

MASTERSONIC[®]



MASTERSONIC[®]
MSG 150 OF

**ULTRASONIC GENERATOR AND
POWER SUPPLY**

MMM, Wideband Multifrequency Technology

**SYSTEM OPERATION
MANUAL**

March 2007

MSG 150 OF

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DEAR CUSTOMER,

The **MASTERSONIC** program represents a brand new approach in **Sonic and Ultrasonic power supplies and equipment**.

The **MASTERSONIC power supply equipment** is based on **MMM** Technology, which produces high efficiency active power in wide-band sonic and ultrasonic vibrations.

Wide-band sonic and ultrasonic energy (ranging in frequency from infrasonic up to the MHz domain) propagates through arbitrary shaped solid structures, heavy and very-thick-walls metal containers, pressurized reservoirs, very thick metal walls of autoclaves, etc. in many different mechanical structures and in liquids, such as ultrasonic cleaning systems. The secret to its application is a novel sonic / ultrasonic, multifrequency power supply (**MMM Technology**) that can initiate ringing and relaxing, modulated, multimode mechanical oscillations including harmonics and sub-harmonics. The system offers fine control and excellent repeatability from its programmable interface and produces high efficiency active power ranging from below 100W up to many kW.

Multifrequency, Multimode, Modulated Sonic & Ultrasonic Vibrations (MMM Technology) can be excited in any heavy-duty conditions, 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. Such multifrequency ultrasonic structural excitation is ideal for agitating arbitrary shaped liquid and solid masses at arbitrary distances and placed in open or pressurized vessels, containers, autoclaves, reservoirs and pipes, at any temperature, while maintaining optimum efficiency of electrical to acoustic energy transfer.

The oscillations of here-described sonic and ultrasonic source are not random - rather they follow a consistent pulse-repetitive pattern, being in the same time frequency, phase and amplitude-modulated by the control system. This avoids the creation of stationary or standing waves (typically produced by traditional ultrasonic systems operating at a single frequency) that generate regions of high and low acoustic activity. **MMM** technology provides great freedom of control, regulation and programming over all vibration, frequency and power parameters.

Fields of possible applications related to **MMM** Technology are: Advanced Ultrasonic Cleaning, Material Processing, Sonochemistry, Liquid Metals and Plastics treatment, Casting, Molding, Injection, Ultrasonically assisted sintering, Liquids Atomization, Liquids Mixing and Homogenization, Materials Testing, Accelerated Aging and Stress Release, Plastic and Metals Welding, etc.

In traditional ultrasonics technology, transducers have been designed to satisfy precise resonant conditions: In order to achieve maximal efficiency, all oscillating elements should operate on the same frequency. **MMM** technology can drive with high efficiency any complex mechanical system up to a mass of several tonnes, consisting of arbitrary resonating elements. **MMM** technology, instead of optimizing transducers to accept certain resonant frequency operation, optimizes the complex electrical driving (or signal shape) to be applicable to any specific oscillating structure, in a wide-band frequency domain, allowing mechanical designers to optimize their mechanical structures without limits.

1. INTRODUCTION

Ultrasonic generators type **MSG 150 OF** are produced under **MASTERSONIC®** trademark and are designed to supply with power piezoelectric loads operating at 150W and 100W and frequency 40 kHz. Generators are adjusted and tested for operation with two or three transducers type **MST-4535D-40**. Electrical capacity is correspondingly 12,3nF for three transducers and 8,2nF for two transducers.

MSG 150 OF ultrasonic generator general appearance is show on fig.1.

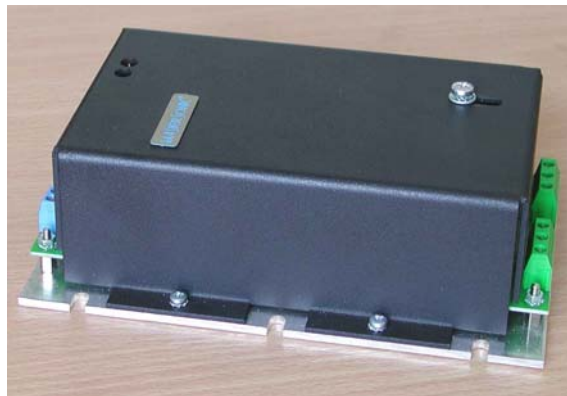


fig.1

The ultrasonic generator is mounted on aluminum plate, designed for direct fastening to a heat sink, if necessary.

The generator is placed in aluminum housing. Connectors for power supply input and acoustic load output are on one of the side panels. ON/OFF connector is on the other side panel.

Generator power supply - 230V / 50 Hz.

100W power for two 40 kHz transducers with 8,2 pF capacity.

150W power for two 40 kHz transducers with 12,3 pF capacity.

1.1. Packing:

The generator is packed in a carton box. In each package is put an electric diagram of the connections of ultrasonic generator.

Please, check the delivery completeness with the delivery.

1.2. Delivery completeness:

1. MSG 150 OF generator
2. Electric diagram of the connections of ultrasonic generator.

1. INTRODUCTION

1.3. Features

The MSG 150 OF generator is delivered adjusted to a specified acoustic load: for 2 transducers and for 3 transducers.

The technical characteristics of the ultrasonic generators, depending on the specified acoustic loads are shown in Table 1.

1.4. Technical characteristics

Table 1

Technical Characteristic	for 2 transducers type MST4535D-40	for 3 transducers type MST4535D-40
Main Supply Voltage	220V/ 230V / 50Hz	
Max. Input Power	110 W	150 W
Frequency of acoustic load	38,000 ÷ 44,000	
Modulated acoustic frequency range	WIDEBAND	
Acoustic load capacitance	8,2 nF	12,3 nF
Average continuous output power	100 W	140 W
Peak output (max. pulsed power)	200 Wp	300 Wp
Output HF voltage	~ 500 V rms	
Dimensions (H x W x D)	60 x 115 x 175 mm	
Weight	0,9 kg	

1.5. System safety:

Read this manual thoroughly and follow all directives and instructions 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.

1. INTRODUCTION

- 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.
- Connecting the Generator unit to mains 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.
- 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 (if not immersible) 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.
- 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 the MasterSonic MSG 150 OF generator fault indicators illuminates, promptly suspend operation and switch the OFF the power. Verify all components are securely connected and adjust system parameters to accommodate the load before resuming operation.

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: 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.

2. DESCRIPTION

2.1. Power supply outlets:

MSG 150 OF ultrasonic generator is connected to 220V / 230V / 50Hz power supply via the terminal block connectors 230V and GND shown on fig.2.

NOTE: In order to prevent the generator from damages and operator from electrical hazards make sure the generator is properly grounded!

2.2. Ultrasonic load outlets:

The acoustic load is connected to terminals LV and HV on the side panel of the ultrasonic generator. The connection outputs are shown on fig.2.

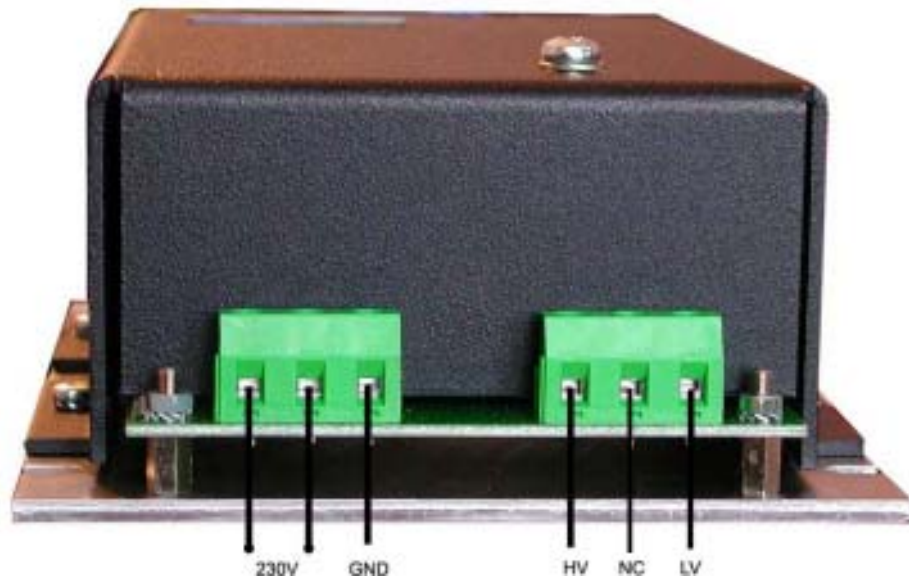


fig.2

2.3. Light indicator:

One three-color light indicator (Func), which indicates operation status of the generator is mounted on the generator. If Func indicator blinks in yellow, the power is ON.

When a control signal is applied to the DC control output Func indicator lights green.

If Func indicator lights red, the generator is overheated and overheat temperature protection is switched on.

Func indicator is located on the MSG 150 OF generator, as shown on fig.3.

2. DESCRIPTION



fig.3

2.4. DC control input.

On the opposite side of the power supply terminal block is mounted a 3-terminal block for ON / OFF control of the generator shown on fig.4.



fig.4

- A) Between 1 and 2 can be connected any external DC voltage (regardless of polarity, because of diode bridge) until 24 VDC: DC voltage connected = generator ON, Nothing connected = generator OFF.
- B) And between 1 and 3 we can also use any independent, external ON-OFF switch or relay contact: Switch = ON = Short = generator ON, Switch = OFF = open = generator OFF .
- C) Of course, not both A) and B) options at the same time (either one or the other).

3. SYSTEM ASSEMBLY

3.1. Transducer power connection

Transducer power connection is shown on fig.5.

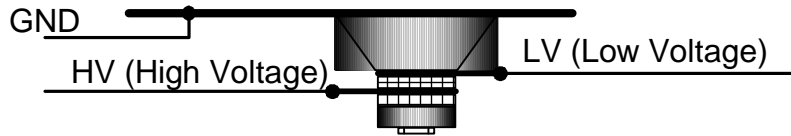


fig.5

3.2. Acoustic load connection:

The acoustic load can be connected with two-wire or three-wire cable. For improved safety the manufacturer strongly recommends connecting the acoustic load using the three wire connection cable.

Connect the cable from the container's body to the LV (Low Voltage) terminal of the acoustic load, as shown on fig.6. Then connect it to the LV terminal of the generator. Connect the HV cable to the HV terminal of the generator.

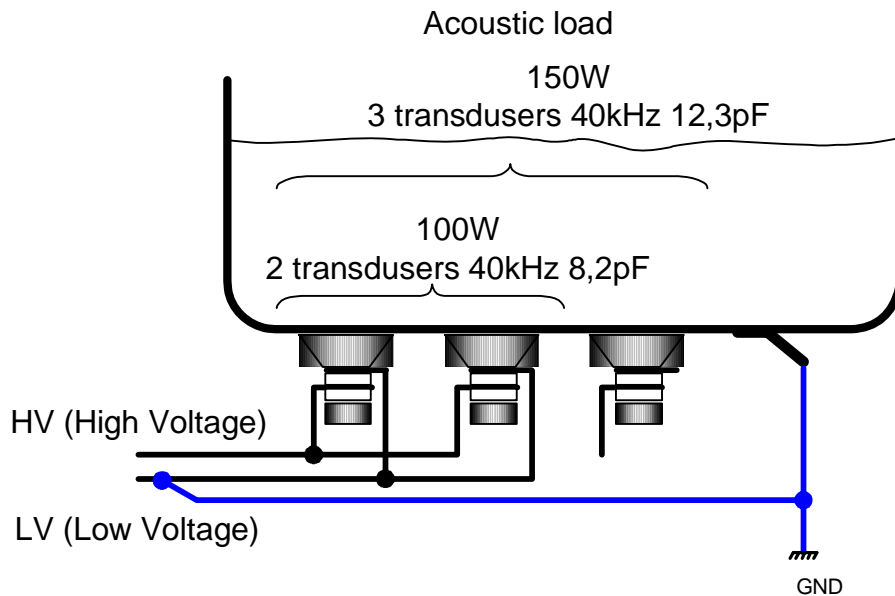


fig.6

3. SYSTEM ASSEMBLY

3.3. Acoustic load mounting:

The acoustic load is connected to terminals LV and HV on the side panel of the ultrasonic generator. The connection terminals are shown on fig.2. The middle terminal is not connected. Connection of acoustic load of two or three transducers is shown on fig.7.

NOTE: For safe operation assure well grounding of the generator!

NOTE: Do not connect the middle terminal! It is for measuring the inductive compensation!



fig.7

3.4. Switching ON/OFF of ultrasonic generator MSG 150 OF:

Generator control is performed through a DC control input by applying 10V÷24V +/- 10% voltage from a PLC control output, or by closing a contact. The generator is turned ON at voltage value in the range 10V÷24V and turned OFF at 0V voltage.

NOTE: For proper operation of the ultrasonic generator do not forget to supply voltage to DC control input!

There are 3 terminals which can be connected in one of the pointed on fig.8 ways.

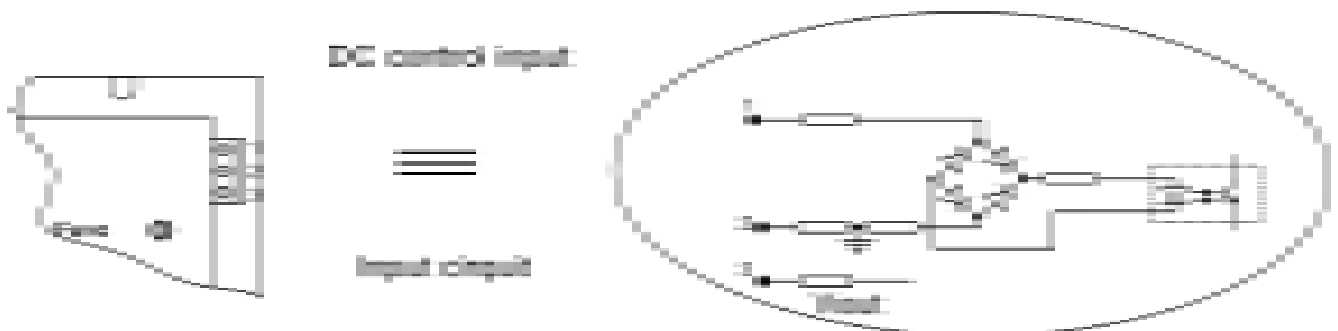


fig.8

3. SYSTEM ASSEMBLY

Connecting MSG 150 OF generator to a 10-24V voltage output of PLC.

NOTE: Input resistance of MSG 150 OF is 10 kOhm. Supplying higher voltage to the input could cause damages.

There are two methods of control of MSG 150 OF generator:

1. For proper operation connect PLC to terminals 1 and 3, connection way does not influence the polarity.

2. Connecting a relay contact for controlling MSG 150 OF generator.

Connect the output of a relay contact or a switch to terminals 1 and 2 of the control input of the generator. When the contact is closed the generator switches on, when the contact opens, the generator switches off.

NOTE: It is not allowed both ways of control to be used together. Use only the control method.

- A) Between 1 and 2 can be connected any external DC voltage (regardless of polarity, because of diode bridge) until 24 VDC: DC voltage connected = generator ON, Nothing connected = generator OFF.
- B) And between 1 and 3 we can also use any independent, external ON-OFF switch or relay contact: Switch = ON = Short = generator ON, Switch = OFF = open = generator OFF .
- C) Of course, not both A) and B) options at the same time (either one or the other).

3.5. Electric diagram of MSG 150 OF connection

On fig.9 is shown electric diagram of the connections of ultrasonic generator:

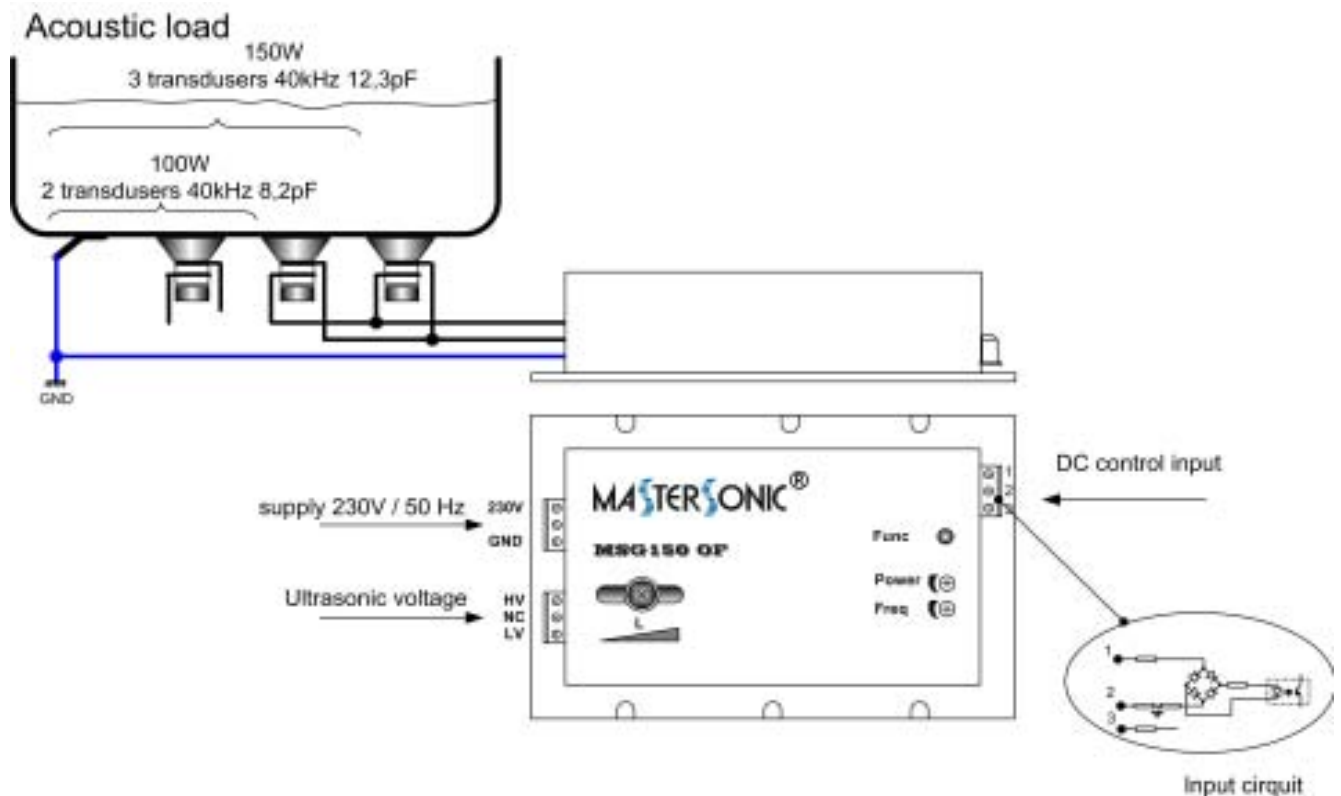


fig.9

4. ADJUSTMENTS

The MSG 150 OF generator is delivered adjusted to a specified acoustic load: for 2 transducers and for 3 transducers type MST4535D-40, as shown on fig.10.

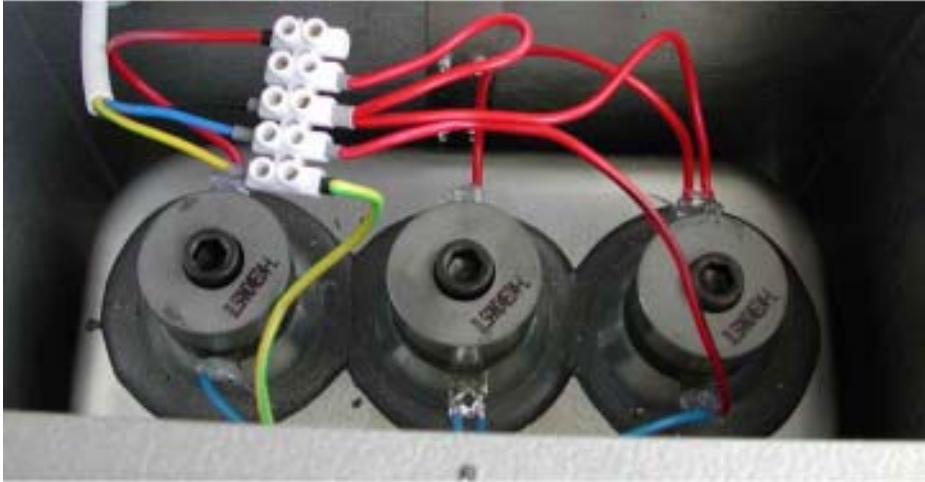


fig.10

If your acoustic load differs from the supplier's acoustic load adjustments, some final tunings must be made.

For the purpose MSG 150 OF ultrasonic generators are equipped with two potentiometers for precise tuning of resonant frequency (Freq) and US Power (Power).

- For tuning of resonant frequency turn potentiometer **Freq.** on fig.11 to the right or left. You can assure the correct frequency is adjusted by the sound of the acoustic load or by setting the input current to its relevant value:
 - for 100W – I ~ 430 mA
 - for 150W – I ~ 650 mA
- For increasing or reducing the US Power use the potentiometer **Power.**

If the inductive compensation does not correspond to the acoustic load, make fine adjustments of the acoustic load by the adjustment screw on fig.11. Lightly unscrew the screw, move and hold it forwards or backwards, to adjust the most suitable value of Inductive compensation for the acoustic load.

4. ADJUSTMENTS



fig.11

Adjusting procedure:

1. Put the potentiometer **Freq.** in “minimum” position, potentiometer **Power** in “middle” position, and inductivity compensation in position “minimum”.

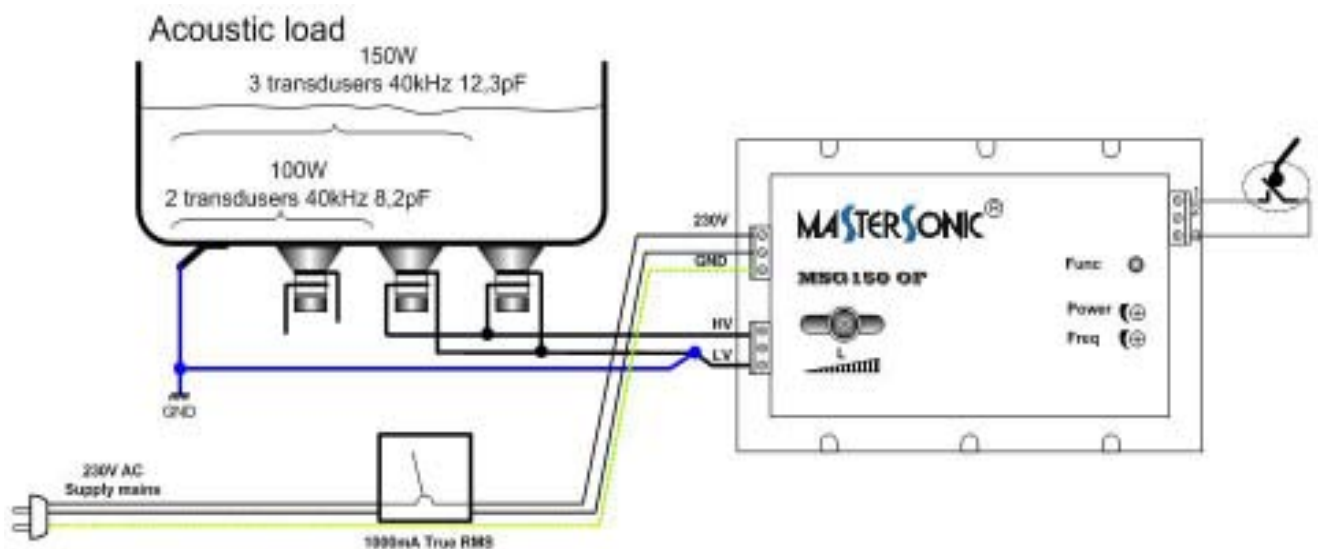


fig.12

4. ADJUSTMENTS

2. Connect the generator to the acoustic load with 40kHz resonant frequency.
3. Connect the generator to the mains and then apply “start” signal to the control terminal.
4. Using the potentiometer **Freq.**, set the value of the input current to be equal or near to its corresponding average value:
 - > for 100W the average value of the current is $I = 0,43A$,
 - > for 150W the average value of the current is $I = 0,65A$.
5. Using the adjustable inductivity compensation, find maximum value of the ultrasonic activity.
6. Using the potentiometer **Freq.**, set the value of the input current to be equal to the corresponding average current value.
6. Using the potentiometer **Power**, you can change a little bit the resonant frequency.
7. If you cannot set appropriate operating mode start the adjusting procedure again.

5. INDUCTIVE COMPENSATION

One other method of MSG 150 OF ultrasonic generator adjustments.

1. Measure the capacitance of the transducers. It must range from 7,5 pF up to 14 pF for frequency from 38kHz to 42 kHz.
2. Count the compensating inductivity with the following formula:

$$L = 1.05 \left(\frac{1}{4\pi^2 f^2 \cdot C} - L_s \right)$$

where:

L - inductivity of compensating coil in , H;

f - central operating frequency in Hz;

C - static (1 kHz) capacitance of ultrasonic transducer in , F;

L_s - Leakage Inductivity of the output transformer: approx. 300. 10⁻⁶ H

3. Connect inductivity-meter between the terminals LV and NC of the output of the ultrasonic frequency.
4. Untighten the screw and adjust the inductivity to be bigger than the counted value. If you do not have inductivity-meter, adjust the inductivity to minimum value.
5. Connect the acoustic load to the generator output, as shown on fig.12.
6. Connect the power supply via a mili-ammeter with possibility to measure 1000 mA True RMS current, as shown on fig.12.
7. Connect the control input - terminals 1 and 2 with a switch, in order to control the generator. Put the switch in open position.
8. Adjust the potentiometer **Freq** to **min** position and potentiometer **Power** in “min” position. (Turn **Power** potentiometer counterclockwise to its end).
9. Switch the generator to the power supply. Function indicator (Func) must blink yellow.
10. Press the switch to apply “start” signal. Function indicator lights green.
11. Turn the frequency control to find the value of the maximum current.
12. Turn the regulating inductivity compensation to find the maximum value of the input current and tighten the screw.

6. TROUBLESHOOTING

Error indication	Possible reasons	Solution
The generator is connected to power supply and Func indicator lights red.	The generator is overheated.	Switch off the generator and wait till it gets cool.
The generator stops after some time, the Func indicator lights red.	The generator is overheated.	Switch off the generator and wait until it gets cool.
The generator stoped after operating, the Func indicator flashes yellow.	The generator has been overheated.	Switch “off” and then switch “on” the generator.
The generator is connected to power supply and Func indicator does not light.	No power supply to the generator	Check power supply cables and connections
	The generator is damaged.	Call service personnel of the producer

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.

MSG 150 OF ultrasonic generator is a module, designed for build-in purposes. When the generator is not properly connected, or is connected to loads, which are not suitable and are not supplied by the producer, the ultrasonic generator will be damaged.

The producer does not accept claims if damages of the generator are caused by improper connection or connection to loads not supplied by the producer.

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.

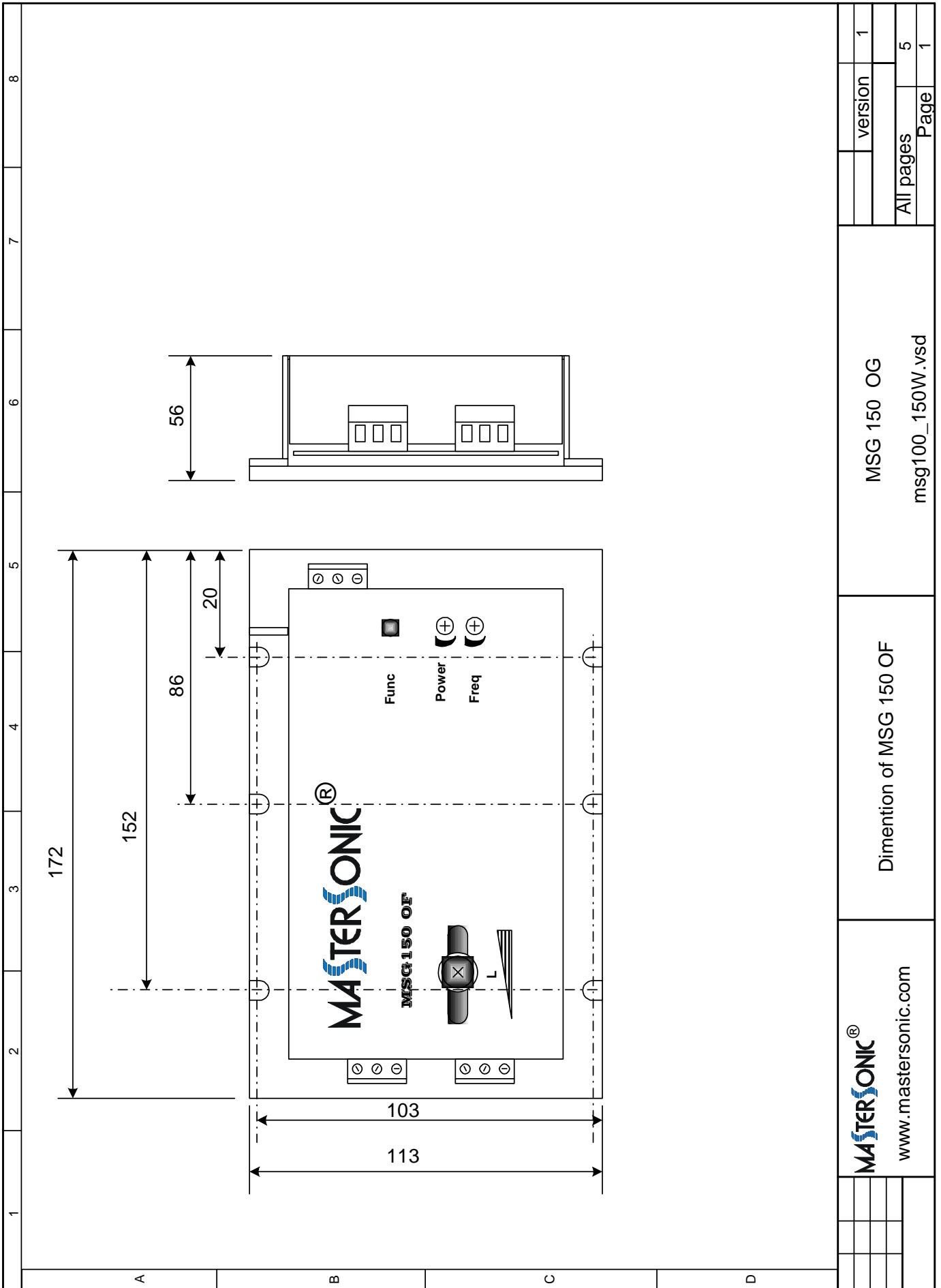
Should the user of this device have any questions or comments as to its specifications, use, limitations, or maintenance, the Manufacturers Service Representative can be contacted as follows:

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

**Telephone/Fax: +41 32 9314045
E-mail: mastersonic@mpi-ultrasonics.com;
www.mpi-ultrasonics.com**

APPENDIX

DIMENSIONS:



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All pages	5
Page	1

MSG 150 OG
msg100_150W.vsd

Dimension of MSG 150 OF

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