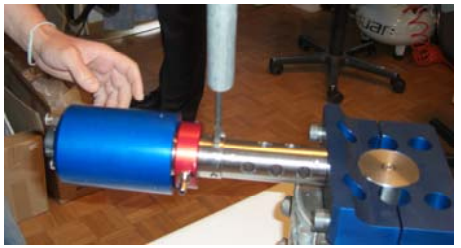
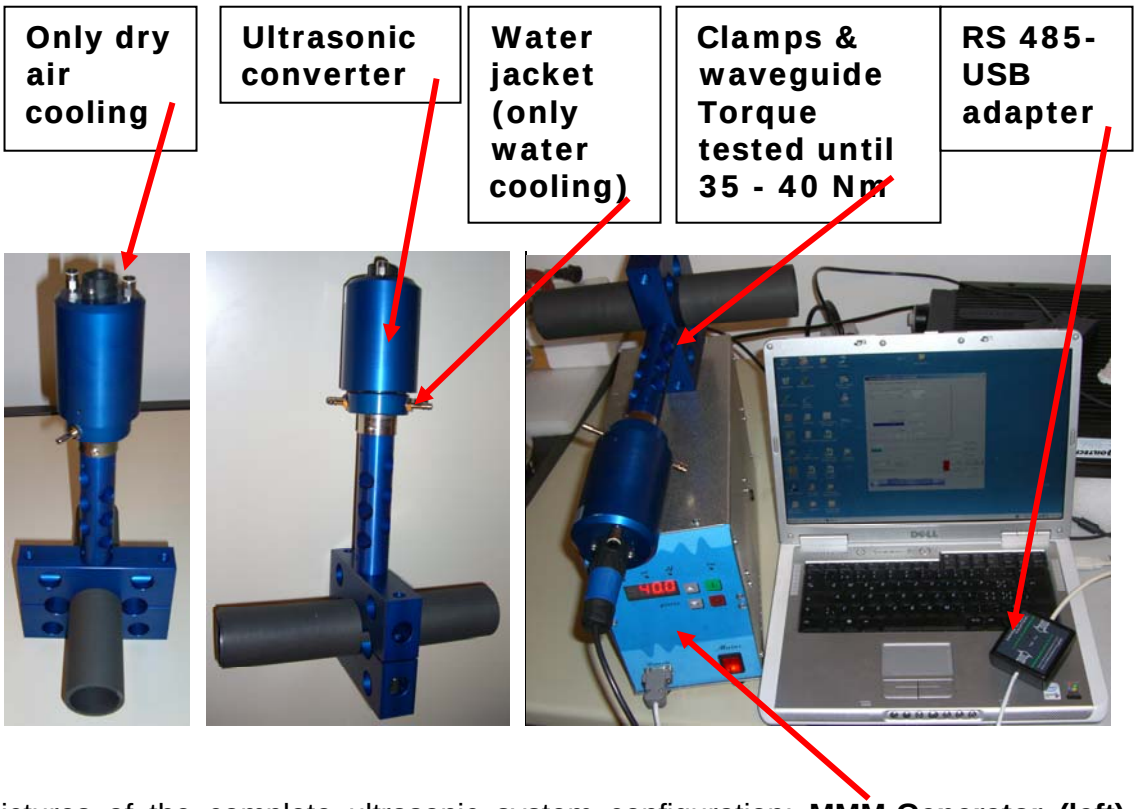
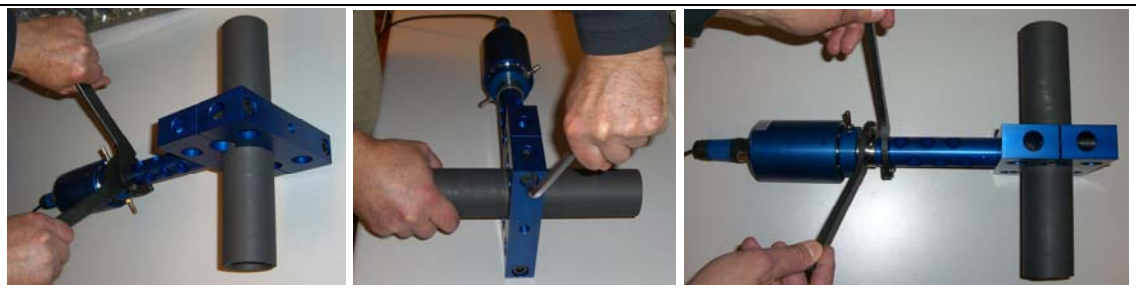
ULTRASONICALLY ASSISTED EXTRUSION

Apply only proper fastening tools (see below): Torque, 35 to 40 Nm





Pictures of the complete ultrasonic system configuration: **MMM-Generator (left)**, Converter-Wave-guide-Water-jacket-Aluminum block and PC. PC Interface RS485 to USB (or RS232) is connected between the PC and MMM generator.



Pictures presenting ultrasonic converter with water jacket (upper part), wave-guide (middle part) and aluminum clamps on the graphite tube (bottom).

Client should use his own PC. Software **mpi_ix.exe** for the MSG.1200.IX should be installed (download software here:

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/msg-ix-generators/latest/).

Do not forget to install drivers (software) for USB, Generator-to-PC-interface. Drivers can be downloaded from here:

http://www.mastersonics.com/documents/mmm_basics/mmm_power_supplies/rs485-USB-adapter-software/

Or, find, download and install latest drivers here:

http://www.ftdichip.com/FTDrivers.htm

The idea behind making holes in the vibrating aluminum clamps is to make such aluminum blocks more flexible, more elastic and to reduce metal rigidity in order to facilitate vibrations and increase amplitude on the contact surface with the graphite tube. Every circular hole (in clamps and waveguide) is reacting as a kind of mass-spring oscillator (with relatively high mechanical quality factor), this way facilitating complex vibration of the aluminum clamps.
Converter should be strongly fixed (by screwing) to one side of aluminum clamps (always using the waveguide between the converter and aluminum clamp), this way taking care that vibrations on the graphite tube will be uniformly distributed and maximized.

In operation, the biggest care should be taken to keep constant low temperature on the ultrasonic converter (always below 50 degrees Celsius). Water jacket should be connected to a water flow in order to keep wave-guide cold and to stop heat penetration from aluminum block towards the converter. Certain forced air flow should be realized inside of the housing of the ultrasonic converter in order to keep converter cold (using pressurized, filtered dry air: dust particles smaller than 5 micrometers).

Usually, when generator settings are well made, when mechanical fixation is sufficiently strong, and when aluminum clamps are properly fixed, converter will not generate heat, or better to say that temperature on the converter body would increase very slowly. Significant heating of the converter parts is always indicating that MMM generator settings are not well made, or that there is a problem in mechanical assembling (parts are not strongly fixed). In such situations, stop the generator, reduce the operating power and search for new settings (later you will see what are good settings found in MPI lab).

When new settings are found, ultrasonic power could be increased. Aluminum clamps and graphite tube will take so much of ultrasonic power as acoustic loading conditions would allow. Generator is able to deliver 1200 Watts (and converter can accept 3000W), but in most of situations (like this one you have) aluminum clamps would take significantly less ultrasonic power because of acoustical loading conditions, acoustic impedances, geometry etc. In your case you could expect operating power levels which are in the range of 100 W, maybe 200 W.

You should experiment (with low power settings; -around 20%) in no-load open-air conditions in order to find the best generator settings and best loading of aluminum clamps and graphite tube.

All metal-to-metal joints (contact surfaces) realized by screwing should be clean, without any particles and dry (no water between contact surfaces) in order to avoid bad acoustic coupling and destruction of contact surfaces. If you intend to make new aluminum parts, the best aluminum for ultrasonic applications is AL-7075.

After creating regular operating conditions (vibrating graphite tube with some powders inside), generator settings should be again readjusted, since initial mechanical oscillating system would change by presence of different loading conditions and different added masses.

Do not apply maximal power settings of the generator, because after certain power level, increasing the power would start producing negative effects, non-linear oscillations, clipping and heat (and graphite tube will brake).

For putting the generator in operation and making proper generator settings (learning process), please download the instructions here (very important, read carefully, go step by step, do not neglect something):

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/msg-ix-generators/latest/instructions-for-first-time-users-ix-generators.pdf

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/msg-ix-generators/latest/ix-single-converter-settings.pdf

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/msg-ix-generators/latest/ix-single-converter-settings.pdf

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/msg-ix-generators/latest/um_msg_ix_yf_2005.pdf

Read also all documents from here:

http://mastersonic.com/documents/mmm_basics/mmm_power_supplies/msg-ix-generators/latest/

If under certain settings generator starts going into overloading state (stopping operation), reduce the power and slowly and systematically change some of setting conditions. Do not force repeatedly the generator to go often in overloading conditions, because this way you would damage the generator, converter and/or mechanical parts.

Above given instructions are generally valid for all MMM and IX generators (like your generator). Details regarding settings and optimal conditions would always be different, depending on operating conditions, geometry of oscillating objects, loading conditions etc. Here given general instructions are good to get basic knowledge and experience regarding how to operate MMM generator and how to make setting, but in client's real operating conditions, **the same, here given instructions should be applied creatively and with intellectual flexibility (meaning client should find**

new set of best operating conditions that are similar, but maybe not identical to here described settings).

Good initial generator settings for oscillating aluminium blocks (for vibrating given graphite tubes) in no-load conditions, found in MPI laboratory during initial testing are (see below):

DDS,
Frequency: Best operating frequency in this case is 18.800 kHz, when operating in no-load conditions. Experiment carefully with fine frequency tuning between 18 and 20 kHz...

Sweeping: Keep at 0.020 kHz. Later experiment using other values (always below 0.100 kHz). In this case lower values are more convenient (better results)

POWER: 10% to 30%. Start testing with low power (example: 15%) in air, no-load conditions (and later increase to a maximum value around 30% in operating conditions). Work at minimum power that is producing good results, linear, smooth and stable oscillations, and minimal heating on the converter parts. In loaded situation power should be readjusted.

Current: set max. current to 3 or 4.5 A (this is internal electronic protection).
PWM-period 0.010s, PWM-ratio 100% (period irrelevant when ratio = 100%).

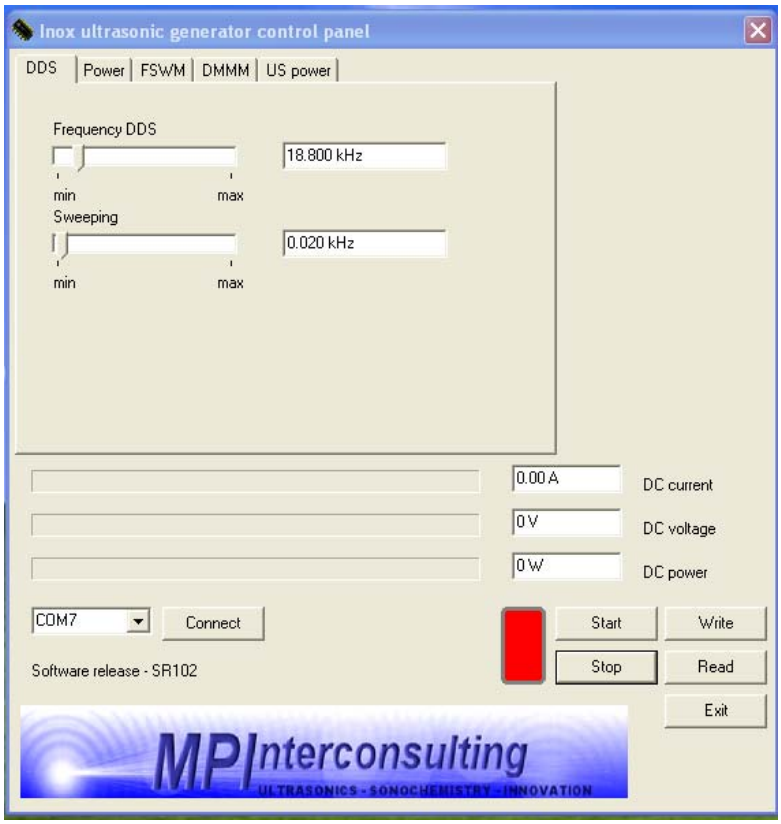
FSWM: best 0.157kHz, Test between 0.1 kHz and 0.3 kHz. (Later experiment with other values),
FSWM-ratio: Keep always 50%,
FSWM-period: keep always 0.010 s.

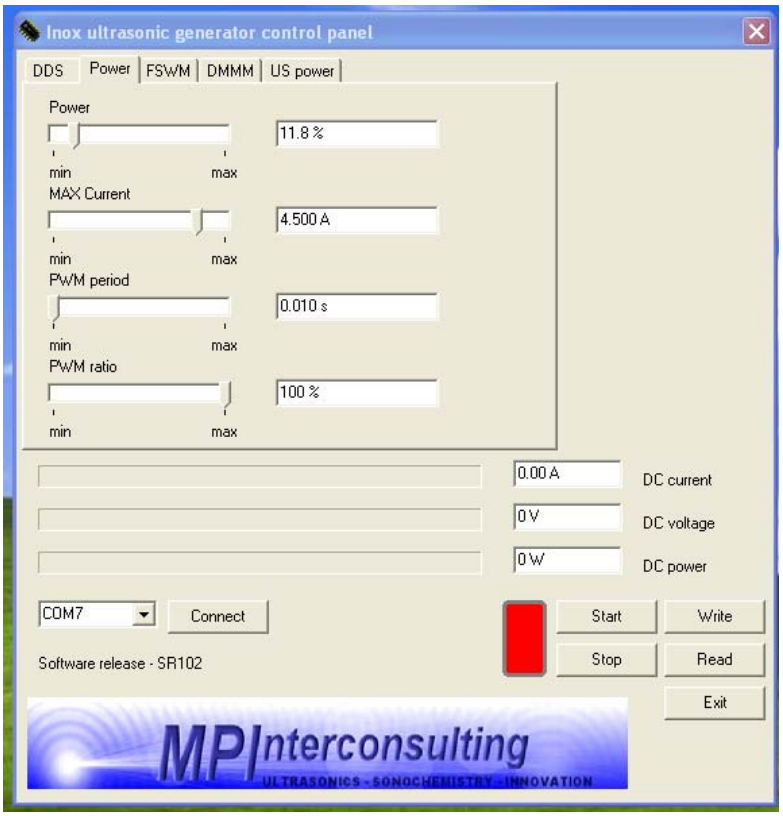
DMMM,
Q-factor: In this case set to 0 (zero). Test from 20 to 50 (also good until 100),

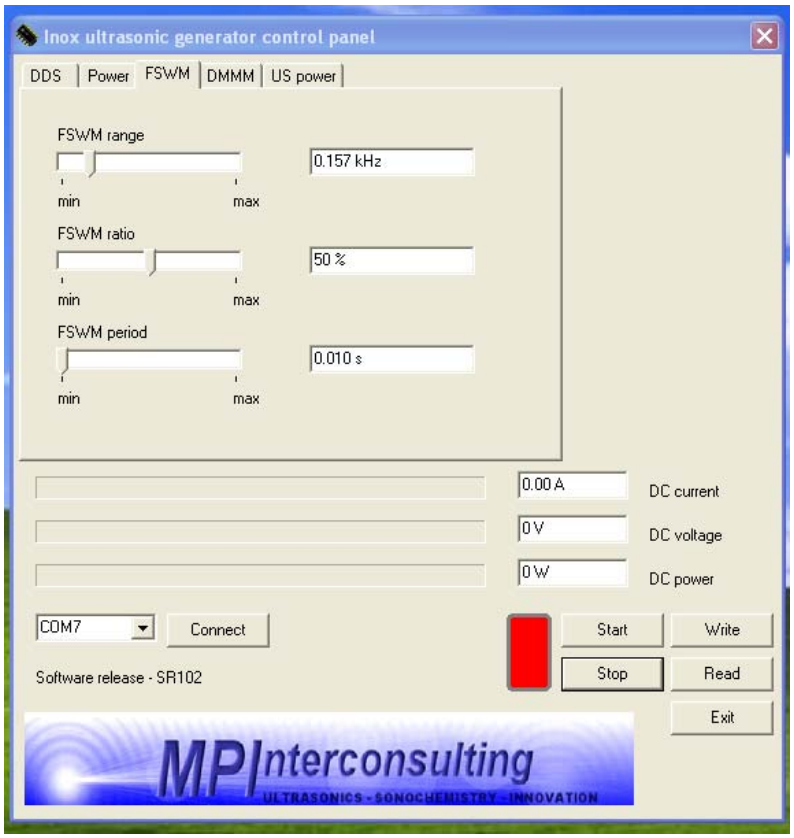
Frequency correction: Maximum 130. Test other values below 130.
Amplification factor: In this case set to 0 (not recommendable to go higher).

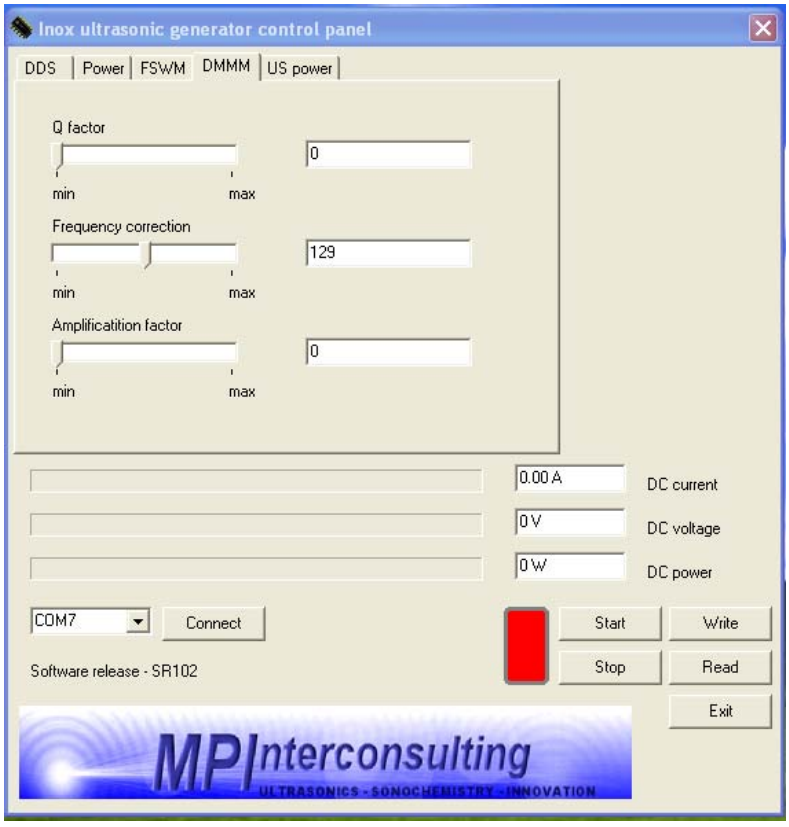
Ultrasonic power: set to 500 (also good below 500). Carefully and prudently; -if you increase until 999 Work at minimum power that is producing good results, linear, smooth and stable oscillations, and minimal heating on the converter parts.

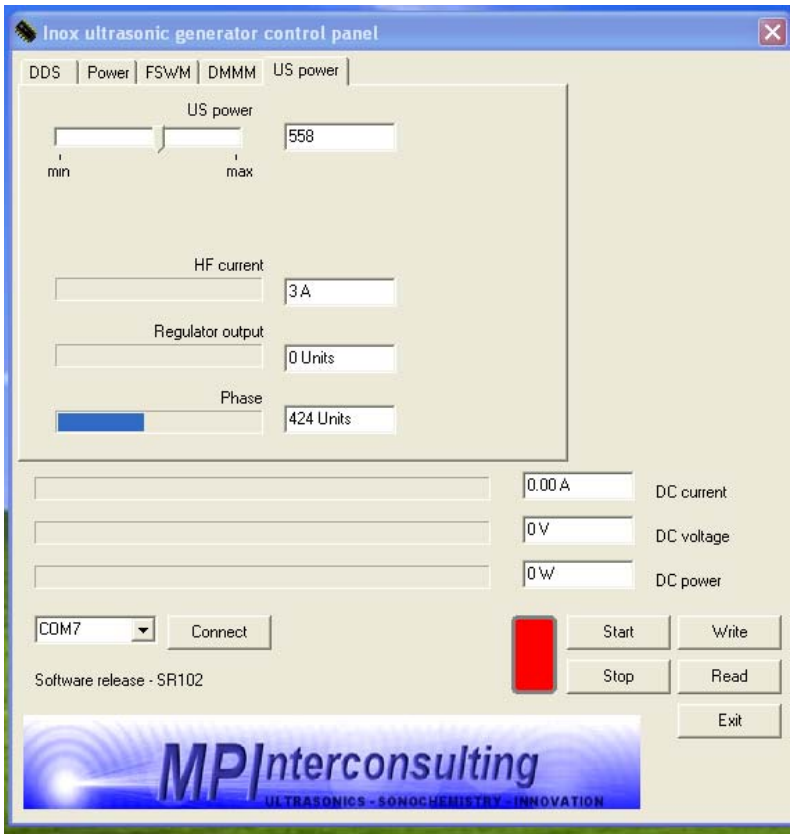
In loading, operating conditions, above-given initial settings should be readjusted to rich maximal ultrasonic activity (start the tuning process again, slowly and step by step).


Inox ultrasonic generator control panel
DDS
Power
FSWM
DMMM
US power
Frequency DDS
18.800 kHz
min
max
Sweeping
0.020 kHz
min
max
0.00 A
DC current
0 V
DC voltage
0 W
DC power
COM7
Connect
Start
Write
Stop
Read
Exit
Software release - SR102
MPInterconsulting
ULTRASONICS - SONOCHEMISTRY - INNOVATION


Inox ultrasonic generator control panel
DDS
Power
FSWM
DMMM
US power
Power
11.8 %
min
max
MAX Current
4.500 A
min
max
PWM period
0.010 s
min
max
PWM ratio
100 %
min
max
0.00 A
DC current
0 V
DC voltage
0 W
DC power
COM7
Connect
Start
Write
Stop
Read
Exit
Software release - SR102
MPInterconsulting
ULTRASONICS - SONOCHEMISTRY - INNOVATION


Inox ultrasonic generator control panel
DDS
Power
FSWM
DMMM
US power
FSWM range
0.157 kHz
min
max
FSWM ratio
50 %
min
max
FSWM period
0.010 s
min
max
0.00 A
DC current
0 V
DC voltage
0 W
DC power
COM7
Connect
Start
Write
Stop
Read
Exit
Software release - SR102
MPInterconsulting
ULTRASONICS - SONOCHEMISTRY - INNOVATION


Inox ultrasonic generator control panel
DDS
Power
FSWM
DMMM
US power
Q factor
0
min
max
Frequency correction
129
min
max
Amplificatition factor
0
min
max
0.00 A
DC current
0 V
DC voltage
0 W
DC power
COM7
Connect
Start
Write
Stop
Read
Exit
Software release - SR102
MPInterconsulting
ULTRASONICS - SONOCHEMISTRY - INNOVATION


Inox ultrasonic generator control panel
DDS
Power
FSWM
DMMM
US power
US power
558
min
max
HF current
3 A
Regulator output
0 Units
Phase
424 Units
0.00 A
DC current
0 V
DC voltage
0 W
DC power
COM7
Connect
Start
Write
Stop
Read
Exit
Software release - SR102
MPInterconsulting
ULTRASONICS - SONOCHEMISTRY - INNOVATION