

Ultrasonic Extrusion and Drawing

- Ultrasonic **Plastic Extrusion**
- Ultrasonic **Metal Extrusion**
- Ultrasonic **Glass Extrusion**
- Ultrasonic **Food Product Extrusion**

- Ultrasonic **Tube Extrusion**
- Ultrasonic **Profile Extrusion**
- Ultrasonic **Wire Drawing**
- Ultrasonic **Glass Drawing**
- Ultrasonic **Fiber Optic Drawing**

MPI offers the industry's one and only effective solution for ultrasonically assisted extrusion and drawing applications. Our patented MMM ultrasonic generators have the unique ability to apply high power ultrasonic energy to large mechanical systems like extruder heads and drawing dies.

In these applications the key benefits to ultrasonic vibrations are:

- Friction reduction between the tool and the extruded or drawn material
 - Improved Material Flow
 - Reduced Pressure
 - Faster Extrusion or Drawing
 - Less breakage in a drawing process improves production yield.
 - Improved surface quality of extruded or drawn material.
- In some processes the material structural characteristics may improve.

The ability to implement such systems in production environments has been restricted due to limitations of conventional ultrasonic technology. Our MMM solution is a breakthrough in this regard and allows us to greatly expand and create new applications.

Key benefits to the MMM ultrasonic technology are:

- Can stimulate wideband (sonic to megahertz) acoustic activity throughout the extruder head or die greatly improves the process.
- MMM eliminates standing waves, the areas of low and high acoustic energy, as seen in fixed frequency systems.
- MMM technology will effectively drive most any size tool or mechanical systems.
- Wave-guides connecting the transducer to the tool can be extended up to 3 meters for very high heat environments or unusual applications requiring the transducer to be located away from the working tool.



Example: Plastic Extruder Head



Tube Extruder Die shown with dual driving transducers

Ultrasonically Assisted Tubes Drawing



System Elements:

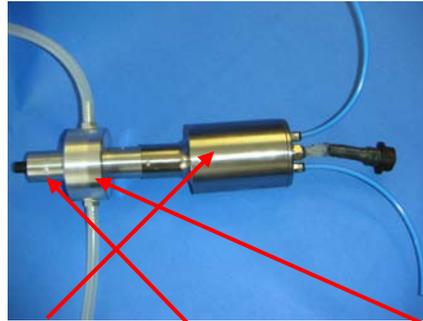
- **Drawing System (Die + Converters)**
- **MMM Ultrasonic Generator**
- **Personal Computer**

The system can operate with only one converter fixed to the Die, or if it is really necessary, then the second converter could be attached. The disadvantage of having 2 converters fixed to the same Die is that if settings are not optimally made, one of converters would start producing thermal dissipation and in some cases cause destructive mechanical interferences with vibrations produced by the second converter. It is recommended to try operating the tubes drawing Die only with one converter.

High Power Piezoelectric Converters with Water Cooling



High power converters with water-cooled housings



Converter + Waveguide + Water Jacket



High power converters with different inlet-outlet tube fittings



Water Jackets and waveguide



High power converters with water-inlet-outlet tubes



The only acceptable way of elements connecting (using 2 of spanner wrench keys)



Water jacket with inlet-outlet silicone tubes



Do not fix anything to the converter housing (the housing is in elastic connection with the converter).

Generator and System Initial SETUP

1. Before you start operating the System, make all mechanical connections properly. Do not attach anything to the water-cooling converter housing during transducer and wave-guide fixation (screwing), since converter housing is not rigidly fixed to the converter (there is only the flexible silicone connection).
2. Connect water supply to the converter housing and to water-cooling jacket.
3. Connect high frequency converter cable to the ultrasonic MMM generator.
4. Connect generator to a PC (using RS485/232 interface link).
5. Connect all main supply power lines.

Before operating the system be sure to read the Generator Manual, which can be found on the following address:

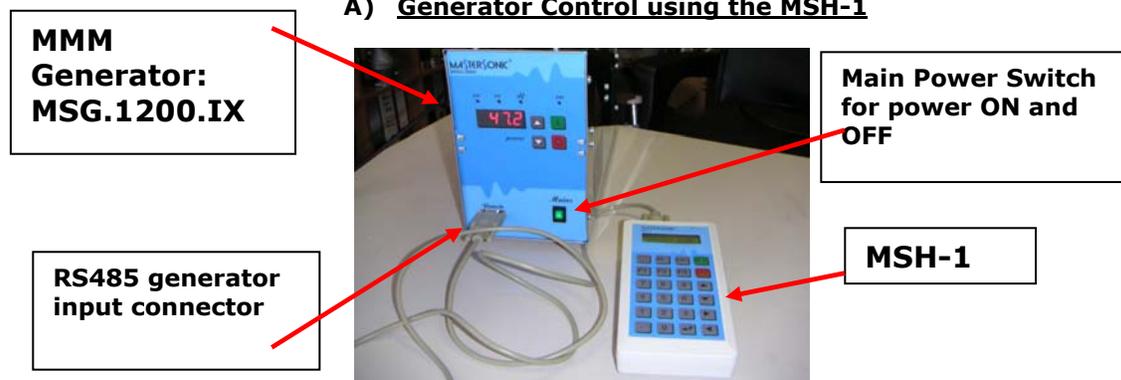
http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/um_msg_ix_v6.pdf

The system can be controlled on two different ways:

- A) Using the Handheld Control Unit MSH-1 (Remote Control Panel),
or
- B) Connecting the generator to a PC serial port and controlling the system operation from the PC with the provided interface software.

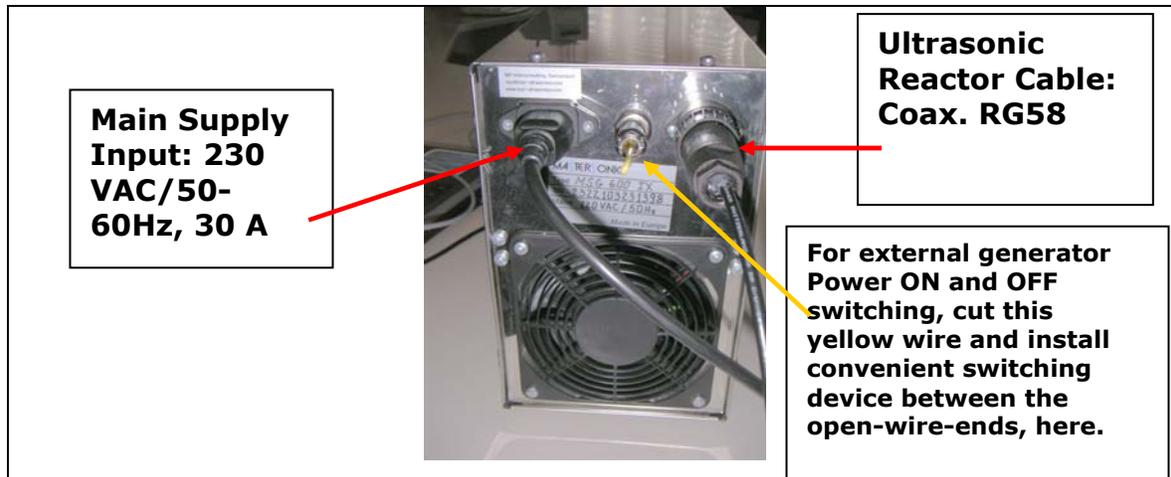
Both options will produce the same results, but using the PC and control software is presenting much more flexible and comfortable way with additional visual and real time information about all operating system parameters.

A) Generator Control using the MSH-1



1. Plug-in the connectors between the Handheld Control Unit MSH-1 and RS485-connector on the front panel of the MSG.1200.IX generator. Handheld Control Unit MSH-1 will operate taking the power directly from the generator (no need for external DC power supply). See instructions regarding how to use MSH-1 on the system manual pages 26 to 29:

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/um_msg_ix_v6.pdf



2. Connect the Ultrasonic Reactor and Main Power Supply cable to the rear panel of the MGG.1200.IX generator. Attention: Apply European 230 VAC, 50/60 Hz, 30 Amp. input power line. When using step-up or step-down transformer, use a 5 kW transformer (to have large safety margin for pulsed-power operations). See instructions on the system manual pages 8, 9 and 10:

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/um_msg_ix_v6.pdf

Then Switch ON the Main Switch on the generator front panel: See the picture from the step 1.

Comments: Main Supply voltage variations between 220 VAC and 235 VAC are acceptable. Do not use 208 VAC, 60 Hz, because the system power would be reduced, and internal drivers of the MSG.1200.IX would not operate properly.

B) Generator Control using the PC serial (RS) port



3. Switch-ON your PC and Download the generator control software file from the following address:

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/inox%20control%20panel-17.5-28khz.exe

and then place it on the PC Desktop (the first screen you will see on your monitor, after initiating MS Windows, before using any software). You will see on your PC



desktop the following **Integrated Circuit Icon**: **Inox.exe** . Later, by clicking on that

icon you will be able to activate the interface software for MSG.1200.IX control. Wait with software activation until you finalize the step 4. (see below).

4. Take the serial interface MMM-Link-2339 (or MSA2218, RS485 Adapter) and plug its cable-connectors between the PC serial port and RS485-connector on the front panel of the MSG.1200.IX generator (see pictures in step 3.). See instructions regarding how to use MMM-Link-2339 on the system manual (pages 30 and 31):

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/um_msg_ix_v6.pdf

As noted in the step 2. The Main power supply and Reactor cable should be connected to the rear panel of the Generator.

Do not open the generator box. The system is factory regulated in the best possible way, so that you will be able to control your system from the MSH-1 or from the PC interface software.

5. Activate the Generator using the MSH-1 (option A)): See instructions regarding how to use MSH-1 on the system manual pages 26 to 29:

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/um_msg_ix_v6.pdf

Or you can also activate and control the generator by clicking on the interface-



software icon: **Inox.exe** (option B)). See instructions regarding how to use software control on the system manual pages 30 and 31:

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/um_msg_ix_v6.pdf

6. Apply the following, initial generator settings (before activating the generator START button, or before sending the ultrasonic power to the reactor):

- a) Read pages 13 and 14 of the following document:

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/um_msg_ix_v6.pdf

- b) Set the Generator Power to not more than 30% of the total power,
- c) Set the MAX current to minimum,
- d) Set PWM period to: 0.010 s,
- e) Set PWM ratio to: 100%,
- f) Read and apply the specific document with the **best settings for your Ultrasonic System** that will be sent to you by MPI.

Example of optimized generator settings (will be explained later in details):

Frequency = 18.890 kHz

Sweeping = 0.299 kHz

Max current = 3A

Power = 50%

PWM period = 0.01 s

PWM ratio = 100%

FSWM range = 0.449 kHz

FSWM ratio = 50%

Q = 237 Freq. correction = 255 Amplitude factor = 255

Example of Appropriate Parameters Setting for Ultrasonic Tubes and Profiles Drawing Operation

The Drawing System should be in its operational position with all components properly connected.

Connect the water cooling system and start water flow through water jackets and transducer cooling-housing.

Connect the generator to ultrasonic reactor converter/s.

Connect the PC Interface Adapter between the PC serial port and the RS485 connector on the generator front panel

Provide mains power to the generator and switch on the generator at the front panel.

Start the MMM PC Interface Control Software. All initial settings will be made using the PC Interface Control Software (before activating the System).

Do not activate the generator to produce an ultrasonic signal. Do not press the Start button provided by the software.

Click on the Power Tab at the top of the PC Interface Control Software and set the input Power (by moving the sliding bar to the left position) to max. 30%.

This example is only applicable to the Ultrasonic Equipment type delivered with these instructions. This procedure will allow you find the best operating conditions quickly without wasted efforts and without making improper settings that could harm the system. You may make slight parameter variations within the given range. When making new settings and System testing (with new mechanical loading), please reduce the power to 30% and first search for the best operating conditions under low power.

After introducing all initial settings as detailed below you may press the software **Start** button. The Generator will start

producing ultrasonic power and the System will start oscillating. You may continue adjusting generator settings when the System is operating.

Monitor the Input DC Power reading (lower right section of the software screen), which is indicating the input power level.

Systematically **repeat** the fine tuning process for all parameters (slightly varying them within the specified ranges) until reaching the highest input DC Power level.

When you reach the maximal input power, memorize the parameters clicking the **Write** button on the control software window. All parameters will be stored in an active memory. Now you can start active drawing tests. After switching-OFF the system (pressing the software **Stop** button), and after re-activating the generator for subsequent tests, you can recall all previous stored parameters by clicking on the **Read** software button. These parameter settings will be read from the generator memory and displayed on the PC control software window.

[Click on the DDS page tab at the top of the PC Control Panel Window:](#)

Make settings:

Frequency:

Preliminary testing shows an efficient central frequency range for the mechanically non-loaded System between 18.690 kHz and 18.890 kHz. Click on the Frequency DDS slide bar and set to 18.500 kHz to start. Using your keyboard Left/Right Arrows or your mouse scroll wheel slowly change the frequency in 10 Hz steps up to 18.890 kHz to find the best central frequency point for every new test environment. Experiment until reaching the highest input power by noting the DC Power indicator in the lower right section of the PC control window. As you pass through the best central operating frequency the higher system efficiency is exhibited by improved DC Power delivery.

Sweeping:

Set from 0.100 kHz to 0.400 kHz (as above find the best interval by slowly sweeping across this defined range. The Best setting is when the input system DC Power is maximized, providing that System is producing uniform and continuous acoustic sound, without whistling, impulsive, non-periodical and cracking noise).

[Click on the Power page tab:](#)

Make settings:

[Power:](#)

Set 30% as the starting point. After experimenting in a real operating regime you may increase the power to 70%. Note that System input power as shown by the DC Power reading on the lower right section of the software screen does not reach more than 600 W. 600 W is the power limit for this mechanical system. Increasing power over this limit would mechanically over-stress the System and could cause damage. Ultrasonic generator can deliver much higher power, but the mechanical system is not able to accept more than 600 W.

[MAX current:](#)

Set to 3 A. If testing with some other liquid (not water), initially set this current limit to 2 A. After a period of safe operation you may gradually increase the setting to 3 A. This is the safe operating margin for your system.

[PWM period:](#)

Set at its minimum 0.010 s setting to start. When the PWM ratio is set to less than 100%, you may experiment by increasing it until 0.100 s).

[PWM ratio:](#)

Keep at 100% until more experience is gained in using this system. When you are fully aware of all parameters and safe operation conditions you may reduce the PWM ratio to 20% to realize low frequency pulsing (ON – OFF) regimes. For tubes and profiles drawing it is recommendable to keep PWM ratio continuously at 100%.

[Click on the FSWM page tab:](#)

Make settings:

[FSWM range:](#)

Set between 0.000 kHz and 0.450 kHz (start with 0.000 kHz, and later experiment by going higher until reaching maximal input DC Power).

[FSMW ratio:](#)

Set between 50% and 90% (start with 50%). Experiment with different values, until getting the highest input DC Power. In most of cases 50% is the very good choice.

FSWM period:

Set between 0.020 s and 0.100 s. Start testing with 0.020 s and higher to reach the highest input DC Power.

[Click on the DMMM page tab:](#)

Make settings:

Q factor:

Set between 100 and 240 (start with 100, and later go higher). For processing soft materials, Q-values should be higher. For hard and high-friction materials, Q-values should be lower. Experiment with different values, until getting the highest input DC Power.

Frequency correction:

Set between 150 and 255 (start with 150). Experiment with different values, until getting the highest input DC Power.

Amplification factor:

Set between 100 and 255. Start testing with 100 and later adjust until getting highest input DC Power.