

# MASTERSONIC®



**MASTERSONIC®  
MSG.300.OF-S  
ULTRASONIC POWER SUPPLY  
MMM, Wideband Multifrequency Technology**

**SYSTEM OPERATION  
MANUAL**

MSG.300.OF-S  
2006

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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 100 W 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

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### 1.1. Features:

The MSG300.OF-S ultrasonic generator utilize the MMM Technology and is constructed with an open frame design intended for integration into Ultrasonic Systems providing appropriate housing and protection.

Presently available module is made for driving the following piezoelectric load:

- MSG 300.OF-S for driving 300W piezoelectric load.

The MSG 300.OF-S system is shown on fig. 1.1.



**Fig. 1.1. MSG.300.OF-S Generator Module**

# 1. INTRODUCTION

## 1.2. Technical Characteristics of MSG 300.OF-S:

	MSG 300.OF-S
Main Supply Voltage	220/230 V; 50/60 Hz
Max. Input Power	400 W
Non-modulated, carrier frequency range	19.020kHz±46.728 kHz
Modulated acoustic frequency range	Wideband, from Hz to MHz
Average Continuous Output Power	300 W
Peak Output (max. pulsed power)	1500 W
Output HF Voltage	~ 500 V-rms
Dimensions (h x w x d)	170x150x150mm
Weight	2 kg

## 1.3. System safety:

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

- Installation of the MasterSonic (ultrasonic 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.
- 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 208 - 230 VAC single-phase outlet with a sufficient current rating.

## 1. INTRODUCTION

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- 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 (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 ON indicator of the MasterSonic is not lit, promptly suspend operation. Switch off the power supply. Verify all components are securely connected and adjust system parameters to accommodate the load before resuming operation.

## 2. SYSTEM SET-UP

### 2.1. Installation and connection.

MasterSonic open frame generator modules are designed for internal mounting in the control cabinets of Ultrasonic Systems. Such cabinets should be very well ventilated, protecting the generator module from excessive dust, moisture, and harmful chemical agents.

Before mounting or connecting the MSG.300.OF-S generator make sure that all protection conditions are strictly observed and satisfied.

The installation and electrical connections of the generator should be performed by a qualified specialist in electronics who is experienced in Power Ultrasonics.

Fig. 2.1. shows the main power supply schematic and the Acoustic Load Connections for the MSG.300.OF-S.

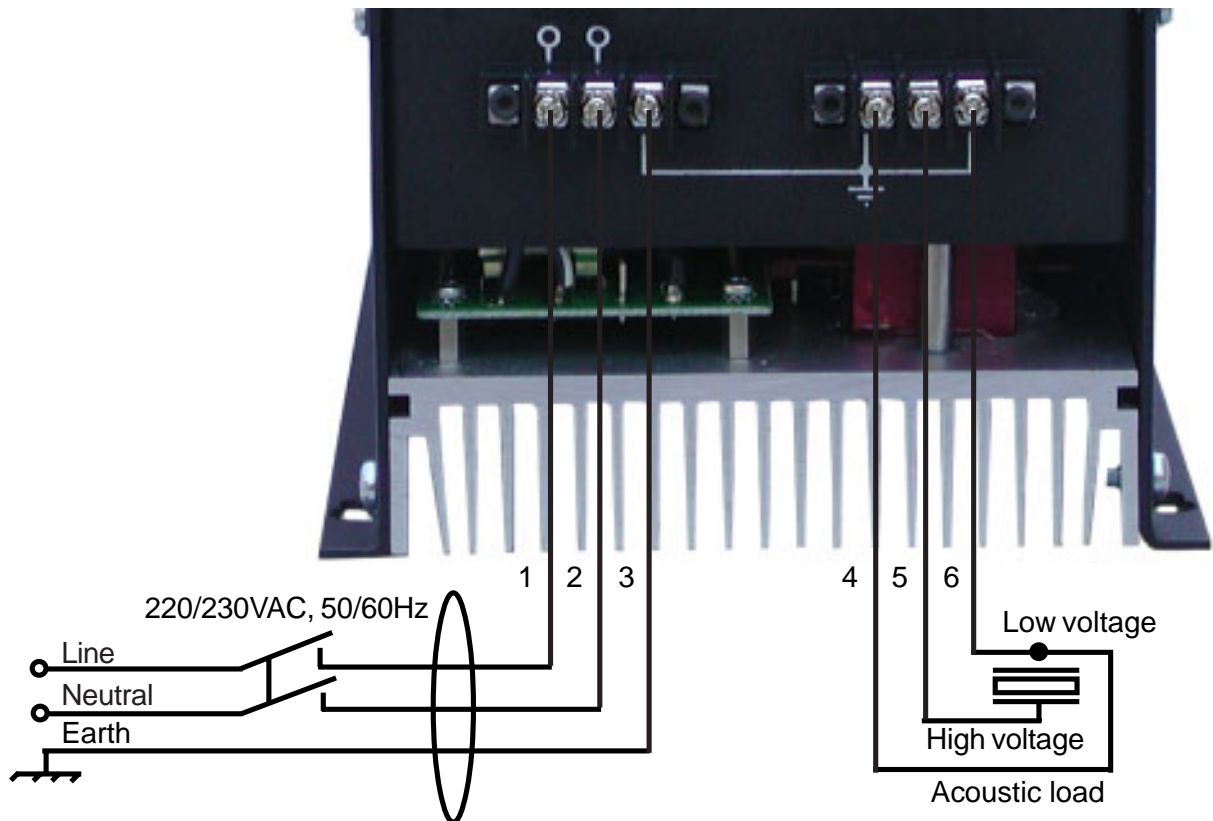


Fig. 2.1. Installation and connection of MSG.300.OF-S.



## 2. SYSTEM SET-UP

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### 2.1.1. Mains Power Supply Connection

Using proper three-wire power supply cable, connect the MSG.300.OF-S to the mains power line as follows:

- L1 – Line is connected to terminal 1;
- Neutral is connected to terminal 2;
- Ground is connected to terminal 3.

**Note:** MSG.300.OF-S is designed as a component part for integration into Ultrasonic systems. Therefore it is not equipped with a Power Supply ON/OFF switch. Make sure the Ultrasonic System you are assembling is provided with such switch.

### 2.1.2. 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 method.

As show in figure 2.1 above the second terminal connector in the lower right side of the MSG.300.OF-S, terminals 5-HV (High Voltage) and 6-LV (Low Voltage), are used to supply ultrasonic power to the Acoustic Load (piezoelectric transducer).

- Terminal 5-HV is **the high voltage ultrasonic signal** output from the power transformer of the generator **and should be connected to the Isolated Terminal of the transducer.**
- Terminal 6-LV should be connected to the inductive compensation of the transducer and to the acoustic system grounding (transducer housing or acoustic load **mass**).

**CAUTION:** The MasterSonic System should only be operated with manufacture approved transducers and cable.

**ATTENTION!** Do not connect the High Voltage (pin. 5) to grounding. This will damage the System.

#### **2 Wire Connections:**

If the acoustic load can only be connected with a two-wire cable, identify the wire that is connected to the acoustic load's ground (Low Voltage - LV) and the one connected to the isolated terminal (High Voltage - HV). Connect the wire that is connected to the acoustic load's grounding to terminal 6-LV and the isolated terminal wire to terminal 5-HV. Connect terminal 6-LV and terminal 4-EARTH together. This will ground the acoustic load internally.

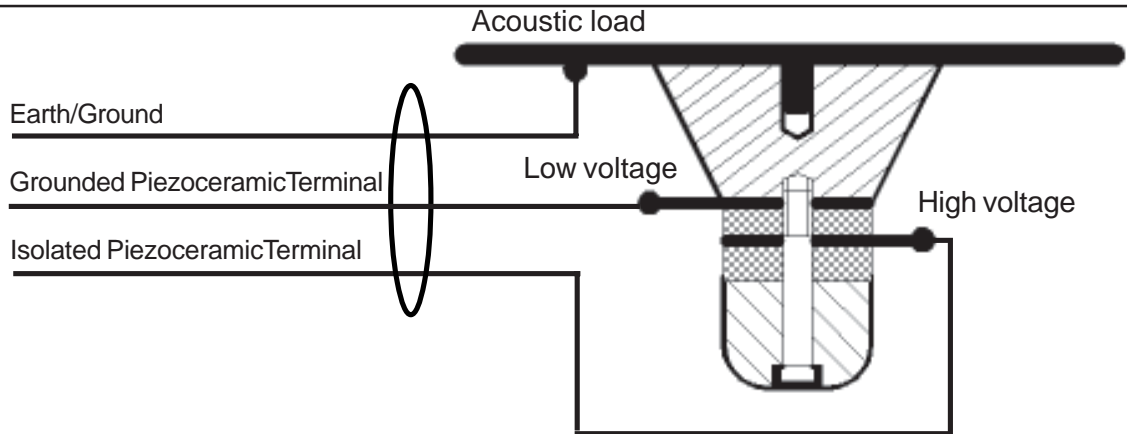
**Note:** The manufacturer does not recommend this connection method and should only be used if a three wire connection is not possible. Two wire connections should only be made by a qualified electrical technician.

#### **3 Wire Connections: (PREFERRED METHOD)**

The preferred method for connecting MasterSonic generator power supplies to acoustic loads is with a three-wire cable, as shown on the following schematic.



## 2. SYSTEM SET-UP



**Fig. 2.1.2. Preferred 3-wire Acoustic Load connection.**

- Isolated Terminal (terminals between ceramic disks or rings without contact to front or back mass of the converter) – This wire (normally Red / White / Black depending on supply source) is the HV (High Voltage) terminal of the ultrasonic transducer.
- Ground Terminal (terminals in contact with the front or back mass of the converter) – This wire (normally Green or Blue depending on supply source) is the LV (Low Voltage) terminal of the ultrasonic transducer.
- Earth/Ground/Mass (normally Yellow / Green / Blue) – This wire is connected to the metal part of the Acoustic Load.

Connect the acoustic load to the MSG.300.OF-S as follows:

- Connect the Isolated Terminal (normally Red Black or White) wire to terminal 5 - HV.
- Connect the Ground Terminal (normally Green, Blue or Yellow) wire to terminal 6 - LV.
- Connect the Earth/Ground/Mass (normally Yellow/Green/Blue) wire to terminal 4 - EARTH.

**CAUTION:** Be careful when handling the acoustic load transducers or cable. The acoustic load may be charged with electro-static high voltage that may produce an electrical shock to the installer if not handled properly. Before installation or before connecting the acoustic load to the Mastersonic generator carefully touch the High Voltage Black wire to the Low Voltage Blue wire to short circuit and discharge electro-static build-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:** Connecting the Generator unit to mains 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. SYSTEM SET-UP

### 2.1.3. Waveguide and Accessories Mounting:

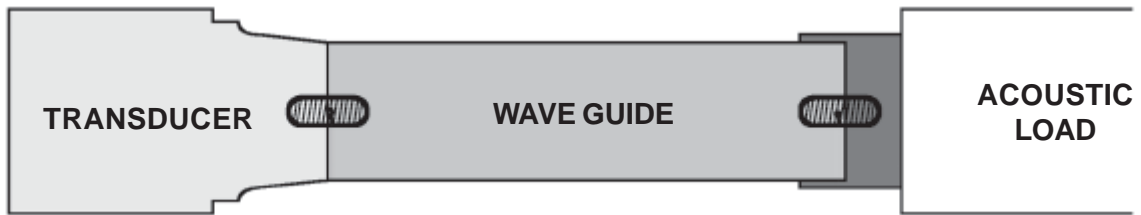


Figure 2.1.3. System Assembly

**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 (spanner) wrenches and make final tightening.

As depicted in Figure 2.1.4. the Wave Guide or Booster should be connected to the transducer tip. Acoustic loads (probes, sonotrodes, etc.) are connected to the opposite end of the waveguide or Booster.

### 2.1.4. Flexible Transducer Option

The MSG.300.OF-S systems offer a new and unique controllable inductive compensation option that enables driving of a large range of ultrasonic mechanical systems with any number of ultrasonic transducers. Acoustic load electrical parameters are the following:

- Average Operating frequency: 20kHz ÷ 40 kHz.
- Static capacity of the complex ultrasonic transducer: 3nF ÷ 30nF.



Fig. 2.1.4. Mastersonic Transducers

## 2. SYSTEM SET-UP

### 2.1.5. Inductive compensation.

THE ULTRASONIC GENERATOR MSG 300.OF-S IS DESIGNED TO SUPPLY POWER LOADS UP TO 300W IN THE FREQUENCY RANGE OF 18KHZ ÷ 45KHZ.

THE RESONANT FREQUENCY IS SET BY A POTENTIOMETER ON THE FRONT PANEL. THE INDUCTIVITY SHOULD THEN BE SET WITH A HEXAGON WRENCH KEY INSERTED INTO THE TOP OF THE MSG 300.OF-S WHERE IT IS MARKED (L). INDUCTIVITY IS CHANGED AS THE FERRITE CORE IS OPENED OR CLOSED (core opening decreases the inductivity and vice versa).

THE COMPENSATING INDUCTIVITY DEPENDS ON THE SYSTEM CENTER FREQUENCY, THE STATIC (shunt) CAPACITY OF TRANSDUCERS AND THEIR OPERATING MODE.

The compensating inductivity of MSG 300.OF-S ranges from 450  $\mu$  H up to 35mH. It is in conformance with and tested in operation of 2 up to 6 transducers.

The generator is factory tested for operation frequency 28kHz with 2 to 6 transducers with capacitance from 14nF up to 27nF respectively, and for operation frequency 40kHz with 2 upto 6 transducers, with capacitance from 8,5nF up to 26nF respectively.

### 2.2. Factory Settings and Initial Generator Start Up.

The MasterSonic MSG.300.OF-S generator includes an optional external power on safety circuit control that may be implemented through relay control of terminals 8 and 15. These terminals may be connected to a temperature control circuit, door panel switches, operator proximity safety switches, etc. To operate the generator module these terminals must be normally closed. An open circuit will stop all generator operations. If the installation does not require such external control these terminals 8 and 15 should be short circuited with a hard wire connection.

The MSG.300.OF-S is delivered from the factory with a short circuit wire between terminals 8 and 15 (as shown on fig.2.2) to allow immediate operation.

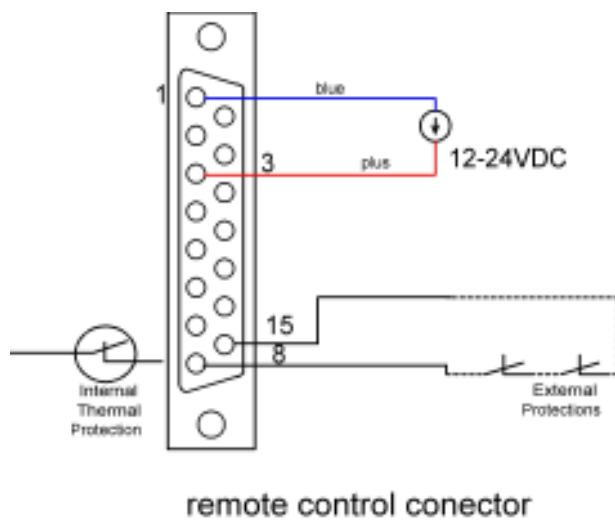


Fig. 2.2. Remote Control Connector

## 2. SYSTEM SET-UP

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### 2.2.1. Simplified method for adjustment of MSG.300.OF-S

- 1. Connect the proper Acoustic load to the output of the generator, observing the method described above.
- 2. Set the coil of the biggest inductivity and complete close it.
- 3. Using the Remote Control Connector on fig.2.2 connect the generator control voltage.
- 4. Switch the Generator to the power supply (208 to 230VAC).
- 5. After the generator is switched on, the yellow indicator POWER on the front panel lights. If the External protection circuit is closed, the green indicator ON blinks.
- 6. Apply control voltage to the pins 1 and 3, the green indicator lights constantly.
- 7. By an oscilloscope or frequency meter connected to the acoustic load adjust the frequency value. By turning the potentiometer placed in the opening marked Overvoltage, adjust the operating frequency to coincide with the middle resonant frequency of the Acoustic load.
- 8. By a device measuring current or power, connected to the input voltage make the necessary adjustments.

Start to reduce the inductivity till reaching the maximum value of current or power, which means, the adjustment of the compensating inductivity to the resonance of the Acoustic load is achieved.

Using the frequency potentiometer and the variable inductivity adjust the most suitable operating mode.

NOTE: On position Ext.Block on fig.1.1 there is a potentiometer, provided for future developments. It does not influence the setting of the generator.

## 2. SYSTEM SET-UP

### 2.3. Control Terminal Block.

The MSG.300.OF-S control is a simplified version of MSG.300.OF generator. Frequency adjustment is provided by only one potentiometer.

The control terminal block connector is shown on fig. 2.3:

- Terminals 1, 3 - ON/OFF Volume Control;  
ON - when >10VDC and <25VDC  
OFF - when < 0,8VDC
- Terminals 8 and 15 - External Protection (see fig.2.2)



Fig. 2.3. Control Terminal Block

### 3. FRONT PANEL



- Yellow Indicator - Power
- Green Indicator - ON
- Potentiometer - Ext. Block (Reserved)
- Potentiometer - Overvoltage (Frequency adjustments)
- Inductive compensation regulator (L)

**Fig. 3. Generator Front Panel**

#### 3.1. Yellow Indicator light:

The yellow indicator light is illuminated (ON) when the generator is connected to the mains power.

#### 3.2. Green Indicator light:

The 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 flashes.

**NOTE:** If the green light (ON) is not illuminated, there is a break in Ext. Block or the generator is overheated. Switch off the generator, locate and fix the problem.

#### 3.3. Ext. Block:

In position Ext. Block on fig.3 there is a potentiometer, provided for future developments. It does not influence the setting of the generator.

#### 3.4. Overvoltage:

In position Overvoltage on fig.3 is located a potentiometer for controlling middle frequency of the generator.

#### 3.5. Inductive compensation regulator.

The inductive compensation regulator controls the inductivity by regulating the airgap of the ferrite core.

Turning the regulator to “-” opens the airgap of the ferrite core and the inductivity decreases. Turning the regulator to “+” closes the airgap of the ferrite core and the inductivity increases.

- When the ferrite core is closed the inductivity is approx. 35mH
- When the Ferrite core is max. opened the inductivity is approx. 450 μH.

**ATTENTION:** The inductivity is set to max. during transportation.

## 4. LIMITATION OF WARRANTY

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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.



## 5. SERVICE

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**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.

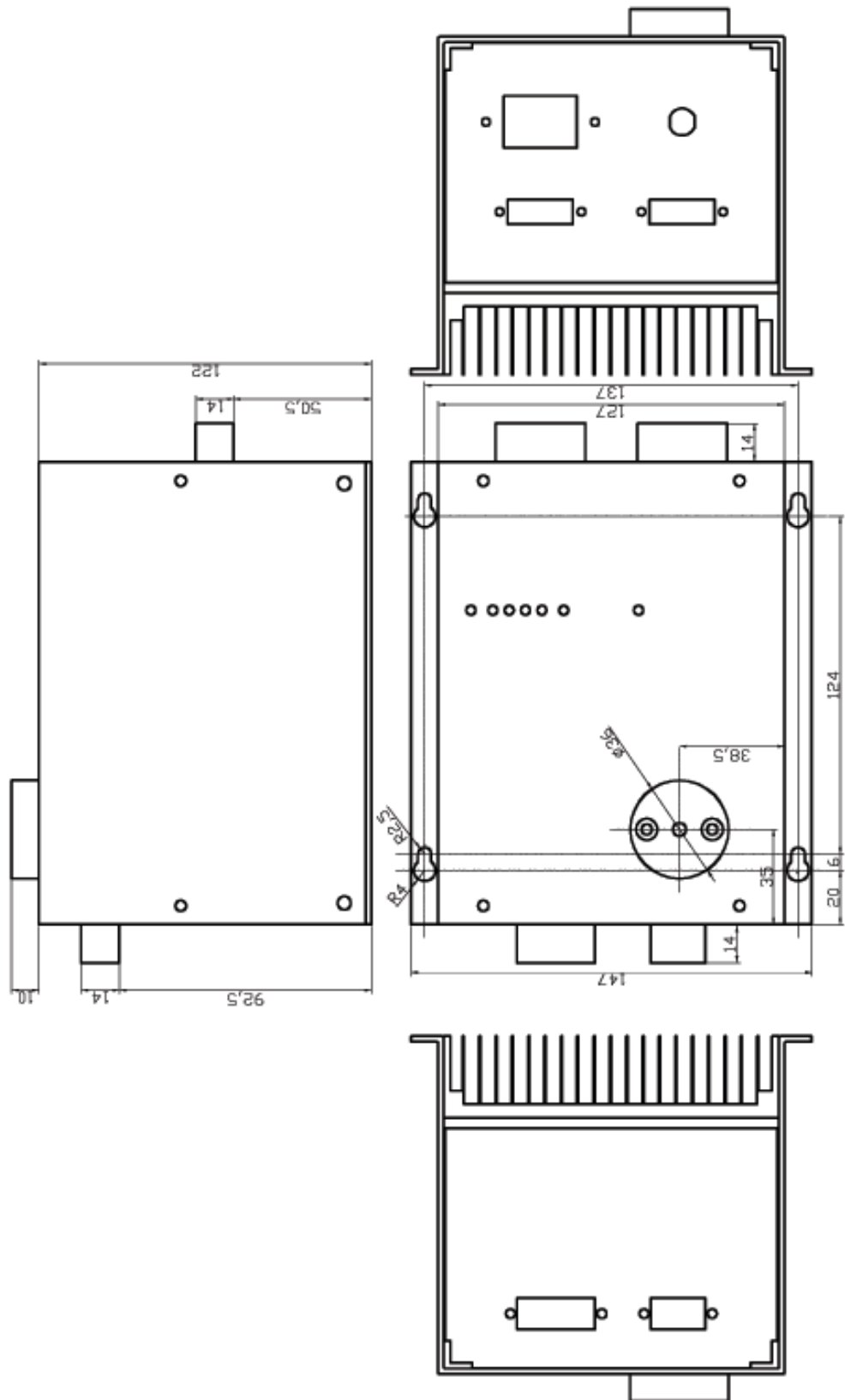
**IMPORTANT NOTICE:** For the protection of employees, shippers, receivers, various personnel, and to remain in compliance with Transit Laws, material returned to the Manufacturer or its designated representatives must be rendered free of any hazardous, noxious or radioactive contamination.

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](mailto:mastersonic@mpi-ultrasonics.com);  
[www.mpi-ultrasonics.com](http://www.mpi-ultrasonics.com)**

OUTLINE DIMENSIONS OF MSG 300.OF-S



Recommendable dimensions of the cabinet for mounting:

- width: 160mm;
- height: 190mm;
- depth: 150mm;