



MASTERSONIC MMM - 4S SONIC & ULTRASONIC POWER SUPPLY

SYSTEM OPERATION MANUAL

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1. SYSTEM SAFETY

Read this manual thoroughly and follow all directions to assure maximum safety during operation.

- Installation of the MasterSonic (generator/power supply) and associated transducers, the “Mastersonic System”, is to be performed by qualified technical personnel only.
- The Mastersonic System is an electro-mechanical device that under certain circumstances could present an electrical shock hazard to the operator.
- The MasterSonic System should only be used and operated by properly trained and qualified technicians.
- Qualified technicians licensed by the manufacturer should only perform servicing of the Mastersonic System.
- Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous exposure to ultrasonic energy.
- To avoid electric shock, do not remove the case covers from the Mastersonic System. There are no user-serviceable parts inside any of these devices.
- Plugging the Generator unit into a socket that supplies improper voltage may cause the Generator to malfunction or create a shock or fire hazard.
- Proper system grounding cannot be insured unless unit is connected to properly wired three prong 220 - 230 VAC single-phase outlet with a sufficient current rating.
- Do not remove the grounding prong on the line cord plug.
- The Generator Electrical Supply cord should not be plugged into a device (e.g. “power strips”, “gang plugs”, etc.) other than an industrial grade wall socket. Such other use could cause significant changes in voltage that could result in an electrical fault indication. This condition may occur even though other equipment plugged into multi-outlet sockets continues to operate.
- Do not restrict airflow to the MasterSonic System by covering or enclosing in a sealed housing while in operation. Airflow must circulate through the unit during operation to facilitate proper cooling of electronic components.
- Do not place Generator on towel, foam or other soft surface since the material may block air vents. Blocking vents may cause Generator to overheat and malfunction or create a shock hazard.
- Do not expose or immerse the MasterSonic System or the transducer in water or liquids. The system is not sealed against liquids and exposure may result in damage to the equipment, create a shock hazard, or fire hazard.

1. SYSTEM SAFETY

- Due to the general operating principles of the MasterSonic System and ultrasonics, this equipment is not suitable for use in environments where danger of explosion exists.
- The Generator should not be turned on until the Transducer Cable has been connected to both the Generator and Transducer. Otherwise, damage to the Generator may result.
- When ultrasound output power is on, do not touch the transducer, booster, sonotrode, waveguide, or any device directly connected to these components; doing so may result in injury.
- Ear protection during operation of the system is highly recommended. Do not position the transducer, booster, sonotrode, waveguide, or any device directly connected to these components near the technician or operators ears. The operating frequency of the MasterSonic System is below, within, and above the range of human hearing, and emits acoustic energy. Do not activate the system if system components are within 4 feet (122 cm) of the ears of technician or operators.
- If one of the MasterSonic fault indicators illuminates, promptly suspend operation. Turn the ultrasonic power switch (Square Red Button on front panel of Generator) to the off position. Verify all components are securely connected and adjust system parameters to accommodate the load before resuming operation.

2. SYSTEM SET-UP

CAUTION: Do not place Generator on towel, foam or other soft surface that may block generator air vents. Blocking any vents may cause the Generator to overheat, malfunction, or create a shock hazard.

CAUTION: Plugging the Generator unit into a socket which supplies improper voltage may cause the Generator to malfunction or create a shock or fire hazard.

CAUTION: The Generator should not be turned on until the Transducer Cable has been connected to both the Generator and Transducer. Otherwise, damage to the Generator may result.

CAUTION: The Generator Electrical Supply cord should not be plugged into a device (e.g. “power strips”, “gang plugs”, etc.) other than an industrial grade wall socket. Such other use could cause significant changes in voltage that could result in an electrical fault indication. This condition may occur even though other equipment plugged into multi-outlet sockets continues to operate.

2.1. Mains Power Connection:

Verify that the Mains Power Switch on the front panel of the Generator is in the “OFF” position. Plug the female end of the supplied line cord into the Mains Power Supply Connector in the rear of the Generator. Plug the other end of line cord into a properly grounded three prong 220 VAC (single phase) socket receptacle. MasterSonic systems with output power up to 3,000 Watts require a mains power circuit with a fuse rating of at least 10 Amps.

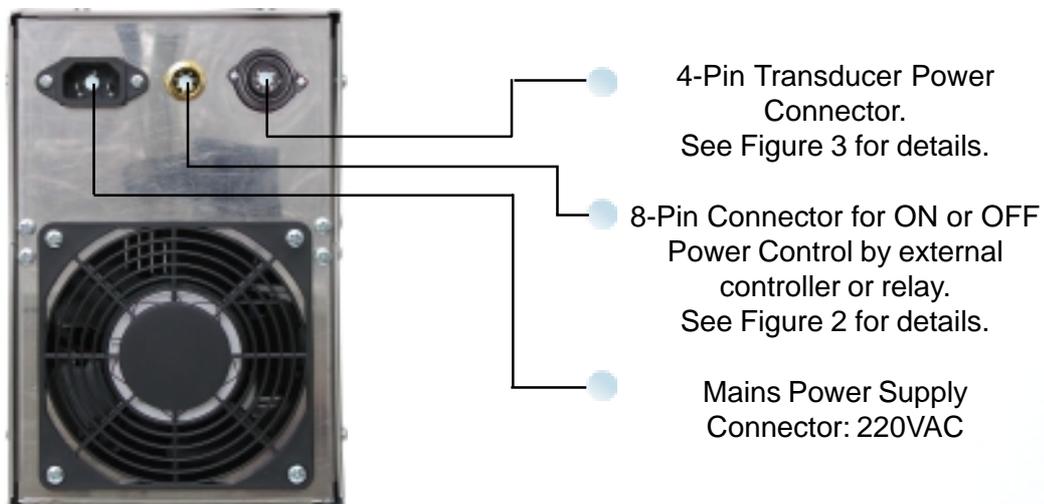


Figure 1. Back Panel Connectors

2.2. External On/Off Power Control:

The 8-Pin connector in the center position of the back panel may be wired for external On/Off Generator Power Control by remote controller or relay.

2.2.1. If external control is not desired Pins 1 and 2 must be connected to operate the generator with the front panel On/Off buttons. This is the MasterSonic Generator factory default setting. No action is necessary for normal operation of the system

2. SYSTEM SET-UP

2.2.2. For external control Pins 3 and 4 should be wired to a controller or relay that will control opening (Power OFF) and closing (Power ON) contact of these two pins.

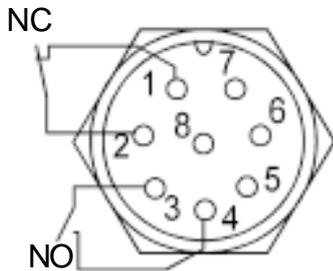


Figure 2 Connector for external ON/OFF Power Control

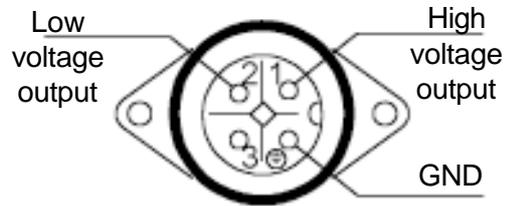


Figure 3 Transducer power connector

2.3. Transducer Power Connection:

The 4-Pin connector in the right position of the back panel is used to supply ultrasonic power to the system transducer.

CAUTION: The MasterSonic System should only be operated with the supplied transducer and cable.

2.3.1. Thread the supplied ultrasonic power cable into the transducer connector by hand until snug.

2.3.2. Thread by hand until snug the other end of the ultrasonic power cable onto the MasterSonic 4-Pin power connector located on the back panel.

2.4. Waveguide and Accessories Mounting:

CAUTION: Ensure all connections and mating surfaces are clean and dry before assembly.

Use the supplied studs to interconnect the mechanical components. All components should be threaded by hand until snug, DO NOT force the threads, they must turn in smoothly all the way until the mating faces touch. Use two open end pin wrenches and make final tightening.

As depicted in Figure 4 the Wave Guide or Booster should be connected to the transducer tip. Accessories such as the stainless steel cup are connected to the opposite end of the waveguide_or Booster.

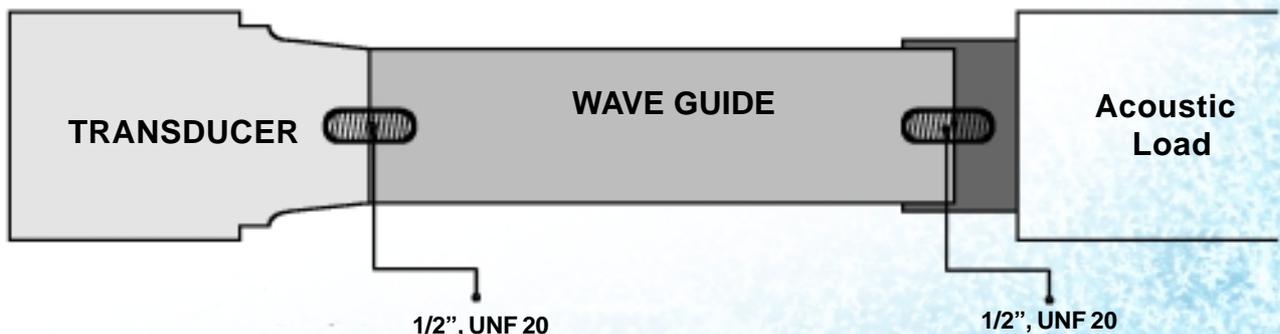


Figure 4 System Assembly

3. FRONT PANEL OPERATION

3.1. Mains Power Switch:

The green colored Mains power switch controls all electrical power to the system.

3.2. Ultrasonic Power Control Buttons:

3.2.1. Ultrasonics Power ON (green button)

3.2.2. Ultrasonics Power OFF (red button)

3.2.3. Ultrasonics Power Level UP (grey up arrow button). Press to increase power level.

3.2.4. Ultrasonics Power Level Down (grey down arrow button). Press to decrease power level.

3.3. Ultrasonic Power Level Display:

The red LED display indicates the ultrasonic generator power level as a percentage of its nominal (maximum) power.



Figure 5. Front Panel

3.4. Indicator lights:

3.4.1. ON - Ultrasonic Power On/Off indicator: This green light is illuminated (on) when the generator is turned ON and producing ultrasonic power output to the transducer. When the generator output power is turned OFF this light is not illuminated.

3.4.2. OVERLOAD PROTECTION (OV, OC, DF): The following three sections describe MasterSonic's built in protection circuits. When any one of these red lights is illuminated (On) the generator is experiencing an internal problem or detecting a problem with the mechanical ultrasonic components and will automatically stop ultrasonic power generation. If the ultrasonic power is not automatically stopped the operator should STOP the ultrasonic operation immediately by pressing the Red Button on the front panel and follow these instructions:

- In production or repetitive test environment: Verify all parameters (Frequency, Power, Sweep Range, PWM period, and PWM ratio) are set to previously established ranges and resume operation. (See Sections 4 and 5 of this manual)

- For Laboratory experiments where operating conditions and parameter boundaries are being tested, reset one or more parameter and resume operation. (See Sections 4 and 5 of this manual)

- Check for loose or broken studs linking the mechanical components.

3. FRONT PANEL OPERATION

- Check the coupling surfaces between transducer, booster, horn, sonotrode, waveguide, and attached mechanical systems.
- Check for cracked booster, horn, sonotrode, waveguide, and attached mechanical systems.

3.4.3. OV - Over Voltage indicator:

- The OV Light is Normally not illuminated (OFF) during good operating conditions.
- Illuminated Red Light (ON) indicates the auto- protection for Over Voltage is activated. This built-in safeguard protects the MasterSonic system from over voltage conditions resulting from extreme production environments or in laboratory testing where experiments test the operational boundaries and effects of MastersSonic's flexible operational parameters.

CAUTION: If OV light is ON and power is not automatically stopped the operator must immediately STOP ultrasonic operation by pressing the Red Button on the front panel and follow instructions in section 3.4.2 above.

3.4.4. OC - Over Current indicator:

- The OC Light is Normally not illuminated (OFF) during good operating conditions.
- Illuminated Red Light (ON) indicates the auto- protection for Over Current is activated. This built-in safeguard protects the MasterSonic system from over current conditions resulting from extreme production environments or in laboratory testing where experiments test the operational boundaries and effects of MastersSonic's flexible operational parameters.

CAUTION: If OC light is ON and power was not automatically stopped the operator must immediately STOP ultrasonic operation by pressing the Red Button on the front panel and follow instructions in section 3.4.2 above.

3.4.5. DF - Driver fault indicator: failure of voltage supplying drivers.

- The DF Light is Normally not illuminated (OFF) during good operating conditions.
- Illuminated Red Light (ON) indicates a system Driver Fault (failure of the system to supply voltage to the drivers).

CAUTION: If DF light is ON and power was not automatically stopped the operator must immediately STOP ultrasonic operation by pressing the Red Button on the front panel and follow instructions in section 3.4.2 above.



Figure 5. Front Panel

3. FRONT PANEL OPERATION

3.5. Interface Connector Port for Remote Control:

3.5.1. This standard RS 485 serial port provides an interface for connection of the generator to a MasterSonic Remote Control Panel, by using a special interface adaptor box option this port may also be connected to a Personal Computer (PC) serial port, or a custom controller serial port via RS232C.

3.5.2. The transfer protocol is semi-duplex and data transfer (reading/writing) is controlled by RTS signaling.

3.5.3. Only one external device may be connected to this port.



Figure 5. Front Panel

- See section 4 for the MasterSonic Remote Control Panel connection and operation.
- See section 5 for PC or Custom Controller connection and operation.

3.5.4. Pin-Out Details for Interface Connector Port RS 485.

Pin 1	NC
Pin 2	B
Pin 3	NC
Pin 4	+12V
Pin 5	GND
Pin 6	A
Pin 7	NC
Pin 8	+12V
Pin 9	GND

3.6. BNC Signal Analysis Ports:

3.6.1. The MasterSonic MMM-4S generator has a special configuration of four BNC connectors on the front panel that output system analysis signals. See section 6 below for a detailed description of connections and signal analysis capabilities.

4. REMOTE CONTROL PANEL

4.1. Remote Control Panel Description:

The remote control panel is designed for rapid parameter setting and tuning of the ultrasonic generator while connected to the oscillating mechanical system.

4.2. Remote Control Panel Connection:

The remote control panel may be connected to the front panel 9-Pin RS232C interface port when the generator is turned ON or OFF. The remote control panel receives power through the connector.

4.3. Remote Control Panel Operation:

The remote control panel has an LCD display with 2 rows of 16 symbols and keyboard with 20 buttons that have the following functions:

Numeric keyboard from 0 to 9 and decimal point for entering new parameters.

Enter button to input parameters or initiate a Function.

“esc” button to escape or cancel current operation.

Up and **Down Arrow** buttons for increasing and decreasing display values.

Left and **Right Arrow** buttons for reading the LCD menu.

Functions buttons:

F1 - reads parameter data stored in the controller memory. Press F1 then select a memory position (0 to 20) to view stored parameters.

F2 - stores new parameter data from the buffer to a selected memory position (0 to 20) in the controller.

F3 - downloads parameter data from the buffer to the MasterSonic generator memory.

NOTE: If the Mastersonic generator is in operation (ultrasonic power is ON) when downloading data from the remote control panel the generator will automatically turn OFF the ultrasonic power for system safety. The generator may be restarted manually by pressing the front panel Green ON button after the download is completed.

4.3.1. When the remote control panel is connected to the MasterSonic generator, the active set of generator parameters that are in its memory are automatically transferred to the buffer of the control panel.

4.3.2. To set Operating Frequency – select desired parameter with LEFT and RIGHT ARROW buttons. Select parameter value with UP and DOWN ARROW buttons, or with numeric keyboard. The ENTER button downloads the current parameter value in the generator.



Figure 6. Remote Control Panel

4. REMOTE CONTROL PANEL

4.3.3. To set Ultrasonic Output Power – select desired parameter with LEFT and RIGHT ARROW buttons. Select parameter value with UP and DOWN ARROW buttons, or with numeric keyboard. The ENTER button downloads the current parameter value in the generator.

4.3.4. To set PWM Period– select desired parameter with LEFT and RIGHT ARROW buttons. Select parameter value with UP and DOWN ARROW buttons, or with numeric keyboard. The ENTER button downloads the current parameter value in the generator.

4.3.5. To set PWM Ratio– select desired parameter with LEFT and RIGHT ARROW buttons. Select parameter value with UP and DOWN ARROW buttons, or with numeric keyboard. The ENTER button downloads the current parameter value in the generator.

4.3.6. To set FSWM Ratio– select desired parameter with LEFT and RIGHT ARROW buttons. Select parameter value with UP and DOWN ARROW buttons, or with numeric keyboard. The ENTER button downloads the current parameter value in the generator.

4.3.7. To set FSWM Period– select desired parameter with LEFT and RIGHT ARROW buttons. Select parameter value with UP and DOWN ARROW buttons, or with numeric keyboard. The ENTER button downloads the current parameter value in the generator.

4.3.8. To set FSWM Range– select desired parameter with LEFT and RIGHT ARROW buttons. Select parameter value with UP and DOWN ARROW buttons, or with numeric keyboard. The ENTER button downloads the current parameter value in the generator.

4. REMOTE CONTROL PANEL

Function	LCD Display Pictures	LCD Displays	Description of Action
Reading Data		<<<<<<<<	Uploading parameters from the generator memory to the remote control panel buffer.
Sending Data		>>>>>>	Downloading parameters from the remote control panel buffer to the generator memory.
Read Memory		Location xx	Reading parameters from a remote control panel memory location (1 to 20) to the remote control panel buffer.
Write Memory		Location xx	Writing parameters from the remote control panel buffer to a remote control panel memory location (1to20).
Frequency		xx.xxx kHz(example: 21.940 kHz)	The average frequency of the ultrasonic transducers (first, natural resonant mode).
Sweeping Range		0 - 1 kHz (example: 0,150 kHz)	Sweeping frequency interval of the ultrasonic signal.
FSWM Period		0,01-10s (example: 0,025s)	Frequency Shift Width Modulation Period
FSWM Ratio		0,100% (example: 50%)	Frequency Shift Width Modulation Ratio
FSWM Range		0-1kHz (example: 0,000kHz)	Frequency Shift Width Modulation Range
Power		xxx %(example: 50%)	The current power as a percent of nominal power of ultrasonic generator.
PWM Period		x.xxx s (example: 1.190 s)	Period of Pulse Width Modulation (PWM in seconds).
PWM Ratio		xx% (example: 65%)	Ratio of Pulse Width Modulation (PWM percent)

5. PC SOFTWARE CONTROL OPTION

5.1. PC and Custom Software Control Description:

MasterSonic generator parameters may be automatically controlled through a PC or other custom controller connected to the front panel 9-Pin interface connector via the optional adaptor box.

NOTE: Only one device may be connected to the MasterSonic 9-Pin controller interface connector. The optional PC control adaptor box and the remote control panel may not be used at the same time.

5.2. PC Graphical User Interface Window:

The optional PC software control accessory is used to control generator parameters through a PC connected via the special interface adaptor box to the MasterSonic front panel 9-pin interface connector.

5.2.1. Installation Instructions for the Mastersonic Control Panel Window: (Windows 98 compatible)

- a) Create a new file folder on your PC in a location where you prefer to store the executable software file.
- b) Copy the file “mastersonic.exe” from the MasterSonic CD and paste to your new file folder.
- c) Right click the copied file “mastersonic.exe” and left click the “make a shortcut” option. Drag the shortcut to your PC desktop or another convenient location.

5.2.2. To run the MasterSonic PC Control Panel Window:

- a) Double click the “mastersonic.exe” shortcut icon.
- b) The MasterSonic Generator Control Panel window will appear. If the PC serial port is properly connected to the MasterSonic Generator the active set of generator parameters that are in its memory are automatically uploaded and displayed in the Control Panel window.

5.2.3. To READ Currently loaded Parameters in the MasterSonic Generator memory:

- a) Click the PC control panel “Read” button.
- b) Parameters are uploaded from the MasterSonic generator memory and displayed on the PC Control Panel window.

5.2.4. To Set New Parameters and WRITE them to the MasterSonic Generator:

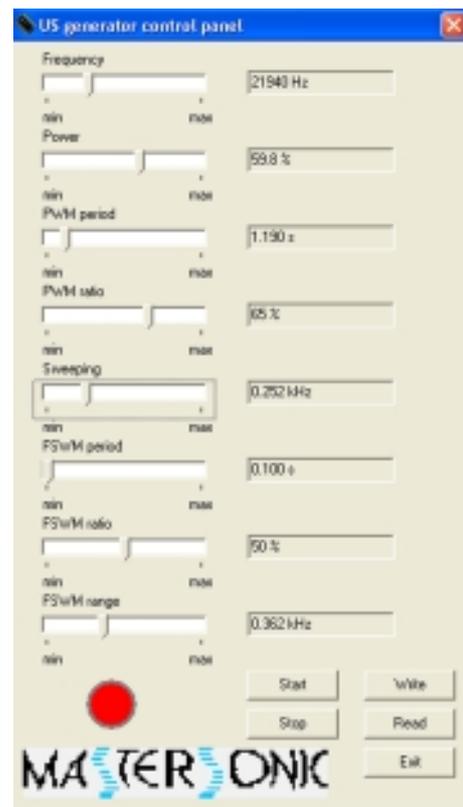


Figure 7. PC Windows Control Panel

5. PC SOFTWARE CONTROL OPTION

- a) Each parameter may be set by either the sliding graphic bar or by typing specific numerical values. (Parameter setting limitations are as described for the control panel above.)
- b) When all parameters are set to the desired value Click the PC control panel “Write” button.
- c) All parameters will be downloaded from the PC Control software to the MasterSonic generator.

NOTE: If the Mastersonic generator is in operation (ultrasonic power is ON) when downloading data from the PC control panel the generator will automatically turn OFF the ultrasonic power for system safety. After the download is completed the generator may be restarted manually by pressing the front panel Green ON button or via the control panel start button.

5.2.5. To Start or Stop the ultrasonic power generation from the MasterSonic Generator:

- a) After desired parameters have been set Click the “START” button.
- b) Press the “STOP” button to stop ultrasonic power generation.

5.2.6. To Quit or Exit from the PC Control Window:

- Click the “EXIT” button.

5.3. Custom Controller or Special PC Command Options:

Using MasterSonic MSA2218 Adapter RS485 / RS232C interface users may develop or use industry standard controllers and PCs for programming and controlling the MasterSonic generator via the optional interface adaptor box.

NOTE: Only one device may be connected to the MasterSonic RS232C controller interface connector. A Custom Controller and the remote control panel may not be used at the same time.

NOTE: This option is not part of standard support. Assistance for hardware interface and programming are quoted by the manufacturer or distributor on a case by case basis.



5.3.1. The RS232C transfer protocol is semi-duplex and data transfer (reading/writing) is controlled by RTS signaling.

5. PC SOFTWARE CONTROL OPTION

5.3.2. MasterSonic Generator Commands.

NOTE: Each command is terminated with carriage return (CR) ASCII code HEX ="0D " or decimal = 13

Inquiry Commands:

%01f(CR)	inquire for Current Frequency of the generator
%01s(CR)	inquire for Current Sweeping of the generator
%01w(CR)	inquire for Current PWM Period of the generator
%01f(CR)	inquire for Current PWM Ratio of the generator
%03p(CR)	inquire for Current Power of the generator
%03a(CR)	inquire for Current FSWM Period of the generator
%03b(CR)	inquire for Current FSWM Ratio of the generator
%03c(CR)	inquire for Current FSWM Range of the generator

Inquiry Reply Formats:

#02fxx.xxx(CR)	Current Frequency reply (xx.xxx is frequency in kHz) o Example: #02f20.100(CR) - means current frequency is equal to 20100 Hz or 20.100 kHz
#02sxx.xxx(CR)	Current Sweeping reply. o Example: #02s00.300(CR) means current sweeping is equal to 300Hz
#02wxx.xxx(CR)	Current PWM Period reply. o Example: #02w00.100(CR) - means the current PWM period is equal to 0.100sec. o Note: The PWM period must be between 10mSec and 10sec
#02m00.xxx(CR)	Current PWM Ratio reply. o Example: #02m00.075(CR) - means the current PWM ratio is equal to 75%
#02p00.xxx(CR)	Current Power of generator reply. o Example: #02p00.085(CR) - means the current power is equal to 85% from nominal power
#02a00.xxx(CR)	Current FSWM Period reply. o Example: #02a00.100(CR) - means the current FSWM Period is equal to 0.100sec. Note: The FSWM period must be between 10mSec and 10sec.
#02b00.xxx(CR)	Current FSWM Ratio reply. o Example: #02b00.075(CR) - means the current FSWM Ratio is equal to 75%.
#02c00.xxx(CR)	Current FSWM Range reply. o Example: #02c00.300(CR) - means the current FSWM Range is equal to 300Hz. Note: The FSWM Range must be between 0-1kHz.

5. PC SOFTWARE CONTROL OPTION

Start/Stop Generator Ultrasonic Power Commands:

@01start(CR)	Start command
@01stop(CR)	Stop command

Set New Parameter Value Commands:

#01fxx.xxx(CR)	Sets a new Operating Frequency for the generator
#01sxx.xxx(CR)	Sets a new Sweeping Frequency
#01wxx.xxx(CR)	Sets a new PWM Period
#01m00.xxx(CR)	Sets a new PWM Ratio
#03p00.xxx(CR)	Sets a new Operating Power for the generator

NOTE: The generator replies with a character "<(CR)" after receiving the setting parameters. The reply is not controlled.

6. SPECIAL SIGNAL ANALYSIS OUTPUTS

6.1. MMM-4S - Signal Analysis Outputs Description:

The MMM-4S has a special configuration of four BNC connectors on the front panel that output system analysis signals extracted from the ultrasonic generator. Measurement devices like oscilloscopes, oscillographs, signal recorders, impedance meters, and spectrum analyzers may be connected and used for development of optimized operating conditions and load characterization.

6.2. Signals Available:

6.2.1. Upper Left BNC connector 1: Signal of the gate driving of the power transistor.

6.2.2. Upper Right BNC connector 2: Signal of the voltage over the transducer.

6.2.3. Lower Left BNC connector 3: Signal of the current through the transducer.

6.2.4. Lower Right BNC connector 4: Signal of PWM

6.3. Signals Specifications:

6.3.1. Signal output levels are from 0 to 10V isolated.



Figure 5. Front Panel

7. LIMITATION OF WARRANTY

The product warranty is detailed in the general conditions of sale or as part of a special sale agreement.

The warranty does not apply and may be voided for equipment subject to unauthorized modifications, repair, misuse, abuse, negligence or accident.

Equipment that, in our judgment, shows evidence of having been used in violation of operating instructions will be ineligible for service under this warranty.

The MasterSonic equipment is designed for maximum operator safety and incorporates built-in safety devices. Any modifications to these safety features will void the warranty. The Manufacturer assumes no responsibilities for consequential damages incurred due to modifications to the said equipment.

Under no circumstances shall the Manufacturer be liable to the purchaser or to any other person for any incidental or consequential damages or loss of profit or product resulting from any malfunction or failure of this MasterSonic product.

No liability is assumed for expenses or damages resulting from interruptions in operation of the product or damages to material in process.

The Manufacturer reserves the rights not to warrant horns, sonotrodes, and waveguides of unusual or experimental design that in our judgment are more likely to fail in use.

Within the period guaranteed, we will repair or replace free of charge, at our sole discretion, all parts that are defective because of material or workmanship, not including costs for removing or installing parts.

Liability, whether based on warranty, negligence or other cause, arising out of and/or incidental to sale, use or operation of the transducer elements, or any part thereof, shall not in any case exceed the cost of repair or replacement of the defective equipment, and such repair or replacement shall be the exclusive remedy of the purchaser, and in no case will we be responsible for any and/or all consequential or incidental damages including without limitation, and/or all consequential damages arising out of commercial losses.

8. SERVICE

WARNING: To avoid electric shock, do not remove the case cover from the Generator or Transducer. There are no user-serviceable parts inside any of these components.

IMPORTANT NOTICE: For the protection of employees, shippers, receivers, various personnel, and to remain in compliance with Transit Laws, material returned to the Manufacturer or its designated representatives must be rendered free of any hazardous, noxious or radioactive contamination.

Should the user of this device have any questions or comments as to its specifications, use, limitations, or maintenance, the Manufacturers Service Representative can be contacted as follows:

By Post/Mail: MP Interconsulting
Attn: MasterSonic Service
Marais 36
2400 Le Locle, Switzerland

Telephone/Fax: +41 32 9314045

mpi@mpi-ultrasonics.com , www.mpi-ultrasonics.com

9. APPLICATION

The MASTERSONIC MMM - 4S ULTRASONIC GENERATOR is adjusted to operate with the LONG TUBE REACTOR M12-0208-095

9.1. Specification.

Model: Tubular transducer (S/N: M12-0208-095)
 Total reactor-tube length: 1500 mm.
 Active tube length: 1200 mm
 Tube external diameter: 48.4mm
 Tube internal diameter: 42.3mm
 Material: 316L
 Number of transducers: 24 pcs
 Transducers: Silicone protected against water and humidity.
 Frequency: 40 KHz
 Power: 1200W – 1500W, continuous.



9.2. Test conditions.

MMM-sweeping generator, on 1200W until 1500 W
 Temperature: 25° C

9.3. Impedance Characteristic.

