

INSTRUCTION MANUAL

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Sonics & Materials, Inc. INSTRUCTION MANUAL • MWS20 WIRE SPLICER

WARNING



SAFETY PRECAUTIONS READ BEFORE INSTALLING OR USING THE EQUIPMENT

Our systems have 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 all applicable instruction manuals carefully before you attempt to operate any equipment.

- 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.
- Never squeeze or grab the vibrating horn or tip.
- Do not modify horn or tip configurations.
- 20 kHz, 30 kHz and 40 kHz ultrasonic welders operate above normal audibility for most people. Ear protection is recommended.
- Do not affix any device to any portion of the horn or tip.

Sonics & Materials, Inc.

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

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IMPORTANT SERVICE LITERATURE



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.



OVERVIEW OF ULTRASONIC METAL WELDING

PROCESS DESCRIPTION

Ultrasonic metal welds are produced when metals are scrubbed together under pressure at a frequency of 15 kHz up to 40 kHz and at a peak-to-peak amplitude of 10 to 80 microns. The intense scrubbing action at the interface causes surface films and oxides to be dispersed and the base metals are then mixed together to form a true metallurgical weld.

The temperature rise during welding is far below the melt temperature of the metals so that no intermetallic's form and the weld does not degrade over time. Typical welds are produced in less than one second and require approximately one tenth the power of a resistance weld.

The welded parts are not annealed and can usually be handled immediately after welding.



The parts to be welded are placed into a locating nest.

One component (part A) rests on a stationary anvil that is serrated to grip the component and hold it in place.



The ultrasonic tool descends and applies clamping pressure between the parts.

The tool then vibrates at its resonant frequency.

The parts are then "scrubbed" together under pressure causing surface oils and oxides to be dispersed.



The base materials are then mechanically mixed causing a metallurgical bond between the parts.

The parts are immediately welded with little or no hold time or curing time.

MATERIALS

The ideal materials for the ultrasonic metal welding process include the softer metals such as copper, aluminum, gold, silver, nickel and brass (no lead). The metal that is vibrated is typically less than 2mm in thickness to permit the vibrations to be transmitted to the weld interface. The stationary part may be any size and thickness.

Ultrasonic metal welding is most beneficial in welding materials that are dissimilar in composition and in thickness. An example is welding copper to aluminum for wire terminations and heat sinks.



TOOLING

Tool steels that are heat treated to Rockwell C 60-62 are excellent for metal welding and, when applied correctly, can often produce up to 500,000 welds depending on the application without any maintenance. Sonics has developed proprietary low cost replaceable tip tooling that can be easily changed in less than one minute.

APPLICATIONS

Typical ultrasonic metal welding applications include the following:

- Wire Terminations
- Wire Splicing
- Tube Sealing for the Refrigeration Industry
- Electrical Switch Gears
- Seam Welding of Solar Water Heaters and Pipe
- Battery Terminations
- Heat Sinks for High Power Electronic Devices

EQUIPMENT

Sonics ultrasonic metal welding systems include:

- 15kHz, 20kHz and 40kHz Universal Spot Welders
- 20kHz Wire Splicers
- 20kHz Seam Welders
- 20kHz Tube Sealers



Spot Welder



Tube Sealer





Seam Welder



OVERVIEW OF ULTRASONIC WIRE SPLICING

SEQUENCE OF OPERATION



1. Stack the wires vertically within the splice zone resting the wires on the ultrasonic horn tip. (Always attempt to stack the wires vertically and not side-by-side as "side splicing" produces inferior welds.



2. Upon cycle activation by depressing the foot pedal switch, the gathering tool moves laterally to the right pushing the wires against the reference block.



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3. The anvil then moves laterally to the left and stops against the gathering tool.



4. The entire anvil housing now descends and as pressure is applied to the wires, ultrasonic's fire and the weld splice occurs.





PROCESS CONTROLS

The "pre-weld height" of the wires is measured and compared to the "pre-height limits." If the height is outside the limits, the cycle is aborted and the operator is alerted to the wire loading error.

With the re-height test satisfied, the ultrasonic vibrations scrub the wire strands at the 20 kHz frequency to remove surface oxides and contaminants.

A precise amount of ultrasonic energy is applied to produce the weld, thus if there is a variation in the amount of oxidation or contaminants on the wire strands, the weld cycle is automatically extended to disperse the oxides or contaminants and achieve optimum weld results.

The welded splice is then automatically measured to confirm proper bundle compaction and splice quality.





Wire Splice Examples



ULTRASONIC WIRE SPLICER





SmartControl Ultrasonic Power Supply

MWS20 Ultrasonic Wire Splicer

The Sonics & Materials Wire Splicer allows the operator the ability to efficiently weld wires.

The SmartControl power supply interfaces with the wire splicer to set weld parameters and collect data. The wire splicer is constructed of true machine tool quality that minimizes stack deflection and maximizes efficiency. This instruction manual outlines how to replace the regular wear items (gathering tool, tip guide, anvil and tip) as a part of regular maintenance.

The MWS20 wire splicer is a precision bench top pneumatic welder used for ultrasonic metal wire assembly and the splicer can be supplied with any of the following SmartControl power supplies:

Power Supply Model	Peak Power	Weld Splice Zone
WSC1500-20	1500 Watts	0.5mm to 15.0mm ²
WSC2500-20	2500 Watts	0.5mm to 25.0mm ²
WSC4000-20	4000 Watts	0.5mm to 40.0mm ²

NORMAL WEAR PARTS REPLACEMENT

During the course of normal use, it will become necessary to replace the gathering tool, tip guide, anvil and welding tip. The tools shown below will be required to perform these operations when the splicer shows signs of wear such as unacceptable weld quality, and/or a noticeable change in the weld results displayed on the touch screen of the SmartControl power supply.

Required Tools

- (2) Spanner Wrenches
- (1) Torque Wrench (Set to 55 Ft. /Lb.)
- (1) 12mm Socket
- (1) Set of Metric Allen Keys
- (1) .001" Shim
- (1) .002" Shim
- (1) 1mm Shim





INSTALLATION

ELECTRICAL POWER

The press is powered by the SmartControl power supply.



Do not connect the press to an air source supplied by an air 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.

- Model WSC1500-20 requires 230VAC Single Phase @ 20A Service
- Model WSC2500-20 requires 230VAC Single Phase @ 20A Service
- Model WSC4000-20 requires 230VAC Single Phase @ 30A Service

AIR SUPPLY

The press requires a source of dry, filtered (5 micron), oil-free, compressed air capable of supplying a constant line pressure of 85 psig. (625 kPa / 6 bar) at a minimum capacity of 2 CFM.

SETTING UP

The press and power supply 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:

- a. The press should be placed on a sturdy, level table or bench capable of supporting a minimum of 110 Lbs. (50 kg)
- b. Allow at least 6 inches (152.4mm) at the rear of the press and power supply for cable connections.



CONNECTIONS



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).

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

- 1. Connect the combination RF/Actuating cable of the press to the power supply.
- 2. Connect the Pressure Regulator and Height Encoder cable.
- 3. Connect the Motor cable.
- 4. Connect the cycle activation Footswitch cable.
- Connect the air supply source to the press air connection located at the rear of the press head, using a hose having a minimum inside diameter of 1/8 inch (3 mm).

A 1/4 NPT connector is provided to attach your air line service. Connectors are typically an instant (push-to-connect) type ¹/₄" O.D. plastic tube fitting.

- 6. Optional Barcode Reader connection.
- 7. Optional PC Interface connection.
- 8. 220VAC single phase incoming power connection.

NOTE - Check with your electrician if you have any wiring questions.



MACHINE SET-UP

INTRODUCTION



Prior to shipment by the factory, the wire splicer was completely setup and gapped for proper operation prior to shipment.

However, responsibility for safe handling was assumed by the carrier upon acceptance of the shipment and the factory cannot be responsible for any carrier negligence in handling of the shipment.

The wire splicer should go through the following set-up procedure after it has been received, prior to its first use, and as planned maintenance.

Sonics & Materials' wire splicer requires simple set-up to minimize tool wear and extend the life of the product. If the critical gaps are not maintained, the tool surfaces will weld to one another and possibly cause further damage that is not covered by the product's warranty.

The ensuing pages of this manual will provide the following instructions for these recommended setup and gapping procedures.

- 1. Gapping between the Reference Block and Horn Side
- 2. Gapping between the Gathering Tool and Horn Tip
- 3. Weld Width Calibration
- 4. Weld Height Calibration

Note - The tools required for these setup and gapping procedures are listed on page 9 of this manual and were included with the machine at shipment.



CAUTION PLEASE READ BEFORE PROCEEDING TO SET-UP GUIDE TO PREVENT TOOL DAMAGE

CRITICAL GAPS



Proper gapping must be maintained to prevent damaging the wire splicer's tooling components. If metal-to-metal contact is made in the two critical areas outlined above, the tooling components will weld together and require replacement, which is not covered by the product warranty.



REFERENCE BLOCK AND HORN GAPPING



Power up the SmartControl power supply.

From the Weld Data Screen or Weld Power Graph Screen, follow these procedures to ensure the anvil housing is in the up position.

- 1. MENU
- 2. SETUP
- 3. CALIBRATE HEIGHT
- 4. HORN OPEN



(A).

Loosen the 2.5mm anvil top set-screw



2

3 L

Loosen the 5mm reference block rear retention bolt (B).

NOTE – Only loosen the retention bolt 1/2 to 1 full turn maximum.

4

Refer to page 14 and follow the power supply procedure to *close the horn*. (Lower the anvil housing.)



5

6

Loosen 8mm reference block side jam nut (C).

Loosen 2.5mm reference block side retention screw (D).



Adjust reference block side retention screw (D) until the gap between the horn side and reference block is .002" (0.050mm) using a precision shim.

Leave the jam nut (c) loose for now.





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Tighten the 2.5mm anvil top set-screw (A) to temporarily secure the reference blocks gapped location.





Tighten reference block rear retention bolt (B).



- Tighten reference guide side 9 jam nut (C)
- 10 Loosen anvil top set-screw (A). (This screw now remains loose.)



Remove Shim.

12 Refer to page 14 and follow the power supply procedure to open the horn. (raise the anvil housing.)





GATHERING TOOL AND HORN TIP GAPPING



From the Weld Data Screen or Weld Power Graph Screen, follow these procedures to extend the gathering tool to the reference block.

- 1. MENU
- 2. SETUP
- 3. CALIBRATE WIDTH
- 4. MOTOR RUN DOWN





2

5

Loosen the gathering tools front 3mm mounting screws (E).



- 3 Insert .005" (.127mm) precision shim between the gathering tool and the horn tip.
- 4 With your finger, apply downward pressure on the gathering tool to "pinch" the shim between the gathering tool and horn tip.
 - Tighten gathering tool front mounting screws (E).





CALIBRATE WIDTH



From the Weld Data Screen or Weld Power Graph Screen, follow these procedures to Calibrate width between the gathering tool and the reference block.

- 1. MENU
- 2. SETUP
- 3. CALIBRATE WIDTH
- 4. SET ZERO WIDTH



SET ZERO WIDTH will automatically close the gathering tool to the reference block. Make sure fingers and obstacles are clear.



GATHERING TOOL

REFERENCE BLOCK

5. MOTOR RUN UP. After setting width, push and hold to return the gathering tool to its home position.





CALIBRATE HEIGHT



From the Weld Data Screen or Weld Power Graph Screen, follow these Procedures to calibrate height.

- 1. MENU
- 2. SETUP
- 3. CALIBRATE HEIGHT
- 4. ANVIL OUT



ANVIL OUT will automatically open the anvil. *Make sure fingers and obstacles are clear.*

- 5. INSERT 1MM SHIM
- 6. SET HGT ZERO
- 7. GO



GO will automatically close the anvil to the horn tip. With the exception of the 1mm shim, *Make sure fingers and obstacles are clear.*





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SMART CONTROL

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Machine Options

Calibrate Heigh

SMART CONTROL

MACHINE MAINTENANCE

GATHERING TOOL INSPECTION

Remove the 3mm gathering tool screws (E) to remove gathering tool.



NOTE - Maintain a sharp edge to prevent wire from getting under the gathering tool.



4 With your finger, apply downward pressure on the gathering tool to "pinch" the shim between the gathering tool and horn tip.









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ANVIL AND ANVIL SUPPORT GUIDE INSPECTION

Loosen the 2.5mm anvil cover set screw (F).

Push retaining pin to right and remove.

Tip the top of anvil cover forward and raise it up to remove it.

NOTE – 3 "Rings" on right side of cover retaining pin when re-assembling.



Anvil Cover



Remove the 5mm reference block rear retention bolt (B).







- 3 Remove the anvil from the anvil actuation pin.
 - Remove the anvil support guide block.
- 5 Check surfaces for wear and replace if necessary.

Anvil Support Guide Block



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ANVIL AND ANVIL SUPPORT GUIDE REPLACEMENT

To re-assemble or replace the anvil assembly components



Place .002" (.05mm) shim between the anvil support guide block and horn tip.

2

3

Snug the 2.5mm anvil top set-screw, rear set screw, (A) to lightly press the anvil against the datum surface of the anvil support guide block.

Adjust the 2.5mm side jacking screw (G) until there is shim friction between The anvil support guide block and horn tip.







5 Loosen the take up screw to allow the anvil to move freely.



Remove the shim.



Replace front covers and tighten the anvil cover pin set screw.





HORN TIP REPLACEMENT

Horn Tip Bolts



2

Remove (2) horn tip bolts using a 12 mm socket and torque wrench.

Check horn tip knurl pattern for wear and either rotate the tip 180° for a new tip surface or replace the tip.

If re-using the tip, check the horn tip sides for gawling and polish sides with emery cloth if needed.



3 Place .002" (.05mm) shim between the anvil support guide block and horn tip.

Re-tighten the horn tip bolts to the horn to 55 Ft./ Lbs. torque.



Shim



HORN TIP ALIGNMENT

3

It is critical that the side of the horn tip be parallel and then properly gapped with the anvil assemblies reference block.

- As shown in figure 1 below, rotate the lower 3mm clocking screw counterclockwise and the upper clocking screw clockwise to rotate the top of the horn tip to the right.
- 2 As shown in figure 2 below, rotate the upper 3mm clocking screw counterclockwise and the lower clocking screw clockwise to rotate the top of the horn tip to the left.
 - Adjust the clocking screws until the horn tip is parallel with the reference block.
- 4 Once the horn tip is parallel with the reference block, make sure that both clocking screws are tight.
- 5 Once the horn is parallel to the reference block, refer to page 14 of this manual for horn to reference block gapping procedures.











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STACK REMOVAL

If it is required that the horn or converter require replacement or service, the ultrasonic stack will need to be removed from the wire splicer.



If replacing the horn or converter, use the supplied spanner wrenches to tighten the stack to approximately 20 ft. / lbs. torque.



BELT TENSION ADJUSTMENT

The following procedures are for adjusting belt tension on the weld distance encoder and gathering tool drive.

Remove the gear housing cover by loosening the three screws on the cover side.

Once the gear housing cover has been removed, check the tension in both belts for approximately 1/8" (3mm) of "play."





1/8" (3mm) Belt "Play"

DO NOT OVER TIGHTEN BELT TENSIONS AS THIS CAN CAUSE BENDING OF THE MOTOR SHAFTS.

Gathering Tool Motor Belt (Front)

Distance Encoder Motor Belt (Rear) -



To adjust gathering tool belt tension, loosen the four motor mount screws on the front of the gear assembly plate.



To adjust encoder belt tension, loosen the two motor mount screws behind the lower sprocket on the gear assembly plate.





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 ext. 343 or 366

Fax: 1-203-270-4610

Email: service@sonics.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 must be sent with all transportation charges prepaid and return method of shipment indicated.

DRAINING THE AIR FILTER BOWL

Periodically check the Air Filter Bowl for any moisture and/or condensation, and drain as necessary.



To drain, unscrew the knurled brass drain screw at the bottom of the air filter bowl and let any collected moisture drain out.



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, 30,000 Hz or 40,000 Hz (15/20/30/40 kHz) electrical energy (depending on frequency of model purchased).

ACTUATOR/PRESS – The pneumatic actuator provides compressive force and mounting for the converter and horn assembly. The bench top press consists of a base assembly and linear actuator.

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

BOOSTER – The booster is a tuned component of the system that transfers the vibration generated by the converter to the welding tip. The booster is designed to amplify the vibration and to provide an efficient mounting system for the ultrasonic stack.

WELDING TIP – The welding tip is a high grade steel tool that vibrates the metal parts to produce the weld. The tip is designed to provide long life and keyed for simple and precise set up.

ANVIL – The anvil provides a stationary rest for the wires and a serrated grip to hold the wires still.

GATHERING TOOL – The gathering tool is motor adjusted to set the width.

ANVIL SUPPORT TOOL - The anvil support tool provides a side wall for the splice.

