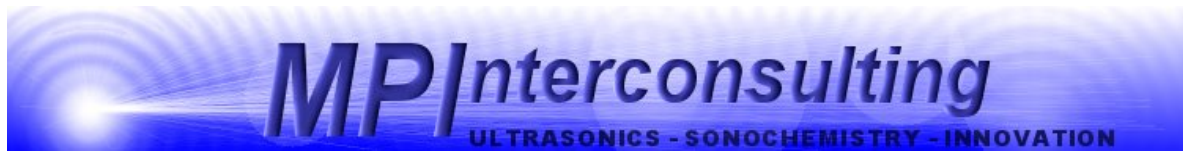


## Ultrasonic Cleaning: How to select the best option



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MPI offers solutions for liquid bath cleaning applications where it is important to deliver uniform and homogenous ultrasonic energy over a large radiating surface. Due to the large radiating surface of the active elements the surface power density is usually on the order of 0.5 to 2 Watts per square centimeter. Such power is providing very good cavitation effects and uniform power distribution throughout the bath or special cleaning chamber.

Through the use of standard plate mount transducers, submersible transducers, tubular arrays, or a single-transducer with an integrated resonating bar or tube, we can provide either standard bath systems or custom baths that adapt to existing wash processes. For special cleaning applications that require strong spot washing or cleaning the interior of very small holes or cavities, as found in small machined parts for the watch or telecommunications industry, we can offer a high power probe cleaning SONICATOR.

For standard cleaning applications we offer both fixed frequency systems and wideband frequency systems using our unique MMM technology. Advantages of our wideband MMM technology include:

- Complex MMM modulation techniques eliminate standing waves and dead zones to improve parts cleaning and reduced hot cavitation zones that can damage small and sensitive parts.
- New modulation techniques offer uniform distribution of ultrasonic energy and generate significant cavitation throughout the bath volume independent of water level.
- Wideband frequency modulations create a wide range of cavitation bubble sizes offering faster and more thorough cleaning of parts.
- Reduction of standing waves reduces transducer or tank pitting to extend operational life.
- Faster liquid conditioning and degassing of fresh cleaning solutions.
- More efficient cleaning method allows reduction or elimination of cleaning solvents and heating.
- Smooth power regulation 0% to 100% plus fully programmable Pulse Width Modulation options allow cleaning of fine and delicate or heavy parts with the same system.
- Adjustable inductive compensation, available on OEM modules, allows simple adaptability to 3rd party transducers and the possibility for field upgrades to existing systems.

MPI' liquid cleaning components are designed for heavy-duty industrial applications and can also be scaled to accommodate most any environment.

**Fixed Frequency Generators:** Standard power supply generators are available for up to 3,000 watt power output (adjustable 50% to 100%) and higher power systems are available on special request. Standard fixed frequency systems are available in 25 kHz, 30 kHz, and 40 kHz (custom frequencies may be discussed). Delivered power to the material under treatment is a function of the radiating surface connected to the transducer, generator power/amplitude adjustment setting, and the treated material density.



**MMM Generators (Multi-frequency, Multimode, Modulated):**




MMM generators deliver wide-band sonic and ultrasonic energy (ranging from infrasonic up to the MHz domain) through arbitrary shaped solid structures and thick or thin wall metal containers to address a variety of cleaning applications. The secret to MMM Technology is its ability to initiate ringing and relaxing, modulated, multimode mechanical oscillations including harmonics and sub-harmonics. MMM Technology is producing pulse-repetitive, phase, frequency and amplitude-modulated bulk-wave-excitation covering and sweeping an extremely wide frequency band. Such sonic and ultrasonic driving creates uniform and homogenous distribution of acoustical activity on a surface and inside of the vibrating system, while avoiding the creation of stationary and standing waves, so that the whole vibrating system is fully agitated. The system offers fine control from a programmable interface and produces high efficiency active power (0% -100%) available in a range from 100 W up to many kW.



**System Control:** Our Fixed Frequency and MMM Wideband Generators may be optioned for Front Panel Control, Removable Handy Panel Control, or Remote Electronic or PC Control.

**Converters/Transducers:** Our transducers are based on piezo-electric ceramic stacks and are designed for demanding ultrasonic cleaning applications.

**Acoustic Elements:** We offer a large variety of radiating elements that may be customized for a wide range of applications.

<ul style="list-style-type: none"> <li>• <b>Ultrasonic Bath:</b> Standard and custom ultrasonic baths constructed of stainless steel with integrated bottom or side wall plate converters. System power may range from 100 W up to many kW using Fixed Frequency or MMM wideband generators.</li> </ul>	
<ul style="list-style-type: none"> <li>• <b>Ultrasonic Plate Arrays:</b> Standard and custom ultrasonic plate arrays for custom stainless steel bath construction. System power may range from 100 W up to many kW using Fixed Frequency or MMM wideband generators.</li> </ul>	
<ul style="list-style-type: none"> <li>• <b>Submersible Ultrasonic Box Arrays:</b> Standard and custom size submersible ultrasonic box arrays constructed of stainless steel. System power may range from 100 W up to many kW using Fixed Frequency or MMM wideband generators.</li> </ul>	
<ul style="list-style-type: none"> <li>• <b>Submersible Ultrasonic Tube Arrays:</b> Standard and custom size submersible ultrasonic tube arrays constructed of stainless steel. These tubular systems radiate acoustic energy 360° around the total length of the tube and generate a high degree of effective cavitation. System power may range from 100 W up to many kW using Fixed Frequency or MMM wideband generators.</li> </ul>	
<ul style="list-style-type: none"> <li>• <b>Submersible Ultrasonic Bar Sonotrodes (Single Ended or Push-Pull Versions):</b> Standard and custom size submersible ultrasonic bar sonotrodes constructed of solid titanium. These bar systems radiate acoustic energy 360° around the total length of the bar and generate a high degree of effective cavitation. System power may range from 100 W up to 3 kW using Fixed Frequency or MMM wideband generators.</li> </ul>	

• **Submersible Ultrasonic Sonotrodes as Single Ended SONICATORS:**

For special cleaning applications that require strong spot washing or cleaning the interior of very small holes or cavities, as found in small machined parts for the watch or telecommunications industry, we can offer a high power SONICATOR.

In combination with our fixed frequency generators we offer a wide range of acoustic elements to meet all of your high power Sonicator / Homogenization needs. Using advanced digital generator technology we have set a new standard in high power liquid processing.

The new generator design offers new capabilities in tracking shifts in the center operating frequency. Normal generators are unable to manage even minor shifts (30 Hz to 100 Hz) when probes become de-tuned due to cavitation wear. Our systems can track simple probes over a very large frequency range of  $\pm 500$  Hz, a 1,000 Hz window in some cases. That means extended probe life, more reliable operation, and less maintenance.

Our converters feature a sealed front mass interface with upper air cooling ports for continuous operations. Boosters are available in titanium or aluminum, with or without mounting rings. Probes may be constructed to your specifications. Standard probes are made of high grade titanium in diameters up to 60 mm

Applications include:

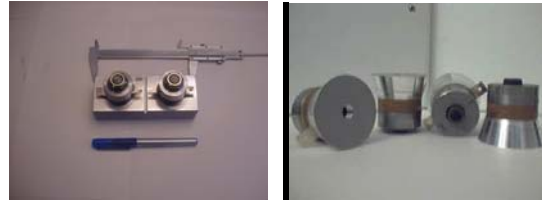
- Ultrasonic Cleaning
- Sonoreactors
- Homogenization
- Emulsification
- Dispersion of solids in liquid
- Disruption of bacterial cells, viruses and spores
- Acceleration of chemical and enzymatic reactions
- Liquids degassing
- Liquid Processing in static or flow cell chambers.
- Laboratory or industrial applications.



- **Pipe Clamp-On:** Custom clamp systems using one or more ultrasonic converters may be externally attached to stainless steel or titanium pipe or tube segments. The clamped segment becomes the radiator of Ultrasonic energy to material internal or external to the pipe. These systems simplify treatment of materials in flow through, high temperature or pressurized systems. System power may range from 100 W up to 1,200 W using MMM wideband generators.



- **3<sup>rd</sup> Party Transducers:** Our MMM generators offer great flexibility in adapting to other supplier's transducers or ultrasonic baths. We can make inductive and frequency adjustments in the field to turn ordinary ultrasonic baths into super cleaning systems.



**Cleaning System Design Services:** We provide consulting and custom design services to aid our clients in construction of cleaning systems for special applications.