MADE WITHOUT PRIOR APPROVAL FROM ULTRASONIC POWER CORPORATION™.

The return address should be as follows:

Ultrasonic Power Corporation

RMA# _____

239 E. Stephenson Street

Freeport, IL 61032

Date of Shipment: _____

Two Year Warranty Expires: _____

Ten Year VIBRA BAR Warranty Expires: _____



Please contact your Ultrasonic Power Corporation™ representative with any question regarding your Ultrasonic cleaning system.

