

*Models*  
*1595 Press /*  
*1596 Actuator*

I N S T R U C T I O N M A N U A L



SONICS



Sonics & Materials, Inc.

# WARNING



## ***SAFETY PRECAUTIONS READ BEFORE INSTALLING OR USING THE EQUIPMENT***

This system has been designed to assure maximum operator safety. However, no design can completely protect against improper usage. For maximum safety and equipment protection, observe the following warnings at all times and read the instruction manual carefully before you attempt to operate the equipment.

- The equipment has safety devices that require both hands to be on the palm buttons until the horn contacts the work piece. Do not defeat or modify these safety devices.
- Do not use with foot switch unless alternate means of pinch-point protection is provided.
- High voltage is present in the equipment. Disconnect plug before removing cover or servicing.
- Make sure equipment is properly grounded with a 3-prong plug. Before plugging in equipment, test outlet for proper earth grounding.
- High voltage potential may be present in the converter as a result of temperature changes. Do not touch the converter contact unless you first short both pins or the button to the converter case with an insulated tool.
- Never squeeze or grab a vibrating horn.
- Do not modify horn configurations.
- Ultrasonic welders operate above normal audibility for most people. Ear protection is recommended.
- Do not affix any device to any portion of the horn.

## **Sonics & Materials, Inc.**

### **Corporate Headquarters**

53 Church Hill Road • Newtown, CT 06470 USA  
203.270.4600 • 800.745.1105 • 203.270.4610 fax  
www.sonics.biz • info@sonics.biz

### **European Office**

13, Rue Pre-de-la-Fontaine • CH - 1217 Meryin/Satigny, Switzerland  
(41) (0) 22/364 1520 • (41) (0) 22/364 2161 fax  
europe@sonicsandmaterials.ch

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INSTRUCTION MANUAL • MODEL 1595/1596



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# IMPORTANT SERVICE LITERATURE

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**NOTE:** Please read carefully before operating the equipment, then forward to your service department.

The system supplied with this instruction manual is constructed of the finest material and the workmanship meets the highest manufacturing standards. It has been thoroughly tested and inspected before leaving the factory and when used in accordance with the procedures outlined in this manual, will provide you with many years of safe and dependable service.

## **MANUAL CHANGE INFORMATION**

We continually strive to be at the forefront of the latest electronic developments by adding circuit and component improvements to our equipment as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we cannot incorporate these changes immediately into printed manuals. Hence, your manual may contain new change information. Change information, if any, is located in the Appendix.

We reserve the right to make any changes in the design or construction of our equipment at any time, without incurring any obligation to make any change whatsoever in units previously delivered.

The technical data and schematics in the manual are for informational purposes only and may not reflect the current configuration being shipped from our factory. Upon formal request, complete and up-to-date information can be provided from the factory free of charge.

# UNPACKING AND INSPECTION



**NOTE:** We recommend keeping all carton(s) and packing material in case it might be necessary to move the equipment, or to ship it for repair.

Before unpacking the equipment, check the shipping carton for any visible damage. If you see any, be sure to follow the procedures described below under “Visible Loss or Damage.” Otherwise, proceed to remove the equipment from the carton. Before disposing of any packing material, check it carefully for small parts. Then perform a visual inspection of the equipment to detect any evidence of damage which might have occurred during shipment. Check the following:

1. all components against the enclosed packing list,
2. all module plug-in units,
3. all wire plug-in connections.

The equipment was carefully packed and thoroughly inspected before leaving our factory. All units are tested and checked for problems prior to shipping. It is asked that when a problem does occur that all parts and components be inspected for damage (especially when the unit is not in working order when received). Responsibility for safe delivery was assumed by the carrier upon acceptance of the shipment. Claims for loss of damage sustained in transit must therefore be made upon the carrier, as follows:

## **VISIBLE LOSS OR DAMAGE**

Any external evidence of loss or damage must be noted on the freight bill or express receipt, and signed by the carrier’s agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier’s refusal to honor a damage claim. The form required to file such a claim will be supplied by the carrier.

## **CONCEALED LOSS OR DAMAGE**

Concealed loss or damage means loss or damage which does not become apparent until the merchandise has been unpacked. The contents might have been damaged in transit due to rough handling even though the container may not show external damage. When the damage is discovered upon unpacking, make a written request for inspection by the carrier’s agent within 48 hours of the delivery date. Then file a claim with the carrier since such damage is the carrier’s responsibility. The form required to file such a claim will be supplied by the carrier. Do not destroy packing materials, or move material from one location to another before the carrier makes their inspection.

If the system or any unit is damaged, notify “Sonics.” “Sonics” will arrange for repair or replacement of damaged equipment without waiting for the claim against the carrier to be settled, provided a new purchase order is issued to cover the repair or replacement costs. Should any damage, shortage or discrepancy exist, please notify us immediately.

# INTRODUCTION

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The models 1595 and 1596 are 15 kHz pneumatic actuators used for ultrasonic plastics assembly. The 1595 is a tabletop version, whereas the 1596 can be mounted on a bridge or rigid structural member for use with automated systems. Both models can be supplied with the following GX-Series power supplies:

- GXT . . . . .Weld by digital time
- GXE . . . . .Weld by digital time and/or constant energy
- GXL . . . . .Weld by digital time, constant energy and/or distance\*

*\*Requires optional linear encoder.*

Both actuators are also compatible with E-Series power supplies.

# OVERVIEW OF ULTRASONIC PLASTICS ASSEMBLY

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## ***WHAT IS ULTRASONICS?***

Ultrasonics refers to vibrational waves with a frequency above the human audible range which is usually above 18,000 cycles per second (Hz).

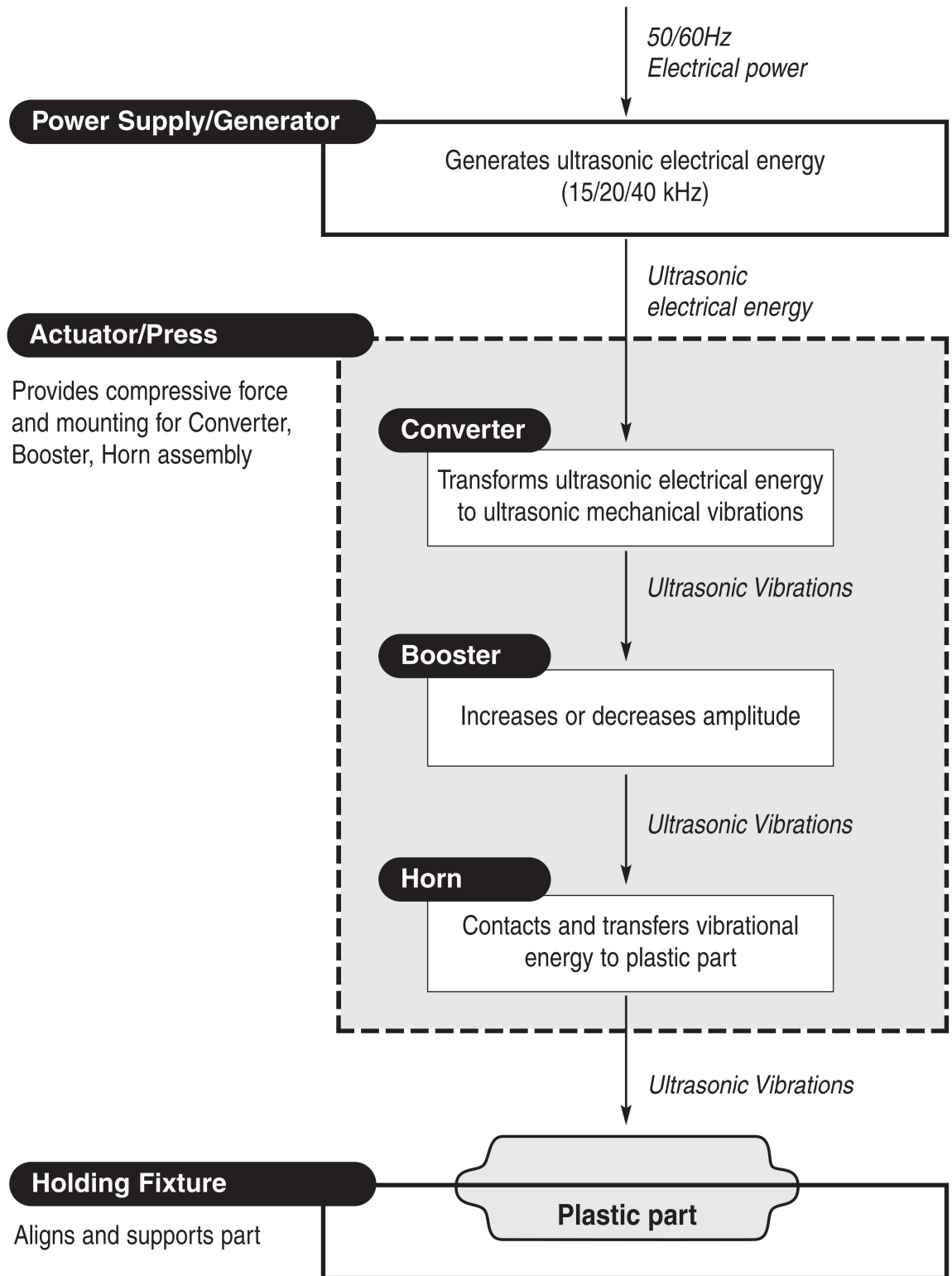
## ***PRINCIPLE OF ULTRASONIC ASSEMBLY***

The basic principle of ultrasonic assembly involves conversion of high frequency electrical energy to high frequency mechanical energy in the form of reciprocating vertical motion which, when applied to a thermoplastic, generates frictional heat at the plastic/plastic or plastic/metal interface. In ultrasonic welding, this frictional heat melts the plastic, allowing the two surfaces to fuse together; in ultrasonic staking or insertion, the controlled flow of molten plastic is used to capture or lock another material in place (staking) or encapsulate a metal insert (insertion).

## ***ULTRASONIC ASSEMBLY SYSTEMS***

“Sonics” ultrasonic assembly systems are generally composed of the following major elements: a power supply, converter, booster, horn, pneumatic press and holding fixture, as detailed in the diagram on the next page. A review of this diagram will help you understand the basic elements involved in the assembly process and their relation to each other.

**“SONICS” ULTRASONIC ASSEMBLY SYSTEMS**





# GLOSSARY OF ULTRASONIC TERMS

**POWER SUPPLY/GENERATOR** – The solid state power supply converts standard 50/60 Hz electrical power to 15,000 Hz, 20,000 Hz, and 40,000 Hz (15/20/40 kHz) electrical energy.

**ACTUATOR/PRESS** – The pneumatic actuator provides compressive force and mounting for the converter, booster, and horn assembly. The tabletop press consists of a base assembly, column and actuator (head).

**CONVERTER** – The converter changes the high frequency electrical energy supplied by the power supply to high frequency mechanical vibrations.

**BOOSTER** – Successful ultrasonic welding often depends on having the right amplitude at the horn face. Often it is not possible to design a horn which has both the necessary shape and required gain (ratios of input amplitude to output amplitude). In such cases, a booster is placed between the converter and the horn to either increase or decrease the amplitude of the horn. In addition to changing/maintaining the amplitude, the booster provides support and alignment in the welding system. (See page 18 for booster selection.)

**HORN** – The horn is a tuned component of the system which comes in contact with the parts to be assembled. The horn 1) transfers the ultrasonic vibrations produced from the converter to the parts being welded, and 2) applies necessary force to the assembly while the material resolidifies.

**HOLDING FIXTURE** – The holding fixture or nest assures proper alignment and support of the parts being assembled.



1595



1596



# INSTALLATION



## WARNING

*Do not connect the press to an air source supplied by a compressor lubricated with synthetic oils or oils containing phosphate esters or chlorinated hydrocarbons. This type of lubricant may cause the air filter to malfunction, and the plastic bowl to rupture.*



**NOTE:** *If the power supply is to be run continuously, air cooling of the converter and horn is required. Use clean, dry compressed air filtered down to 5 microns (supplied to converter fitting).*

## ELECTRICAL POWER

The press is powered by the power supply. Consult your power supply instruction manual to determine power specifications.

## AIR SUPPLY

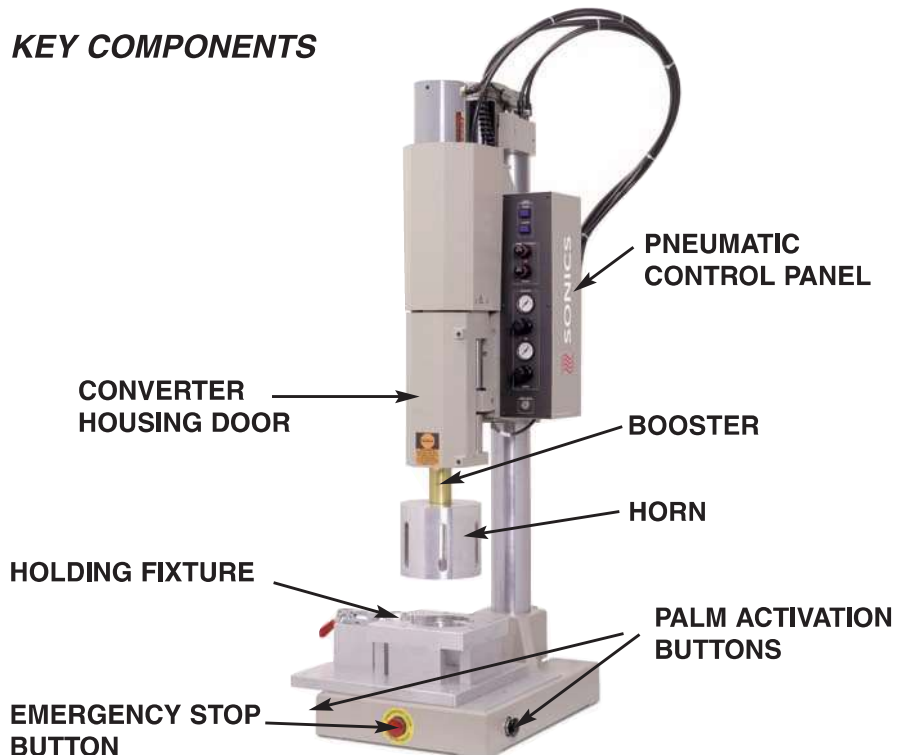
The press requires a source of dry, filtered (5 micron), oil-free, compressed air capable of supplying a constant line pressure of 100 psig. (690 kPa / 7 bar) at a minimum capacity of 4 CFM (.1 cubic meters).

## SETTING UP

The press should be installed in a clear, uncluttered location that is free from excessive dirt, dust, corrosive fumes, and temperature and humidity extremes. The selected installation site should be near the electrical power and air supply sources and away from any equipment that generates abnormally high electrical transients. Observe the following additional instructions when installing the press:

- The press should be placed on a sturdy, level table or bench capable of supporting a minimum of 500 pounds (227 kg).
- Allow at least 6 inches (152.4mm) at the rear of the press for cable connections.

## KEY COMPONENTS





**NOTE:** Do not strain or kink the cables. When going around corners, allow as wide a bend as possible. Do not run the cables parallel to any power line within a distance of less than 1 foot (304.8mm).

## CONNECTIONS

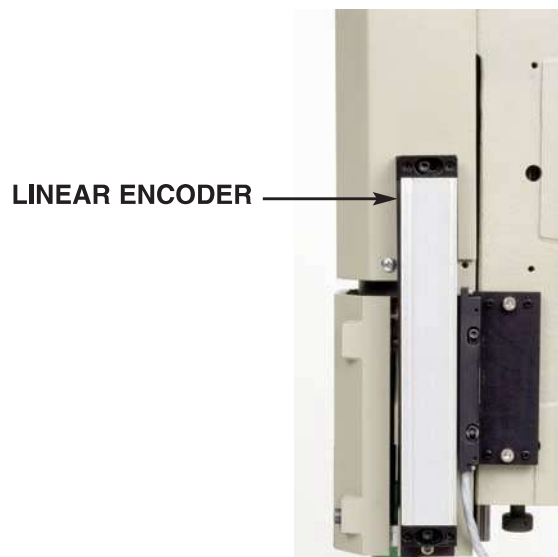
When making the initial connections, make sure all power is disconnected.

1. Connect the air supply source to the press air filter located at the bottom rear of the control panel, using a hose having a minimum inside diameter of 1/4 inch (6.4 mm).
2. Connect the RF and base (actuating) cables of the (table top only) press to the power supply. (Consult your power supply instruction manual for details.)
3. Check with your electrician if you have any wiring questions.

## OPTIONS

A Linear Encoder is available as an option for the 1595 and 1596 models. The Linear Encoder allows distance-controlled welding in both incremental and absolute modes.

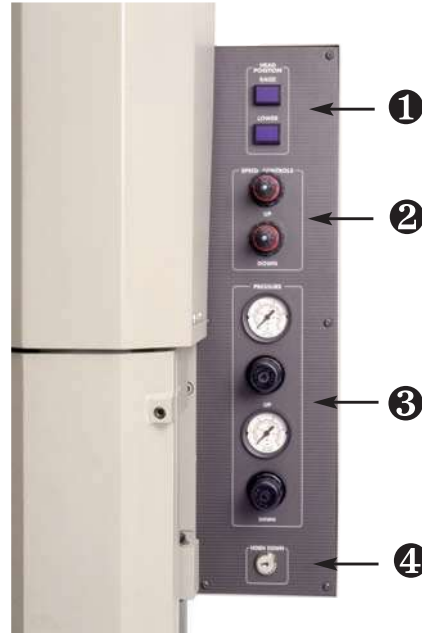
The Linear Encoder is supplied with a 9-pin male connector that connects to a matching 9-pin female connector on the power supply (factory installed).



# OPERATING PROCEDURES

## CONTROL PANEL

Located to the right of the converter housing is a control panel with the following features:



1. Blue **HEAD POSITION** buttons (labeled “RAISE” and “LOWER”) which move the head up or down on the column when depressed.
2. Black and red **SPEED CONTROL** knobs which allow regulation of the speed at which the horn descends and returns (stroke speed).

These controls are factory adjusted for average operating conditions. When minor adjustments are necessary, be sure to adjust in small degrees.

The upper knob, labeled “UP,” controls the return speed – turn it clockwise to slow the speed, counterclockwise to increase speed.

The lower knob, labeled “DOWN,” controls the extend speed – turn it clockwise to slow the speed, counterclockwise to increase the speed.

3. Black **PRESSURE REGULATORS** with corresponding gauges that allow regulation of the pressure with which the horn contacts the part and returns to the home position. Pull the knobs to make adjustments, and then push in to lock settings when desired pressure is displayed. Once pulled, turning the knobs clockwise increases pressure, and turning them counterclockwise decreases pressure.
4. The **HORN DOWN** key switch which when turned clockwise moves the converter housing to the extended position (this action does not cause ultrasonics to be activated).

# INITIAL EQUIPMENT SETUP



## WARNING

*Never tighten the horn to the booster using the housing door as the upper wrench as this may cause damage to the booster and/or converter.*

## ASSEMBLING AND MOUNTING CONVERTER, BOOSTER, AND HORN

If the converter, booster, and horn are not already assembled, follow these instructions:

1. Clean the mating surfaces of the converter and booster, as well as the threaded stud and hole. Check that the stud is tight (see recommended torque requirements on page 13).
2. Hand assemble the converter and booster together. Using spanner wrenches as shown below, tighten to 50-55 foot-lbs. (68-75 newton-meters). **Do not force or overtighten.**



CONVERTER/BOOSTER

3. Clean the mating surfaces of the booster and horn, as well as the threaded stud and hole. Check that the stud is tight. (See recommended torque requirements on next page.)
4. Hand assemble the horn to the booster. Using spanner wrenches as shown below, tighten to 50-55 foot-lbs. (68-75 newton-meters). **Do not overtighten.**



CONVERTER/BOOSTER/HORN





**NOTE:** When performing any of the operations described on this page and pages 14 and 15, DO NOT turn on the power supply.

- Using the 3/16" (4.7 mm) T-handle wrench provided, loosen (turn counterclockwise) the two cap screws on the hinged converter housing and open the door.
- Place the converter / booster / horn assembly in the housing with the horn facing down. Fit the male brass button connector on the top of converter into the brass grooved ridge connector in the bottom of the interior housing, and gently push the assembly up and in so that the booster mounting ring rests on the lower support ridge.

**CONVERTER / BOOSTER / HORN ASSEMBLY**



**WARNING**

Never tighten the horn to the booster using the housing door as the upper wrench as this may cause damage to the booster and/or converter.

- Close the converter housing door and tighten (turn clockwise) the two socket head cap screws just until they are snug. Do not tighten the horn to the booster using the door as the upper wrench. Hand-forcing the horn on and off in this manner can twist the converter wires and cause a failure. If the horn is not in the correct position to make contact with your material, loosen the cap screws re-open the converter housing door, and re-position the converter / booster / horn assembly.



**NOTE:** If you do not close the housing door once the assembly is in place, the assembly can fall out.

**RECOMMENDED TORQUE REQUIREMENTS**

Component	Foot-Lbs.	Newton-Meters
Converter / Booster	50 - 55	68-75
Booster / Horn	50 - 55	68-75
Stud	55	75

## HORN AND FIXTURE ALIGNMENT

For maximum productivity, the clearance between the horn and the part should be at a minimum. However, adequate clearance should be provided to enable easy loading and unloading of the part from the holding fixture. The maximum stroke distance is 4" (optional 6" stroke available). Ensure that the head is not too close to the limit of its down travel distance. Otherwise, the horn may not have sufficient distance to travel downwards to achieve a full depth of weld. Set welding height as described below:



### WARNING

*When the air pressure is decreased, the converter housing can drop down to its limit, so be sure to either support it or remove anything in its path.*

1. Position the holding fixture loosely on the base plate using 3/8-16 screws.
2. Place the part to be welded in the fixture.
3. Set the air pressure to zero by turning the UP PRESSURE regulator knob fully counterclockwise.
4. To get the head into the position desired, use one or both of the methods described below to make adjustments as needed:
  - a. Loosen the two column clamps (counterclockwise) and use the HEAD POSITION buttons to move the head up or down. The head can also be manually rotated slightly (from side to side). Once the head is in the desired position, tighten the column clamps.
  - b. With the column clamps locked (tightened) in place, the HORN DOWN Key switch (which activates the air cylinder) can be used to advance the horn.
5. Loosen the cap screws on the converter housing door and gently rotate the converter/booster/horn assembly as required to ensure proper horn-to-part alignment.



6. Tighten the converter housing door screws, and then tighten the fixture on the base plate.
7. Check for proper mating of fixture, parts, and horn. If the horn and parts are not in parallel contact, shim the fixture or adjust leveling screws as required. Adjust the positive stop knob for proper weld depth (see below).
8. Set the UP PRESSURE regulator to a reading of 20 psig (140 kPa/1.4 bar) on the pressure gauge. (Turn the PRESSURE knob clockwise.) This 20 psig reading is the initial pressure and may later change according to application requirements.

The UP PRESSURE, used to raise the horn, should be regulated according to the size of the horn you are using. The larger the horn, the more UP PRESSURE required.



**NOTE:** For maximum safety and productivity, adjust the clearance between the horn and the part to a minimum that will still allow ease of loading and unloading.

### **POSITIVE STOP ADJUSTMENT**

The positive stop is set to limit the downward travel of the horn to approximately 75%. Readjustments may be required. Coarse adjustment of the clearance between the face of the horn and part should be made using the elevation control. Fine adjustment should be made using the positive stop. The positive stop can adjust vertical positioning with a 4" stroke (or optional 6" stroke).



The positive stop adjustment knob is located behind the converter housing. Turning the knob clockwise will decrease downward travel distance. Turning the knob counterclockwise will increase the downward travel distance. When making any adjustments be aware of the necessary clearances required.



# OPERATION



## WARNING

*The equipment has safety devices that require both hands to be on the palm buttons until the horn contacts the workpiece. **Do not defeat or modify these safety devices.***



**NOTE:** *Power supply cannot be shut off once the weld cycle has started. Termination of cycle can only be achieved by using the EMERGENCY STOP button.*



## WARNING

*Do not use with a footswitch unless alternate means of pinch-point protection is provided.*

## ACTUATION

The 1595 press is equipped with two maintained anti-repeat (non-tie-down) palm buttons, one located on the left and one on the right side of the base of the press. Both palm buttons must be pressed simultaneously to activate the press to cycle the welder. To operate the press, follow these simple steps:

1. Make sure the column clamps are locked.
2. Depress both black palm buttons simultaneously.
3. Once the horn comes in contact with the part and the ultrasonics are activated, release the palm buttons. If you release the buttons before contact is made, the head will immediately return to its “home” position.

The operation of the 1596 actuator is controlled by the automated system. A four-wire actuation cable is provided which ties into the output side of a PLC, or other system controlling device. Momentary two wire closure from a dry source will initiate the welder’s cycle. For more information, refer to the power supply manual and the included wiring diagrams.

## EMERGENCY STOP

To abort the 1595 press during welding, simply press the red EMERGENCY STOP button located at the front center of the press base.

Once the EMERGENCY STOP button has been depressed, the head will retract and return to its “home” position, remaining there until the button is released. Simply rotate the EMERGENCY STOP button to the right 1/4 turn to release the press for further operation.

For the 1596 actuator, a four-wire actuation cable contains two normally closed wires which control the emergency stop function. For more information, refer to the power supply manual and the included wiring diagrams.



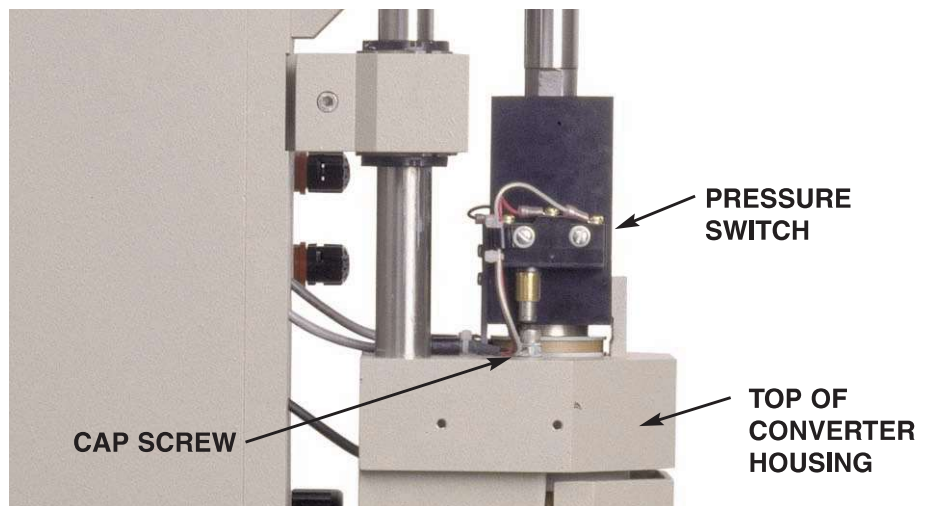
# FINE ADJUSTMENTS

## ***PRESSURE SWITCH ADJUSTMENT***

For systems mounted in the normal vertical position with downward travel, no adjustment should be necessary. The minimum trigger pressure is factory set to approximately 10-12 psig (69 kPa/.7 bar - 83 kPa/.8 bar).

However, if the minimum trigger pressure requires recalibration or re-adjustment, observe the following procedure:

1. Maintain air pressure and unplug the power supply from the electrical source.
2. Remove the four screws holding the five-sided cover.
3. Loosen the jam nut holding the 8-32 cap screw in place.
4. Rotate the cap screw counter-clockwise (up) until the Pressure Switch closes.



5. Next rotate the cap screw clockwise (down) until the Pressure Switch opens.
6. Rotate cap screw clockwise (down) 1/4 turn past the Pressure Switch open position.
7. Tighten the jam nut to lock cap screw in position.
8. Replace the cover and four screws.
9. Plug the power supply into the electrical source.
10. Cycle the welder.

A press actuating in an upward direction should be set to trigger at a minimum of 14-16 psig (a value which is nominally factory set only if "Sonics" is notified prior to purchase that the press will be used for vertical welding). Lower values may affect trigger performance where false triggering may be observed.

## UPPER LIMIT SWITCH

The optional Upper Limit Switch may be used as a safety interlock in automation to prevent the movement of material handling equipment (indexing) when the horn is down. It also may be used to initiate the movement of material handling equipment when the horn is up. The Upper Limit Switch is located opposite the Pressure Switch.

The Upper Limit Switch is factory set and should be suitable for all applications.



**NOTE:** Consult the Applications Manual or call our Applications Lab for proper booster selection.

## BOOSTER SELECTION

The first step in optimizing welding conditions is to select a booster which will provide the necessary amplitude. For parts 2" (50.8mm) in diameter or greater, start with a moderate amplitude booster such as a green. Determine optimum amplitude by welding a few parts, and repeat the procedure with boosters giving higher or lower amplitude. If there appears to be little or no difference, use the booster giving the highest amplitude.

Six standard boosters, color coded or engraved for ease of identification, are available either to increase or decrease the amplitude.



### WARNING

High gain boosters, such as silver and black in combination with high gain horns can result in the horn cracking or failing. See note above.

### BOOSTERS

Color	Part No.	Gain	Amplitude Effect
Black	BHN16TBK	2.50	Increase
Silver	BHN16TSI	2.00	Increase
Gold	BHN16GD	1.50	Increase
Brown	BHN16BR	1.25	Increase
Green	BHN16GR	0	No Change
Purple	BHN23PU	0.75	Decrease

## **PRESSURE**

During the welding process, sufficient pressure should be applied to the part so that the mating surfaces contact each other. If the pressure is too low, the process will run inefficiently causing unnecessarily long weld time cycles, marking of the parts or poor welding. If the pressure is too high, the horn may stop vibrating, the part(s) might fracture, or the power supply might overload.

Refer to the Applications manual for additional information on pressure settings. In general, a starting setting of between 25-30 psig (172 kPa/1.7 - 207 kPa/2 bar) can be used as a guideline, but you will need to adjust the air pressure to a desired setting based upon the application results.



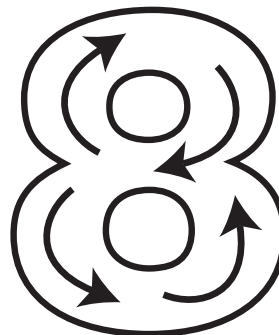
**NOTE:** Contact between the booster and horn should be parallel. When encountering symptoms such as loud noises or tuning difficulties, examine the booster / horn interfaces for parallelism, corrosion, galling or foreign deposits. Also check the tightness of the stud.

## **RE-ESTABLISHING PROPER BOOSTER / HORN INTERFACES**

To re-establish proper interfaces, follow these instructions:

1. Using open-ended wrenches, separate the booster from the horn. Clean each item and then examine interfaces for irregularities (scoring).
2. If irregularities are present, remove the stud.
3. Tape a sheet of 400 grit emery cloth to a smooth, flat surface. (Do not use coarser than 400 grit.)
4. Grasp the lower portion of the booster or horn and move it across the emery cloth. To ensure proper lapping, a) hold the part straight, b) apply light downward pressure, and c) move in one direction only in a figure 8 pattern.

Repeat the figure 8 pattern once more.



### **WARNING**

DO NOT use anything coarser than 400 grit emery cloth.





**NOTE:** Machining of booster / horn may alter the ability to tune the component to the system. System inoperation may occur.

5. Then, rotate the booster or horn 1/3 of a turn in a clockwise direction and then repeat step 4.
6. Repeat step 5.
7. Using wire brush, clean stud, then replace securely. Tighten new stud to the recommended torque specifications on page 13.

# MAINTENANCE

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**NOTE:** *If packing unit for return shipment, DO NOT use styrofoam “peanuts.”*

## **REPAIRS / SERVICE**

If problems are encountered, contact our Service Department as follows:

Phone: 1-800-745-1105 • 1-203-270-4600

Fax: 1-203-270-4610

E-Mail: [service@sonicsandmaterials.com](mailto:service@sonicsandmaterials.com)

It is suggested that a system in need of repair be sent back to the factory, with a written description pertaining to the nature of the problem.

**Always contact the factory for return authorization** before shipping any instrument. Include date of purchase, model number, and serial number. For units not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay. Care should be exercised to provide adequate packing to insure against possible damage in shipment. The system should be sent with all transportation charges prepaid and return method of shipment indicated.



# WARRANTY

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Sonics & Materials, Inc., hereinafter referred to as “Sonics,” warrants its products for a period of one year from the date of shipment against defect in material and workmanship under normal installation, use, and maintenance as described in the operating instructions which accompany such equipment. During the warranty period, “Sonics” will, at its option, as the exclusive remedy, either repair or replace without charge for material and labor, the part(s) which prove upon our examination to be defective, provided the defective unit is returned to us properly packed with all transportation charges prepaid.

Ultrasonic welding horns constructed of titanium or aluminum are guaranteed against defects for a period of one year from date of shipment. “Sonics” will repair or replace a cracked or defective horn once without charge, if failure occurs within the warranty period.

Ultrasonic welding horns constructed of steel are guaranteed against defects for a period of ninety days from date of shipment. “Sonics” will repair or replace a cracked or defective steel horn once at a charge of 50% of the original purchase price, if failure occurs within the warranty period.

## ***LIMITATION OF WARRANTY***

This warranty is in lieu of any other warranties, either express, implied, or statutory. “Sonics” neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with the sale of its products. “Sonics” hereby disclaims any warranty or merchantability or fitness for a particular purpose. No person or company is authorized to change, modify, or amend the terms of this warranty in any manner or fashion whatsoever. Under no circumstances shall “Sonics” 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 “Sonics” product.

This warranty does not apply to equipment which has been subject to unauthorized repair, misuse, abuse, negligence or accident. Equipment which, in our judgment, shows evidence of having been used in violation of operating instructions, or which has had the serial number altered or removed, will be ineligible for service under this warranty.

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

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

“Sonics” reserves the right not to warrant horns of unusual or experimental design which in our judgment are more likely to fail in use.

This warranty does not cover equipment used for applications requiring metal-to-metal contact with weld time in excess of 1 second.

Data supplied in the instruction manual has been verified and validated and is believed adequate for the intended use of the equipment. If the equipment or procedures are used for purposes other than those specified herein, confirmation of their validity and suitability should be obtained in writing from “Sonics.”



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**Sonics & Materials, Inc.**

**Corporate Headquarters**

53 Church Hill Road • Newtown, CT 06470 USA  
203.270.4600 • 800.745.1105 • 203.270.4610 fax  
[www.sonicsandmaterials.com](http://www.sonicsandmaterials.com) • [info@sonicsandmaterials.com](mailto:info@sonicsandmaterials.com)

**European Office**

22 ch du Vernay • CH - 1196 Gland, Switzerland  
(41) (0) 22/364 1520 • (41) (0) 22/364 2161 fax  
[europa@sonicsandmaterials.ch](mailto:europa@sonicsandmaterials.ch)