Original Instructions
DCM00038 - REV. 08

EMERSON

Ultrasplice 40
Actuator

Operating Manual

Branson Ultrasonics Corp.
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BRANSON

Manual Change Information

At Branson, we strive to maintain our position as the leader in ultrasonics metal welding, plastics joining, cleaning, and related technologies by continually improving our circuits and components in our equipment. These improvements are incorporated as soon as they are developed and thoroughly tested.

Information concerning any improvements will be added to the appropriate technical documentation at its next revision and printing. Therefore, when requesting service assistance for specific units, note the Revision information found on this document, and refer to the printing date which appears on this page.

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Foreword

Congratulations on your choice of a Branson system!

The Branson Ultrasplice 40 Series system is process equipment for the joining of metal parts using ultrasonic energy. It is the newest generation of product using this sophisticated technology for a variety of customer applications. This Operating Manual is part of the documentation set for this system, and should be kept with the equipment.

Thank you for choosing Branson!

Introduction

This manual is arranged into several structured chapters which will help you find the information you may need to know to safely handle, install, set up, program, operate, and/or maintain this product. Please refer to the Table of Contents of this manual to find the information you may be looking for. In the event you require additional assistance or information, please contact our Product Support department (see 1.4 How to Contact Branson for information on how to contact them) or your local Branson representative.

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Chapter 1: Safety and Support

1.1 Safety Requirements and Warnings

This chapter contains an explanation of the different Safety Notice symbols and icons found both in this manual and on the product itself and provides additional safety information for ultrasonic welding. This chapter also describes how to contact Branson Metal Welding for assistance.

1.1.1 Symbols Found in This Manual

These symbols used throughout the manual warrant special attention:

NOTICE	
	A Note contains important information. It does not alert the user to potential injury, but only to a situation that might eventually require additional work or modification if you ignore it initially.

CAUTION	
	A Caution indicates a potentially hazardous situation, which, if not avoided, can result in minor or moderate injury. It can also alert the user to unsafe practices or conditions that can damage equipment if not corrected.

WARNING	
	A Warning indicates a hazardous situation or practice that, if not avoided, can result in serious injury or death.

1.1.2 Symbols Found on the Product

The Ultrasplice 40 Actuator has several warning labels on it to alert the user of items of concern or hazard. The following warning symbols appear on the Ultrasplice 40 Actuator:

Figure 1.1 Safety Label found on the Ultrasplice 40 actuator

1.2 General Precautions

Take the following precautions before servicing the Controller:

CAUTION	
	Be sure the power switch is in the Off position before making any electrical connections.

- To prevent the possibility of an electrical shock, always plug the Controller into a grounded power source
- Controllers produce high voltage. Before working on the power supply module, do the following:

  Turn off the Controller;

  Unplug main power; and

  Allow at least 2 minutes for capacitors to discharge
- High voltage is present in the Controller. Do not operate with the cover removed
- High line voltages exist in the ultrasonic power supply module. Common points are tied to circuit reference, not chassis ground. Therefore, use only non-grounded, battery-powered multimeters when testing these modules. Using other types of test equipment can present a shock hazard
- Be sure power is disconnected from the Controller before setting a DIP switch
- To prevent any possible electrical shock from the high voltage contact on the converter, ensure that the power supply is off before removing the actuator cover
- Do not cycle the welding system if either the RF cable or converter is disconnected
- Use extreme caution when loading parts into the fixture since a pinch point may exist between the horn and the anvil
- Do not operate the system without guards or covers in place

WARNING	
	Sound level emissions of up to 84.9 dB have been measured using a standard test load. To prevent the possibility of hearing loss, use appropriate hearing protection.

NOTICE	
	Sound level and frequency of the noise emitted during the ultrasonic assembly process may depend upon a. type of application, b. size, shape and composition of the material being assembled, c. shape and material of the holding fixture, d. welder setup parameters and e. tool design. Some parts vibrate at an audible frequency during the process. Some or all of these factors may result in sound levels of up to 84.9 dB. In such cases operators may need to be provided with personal protective equipment. See 29 CFR (Code of Federal Regulations) 1910.95 Occupational Noise Exposure. For all other countries, follow your local regulations.

1.2.1 Intended Use of the System

The Branson Metal Welding Controller and Ultrasplice 40 Actuator are components of an ultrasonic welding system. These are designed for a wide variety of welding or processing applications:

- Wire to wire
- Stranded Wire to resistor
- Magnet Wire to wire

1.2.2 Regulatory Compliance

The Branson Ultrasplice 40 Actuator is designed to be in compliance with the following U.S. regulatory and agency guidelines and standards:

- ANSI Z535.1 Safety Color Code
- ANSI Z535.3 Criteria for Safety Symbols
- ANSI Z535.4 Product Safety Signs and Labels
- ANSI Z535.6 Product Safety Information in Product Manuals, instructions
- NFPA 70 National Electric Code Article 670 Industrial Machinery
- NFPA 79 Electrical Standard for Industrial Machinery
- 29 CFR 1910.212 OSHA General Requirements for all machines
- 47 CFR Part 18 Federal Communications Commission
- The Branson Ultrasplice 40 Actuator is designed to be in compliance with the following European standards as specified by the Directives issued by the European Parliament and The Council of the European Union:
- Machinery Directive 2006/42/EC
- Low Voltage Directive 2006/95/EC as Amended
- EMC Directive 2004/108/EC as Amended
- BS EN ISO 13850 Safety of Machinery - Emergency stop equipment, Functional aspects - Principles for design
- EN ISO 14121-1 Safety of Machinery - Risk assessment - Part 1: Principles
- EN 13849-1 Safety of Machinery - Safety Related Parts of Control Systems
- BS EN ISO 12100-1, -2 Safety of Machinery - Basic concepts, general guidelines for design
- EN 55011 Limits and methods of measurement of radio disturbance of industrial, scientific and medical radio-frequency equipment
- EN 60204-1 Safety of Machinery - Electrical Equipment of machines
- EN 60529 Degrees of protection provided by enclosure
- EN 60664-1 Insulation coordination for equipment within low-voltage systems
- EN 61000-3-2 Electromagnetic Compatibility - Limits for harmonic emissions (For European products that draw less than 1000 watts from the line at full rated power)
- EN 61000-3-3 Electromagnetic Compatibility - Limitations of voltage fluctuations and flicker in low voltage supply systems (For European products that draw less than 1000 watts from the line at full rated power)
- EN 61000-6-2 Electromagnetic Compatibility - Generic standards - Immunity for industrial environments
- EN 61310-2 Safety of Machinery - Indication, marking, actuation

All Ultrasplice 40 Actuators are CE Compliant (see Figure 1.2 below).

Figure 1.2 CE Mark

CE

1.3 Warranty

For warranty information please reference the warranty section of Terms and Conditions found at: www.emerson.com/branson-terms-conditions.

1.4 How to Contact Branson

Branson is here to help you. We appreciate your business and are interested in helping you successfully use our products. To contact Branson for help, use the following telephone numbers, or contact the field office nearest you.

- **Brookfield Main Number (all Departments):** (203) 796-0400 (Eastern Time Zone)
- **Parts Store:** Direct Number for Parts Store in Brookfield (203) 796-9807

Tell the operator which product you have and which person or department you need. If after hours, please leave a voice message with your name and return telephone number.

1.4.1 Before Calling Branson for Assistance

This manual provides information for troubleshooting and resolving problems that could occur with the equipment (see Chapter 7: Maintenance). If you still require assistance, Branson Product Support is here to help you. To help identify the problem, use the following questionnaire which lists the common questions you will be asked when you contact the Product Support department.

Before calling, determine the following information:

- Your company name and location
- Your return telephone number
- Have your manual with you
- Know your equipment model and serial numbers (found on a gray data label on the units). Information about the Horn (part number, gain, etc.) or other tooling may be etched into the tooling. Software- or firmware-based systems may provide a BIOS or software version number, which may be required
- What tooling (horn) and booster are being used?
- What are the setup parameters and mode?
- Is your equipment in an automated system? If so, what is supplying the “start” signal?
- Describe the problem; provide as much detail as possible. For example, is the problem intermittent? How often does it occur? How long before it occurs if you are just powering up? If an error is occurring, which error (give error number or name)?
- List the steps you have already taken.
- What is your application, including the materials being processed?
- Have a list of service or spare parts you have on hand (tips, horns, etc.)
- Notes: _____
  _____
  _____

1.5 Returning Equipment for Repair

Before sending equipment for repair, provide as much information with the equipment to help determine the problem with the system. Use the following page to record necessary information.

NOTICE	
	To return equipment to Branson, you must first obtain an RGA number from a Branson representative, or the shipment may be delayed or refused.

If you are returning equipment to Branson for repair, you must first call the Repair department to obtain a Returned Goods Authorization (**RGA**) number. (If you request it, the repair department will fax a Returned Goods Authorization form to fill out and return with your equipment.)

Branson Repair Department

120 Park Ridge Road

Brookfield, Connecticut 06804 U.S.A.

direct telephone number: (203) 796-0575

fax number: (203) 796-0574

- Provide as much information as possible that will help identify the need for repair
- Carefully pack the equipment in original packing cartons
- Clearly label all shipping cartons with the RGA number on the outside of cartons as well as on your packing slip, along with the reason for return
- Return general repairs by any convenient method. Send priority repairs by air freight
- You must prepay the transportation charges FOB Brookfield, Connecticut, U.S.A.

1.5.1 Get an RGA Number

RGA# _____

If you are returning equipment to Branson, please call the Repair Department to obtain a Returned Goods Authorization (RGA) number. (At your request, the Repair Department will fax an RGA form to fill out and return with the equipment.)

1.5.2 Record Information About the Problem

Before sending equipment for repair, record the following information and send a copy of it with the equipment. This will greatly increase Branson's ability to address the problem.

1. Describe the problem; provide as much detail as possible. For example, is the problem intermittent? How often does it occur? How long before it occurs after powering up?

   _____
   _____
   _____
   _____

2. Is your equipment in an automated system? NO / YES
3. If the problem is with an external signal, which signal? If known, include plug/pin # (e.g., P29, pin #3) for that signal

   _____
   _____

4. What are the Weld Parameters?

   _____
   _____
   _____

5. What is your application? (Type of weld, metal material, etc.)

   _____
   _____

6. Name and phone number of the person most familiar with the problem:

   _____
   _____

7. Contact the Branson office prior to shipping the equipment.
8. For equipment not covered by warranty, to avoid delay, include a Purchase Order.

Send a copy of this page with the equipment being returned for repair.

1.5.3 Contact Information

Call your local Branson Metal Welding Representative, or contact Branson by calling (203) 796-0400.

My Local Branson Representative's name is:

_____

I can reach this representative at:

_____

1.5.4 Pack and Ship the Equipment

1. Carefully pack the system in original packing material to avoid shipping damage. Plainly show the RGA number on the outside of cartons as well as inside the carton along with the reason for return. Make a list of all components packed in the box. KEEP YOUR MANUAL.
2. Return general repairs by any convenient method. Send priority repairs by air freight. Prepay the transportation charges FOB the repair site (either the Branson field office or Brookfield, Connecticut USA location).

NOTICE	
	Items that are sent Freight Collect will be refused.

1.6 Obtaining Replacement Parts

You can reach Branson Parts Store at the following telephone numbers:

- Direct Telephone Number: (203) 796-9807
- Fax number: (203) 926-2678

Many parts can be shipped the same day if ordered before 2:30 p.m., Eastern time.

A parts list is found in Chapter 7: Maintenance of this manual, listing descriptions and EDP part numbers. If you need replacement parts, coordinate the following with your purchasing agent:

- Purchase order number
- 'Ship to' information
- 'Bill to' information
- Shipping instructions (air freight, truck, etc.)
- Any special instructions (for example, "Hold at the airport and call"). Be sure to give a name and phone number
- Contact name information

Chapter 2: The Ultrasplice 40 Actuator

2.1 Model Covered

This manual contains instructions for installing, setting up and operating the Ultrasplice 40 Actuator.

An Ultrasplice 40 Actuator requires a compatible Branson Metal Welding Controller to function, that is covered in separate manuals and user documents.

2.1.1 Controller Manual Set

The Following documentation is available for Branson Metal Welding Controllers that are compatible with Ultrasplice 40 Actuators:

- Ultrasplice 40 VersaGraphix Controller Instruction Manual (DCM00061)
- Ultrasplice 40 Touch Screen Controller Instruction Manual (DCM00002)

2.2 Overview of this Model

Figure 2.1 The Ultrasplice 40 Actuator

The Branson Ultrasplice 40 system is comprised of a power supply and control box, ultrasonic stack assembly, application tooling, and mechanical actuator. The Ultrasplice 40 actuator is the part of the system that rigidly holds and moves the converter, booster and horn assembly known as the ultrasonic stack. A pneumatic cylinder drives the anvil actuator to apply a precise pressure to the parts to be welded during the weld cycle.

The Ultrasplice 40 Actuator requires a compatible Branson Metal Welding Controller for power and control of the Actuator's operation and to provide ultrasonic power to the Converter in the Actuator.

The Ultrasplice 40 Actuator is designed with full, built in mechanical controls. Pneumatic control is done by a compatible Branson Metal Welding Controller.

Operation of the Ultrasplice 40 is controlled by inputs from a compatible Branson Metal Welding Controller.

2.2.1 Polar Mount & Ultrasonic Stack

The converter-booster-horn assembly or ultrasonic stack is supported in Polar mount by means of diaphragm springs. The diaphragm springs are mounted securely to the Polar Mount. The diaphragm shaped springs are made from titanium and are acoustically tuned at the 40 kHz operating frequency. This system permits very efficient transmission of ultrasonic vibration along the axis of the ultrasonic stack while providing an extremely rigid mounting.

The 40 kHz electrical energy from the power supply is applied to the transducer element or converter, which transforms the high frequency electric current into high frequency mechanical vibrations at the same frequency. The heart of the converter is a lead-zirconate-titanate electrostrictive element that, when subjected to an alternating voltage expands and contracts. The converter's efficiency of changing electrical energy to mechanical vibrations exceeds ninety-five percent.

2.2.2 The Pneumatic System

A pneumatic cylinder drives the anvil actuator to apply a precise pressure to the parts to be welded during the weld cycle. Pneumatic control is done by a compatible Branson Metal Welding Controller.

2.2.3 The Linear Encoder

The linear encoder is a sensing device that tracks mechanical displacements related to the splice's resulting height and/or width. The accuracy of the encoder is ±0.002 in (±0.05mm).

2.2.4 Converter

The 40 kHz electrical energy from the power supply is applied to the transducer element or converter, which transforms the high frequency electric current into high frequency mechanical vibrations at the same frequency. The heart of the converter is a lead-zirconate-titanate electrostrictive element that, when subjected to an alternating voltage expands and contracts. The converter's efficiency of changing electrical energy to mechanical vibrations exceeds ninety-five percent.

2.2.5 Booster

A booster couples the converter to the horn and helps determine the amplitude of vibration produced at the face of the horn. The booster is a resonant half-wave metal device made of titanium or aluminum and is designed to resonate at the same frequency as the converter with which it is to be used.

A booster has two functions:

- A rigid mounting for the converter/booster/horn stack
- An amplitude-of-vibration increaser or decreaser as ultrasonic energy is transmitted from the converter through the booster to the horn. The ratio of input to output amplitude is called the gain.

2.2.6 Horn

The horn is a half-wave length resonant metal device that transfers the ultrasonic vibrations from the converter to the weld. The horn is made of tool steel and is designed to resonate at 40 kHz.

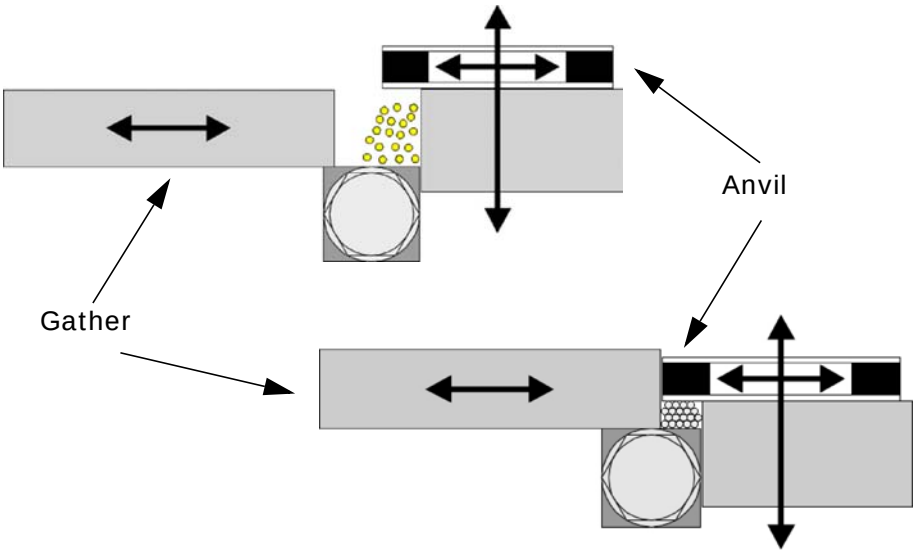
The horn is designed to grip the lower component of the parts to be welded, and to couple the ultrasonic vibrations through that element into the bonding area. Horns are fabricated from high-speed tool steel and heat-treated to precise specifications to provide maximum life. The horn is coated to further enhance tool life and to provide corrosion resistance.

Since the horn is a vital part of the ultrasonic assembly system, it should not be altered without proper training and advice from Branson.

2.2.7 Gathering Tool

A Gathering Tool sweeps across the face of the Tip to collect the wire strands and forms the width of the compression chamber.

Figure 2.2 Gather and Anvil



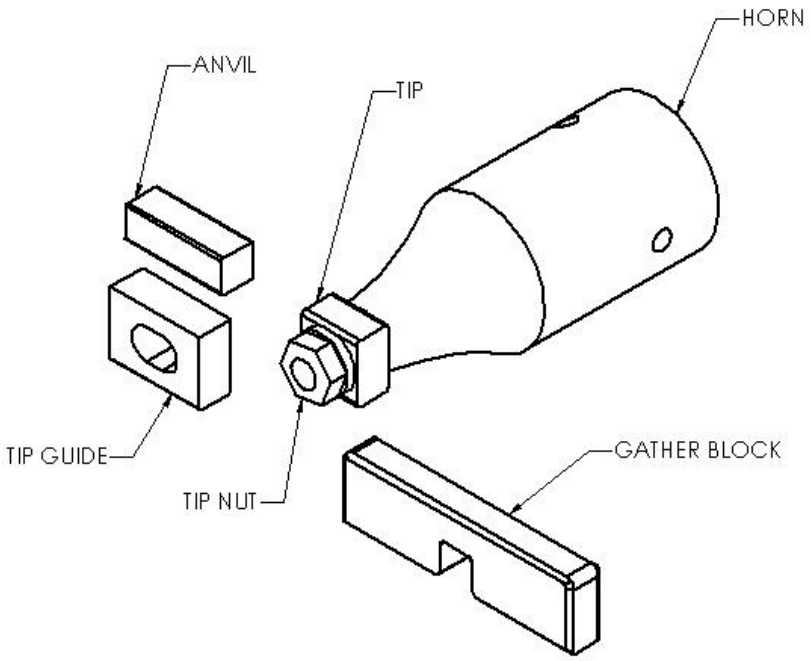
2.2.8 Anvil

The Anvil contains a serrated or knurled surface and is designed to hold the wires to be welded stationary against the lower component, which is vibrating at 40,000 Hz. The Anvil is supported on precision, roller bearings and applies the compressive force required to bond the wires.

2.2.9 Application Tooling

Application tooling is designed and manufactured to position and weld component materials to meet customer specifications. Application tooling typically consists of a tip, horn, anvil, tip guide block and gather block. The required knurl/serration pattern is generally determined by the weld application. The System Specification Sheet in the beginning of this manual lists tips and anvils that are commonly used.

Figure 2.3 Application Tooling



2.3 Features

The UltraSplice 40 is a complete 40 kHz, precision, light weight and portable, ultrasonic wire splicing system capable of producing perfect quality wire splices up to six square millimeters in cross section using an advanced 700 watt power supply.

The Ultrasplice 40 ultrasonic wire splicer offers the following features:

- Fully automatic wire gathering mechanism for ease of operation and maximum productivity
- Automatic process monitoring of each splice to ensure it falls within preset limits of weld time and weld power
- Infinite and automatic adjustment of splice energy and pressure
- Proprietary quick change tooling with multiple weld surfaces that can produce a million splices at minimum cost
- Simple procedure permits setup of various splice applications in under ten seconds
- User friendly control box with membrane switches and liquid crystal display
- Memory storage for 100 preset splicing parameters and sequences

2.4 Controls

- **Down Stop:** The down stop is used to prevent contact between the Horn and Anvil if the welder is cycled without the part(s) to be welded. A minimum gap of 0.001 in (0.02mm) is recommended
- **Gather adjusting screw:** Used to set the width of the compression chamber. Depending on the application the anvil will need to be set accordingly

2.5 Ultrasonic Theory

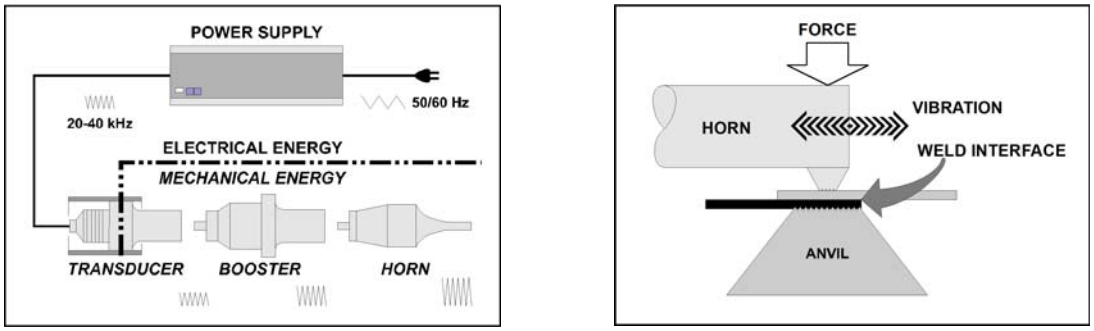
2.5.1 What Is an Ultrasonic Weld?

Ultrasonic welding joins metal parts by applying the energy of high frequency vibrations onto the interface area between the parts to be welded.

2.5.1.1 How Does It Work?

Electrical Energy is transformed into high frequency mechanical vibration. This mechanical vibration is transferred to a welding tip through an acoustically tuned horn. The parts are "scrubbed" together under pressure at 20,000, 40,000, or 60,000 cycles per second. This high frequency vibration, applied under force, disperses surface films and oxides, creating a clean, controlled, diffusion weld. As the atoms are combined between the parts to be welded, a true, metallurgical bond is produced.

Figure 2.4 How does Ultrasonic Welding Work?



2.5.1.2 Benefits of Ultrasonic Welding

Ultrasonic metal welding exhibits unique welding properties that include:

- Excellent electrical, mechanical, and thermal connections between similar and dissimilar metals
- Low heat build up during the ultrasonic process (no annealing of materials)
- Compensation for normal surface variations of the material
- Ability to clean surface oxides and contaminants prior to welding
- Ability to weld large areas using minimal energy
- Ability to weld thin materials to thick materials
- Low cost per weld

2.5.2 How Is an Ultrasonic Weld Made?

Although the theoretical process of producing an ultrasonic weld is uncomplicated, the interactions of the various weld parameters are important and should be understood. When producing an ultrasonic weld, there are three primary variables that interact; they are:

- **Time:** The duration of applied ultrasonic vibration
- **Amplitude:** The longitudinal displacement of the vibration
- **Force:** The compressive force applied perpendicular (normal) to the direction of vibration

The power required to initiate and maintain vibration (motion) during the weld cycle can be defined as:

Table 2.1 Calculating Power

P = F x A x f	Where: • P = Power (watts) • F = Force * (N) • A = Amplitude (microns) • f = Frequency (Hertz)
*Note: Force = (Surface Area of the Cylinder) X (Air Pressure) X (Mechanical Advantage)	

Energy is calculated as;

Table 2.2 Calculating Energy

E = P x T	Where: • E = Energy (joules) • P = Power (watts) • T = Time (seconds))

Thus the complete 'Weld To Energy' process would be defined as:

E = (F x A x f) x T

A well designed ultrasonic metal welding system will compensate for normal variations in the surface conditions of the metals by delivering the specified energy value. This is achieved by allowing Time (T) to adjust to suit the condition of the materials and deliver the desired energy.

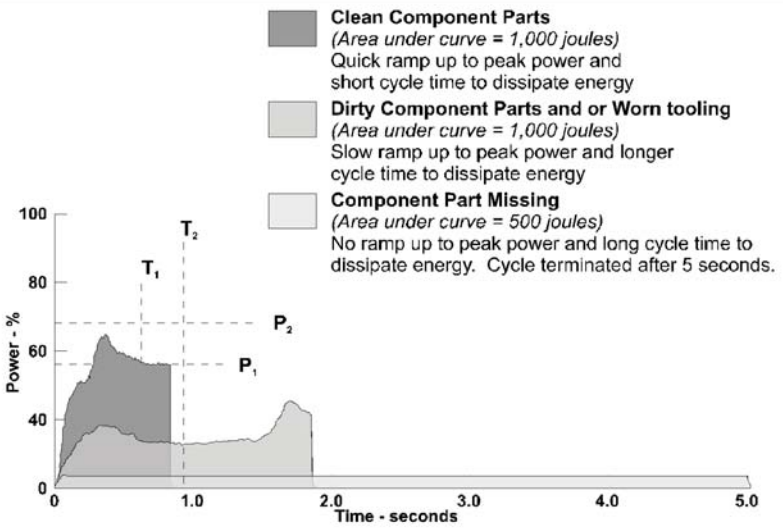
2.5.3 Welding to Energy - Why?

Most metal welding applications are produced by 'Welding To Energy' in order to compensate for the various surface oxides and contaminants associated with the metals being joined. In a few applications 'Welding To Time' or 'Welding To Height' will yield better results. Since the majority of all metal welds are produced using energy as the controlling factor we will confine our discussion to that condition.

Welding to energy is necessary because of the non-metallic oxides that form on the metal's surface as well as other contaminates such as grease and dirt. To producing quality welds reliably it is necessary that the surfaces to be joined are clean. The high frequency scrubbing action, combined with pressure, cleans the weld interface at the beginning of the weld process.

The following graph (Figure 2.5) illustrates a weld produced. The weld 'power graph' is sometimes to referred to a weld 'footprint'. It can be used to visualize the weld cycle and assists in parameter optimization. Graphs from consecutive welds will vary slightly as the system dynamically adjusts time to accommodate varying surface conditions. The weld power data is gathered by sampling the power used in 5 millisecond intervals.

Figure 2.5 Weld Power Graph for Clean Components, Dirty Components and when Part is Missing

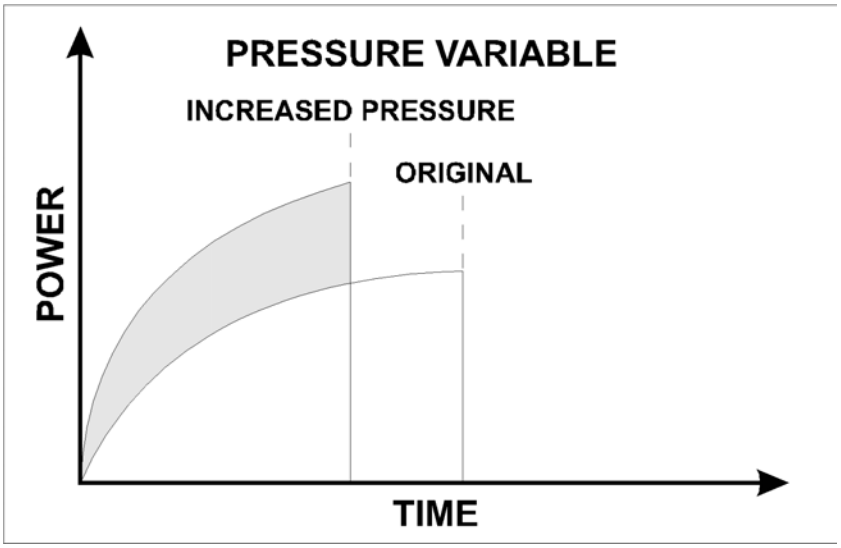


2.5.4 Power

The converter/ booster/ horn, (stack assembly), requires minimal electrical power to initiate and maintain motion (vibration) at a 'no-load' condition. As the mechanical load increases, the power required to maintain the mechanical vibration also increases. The maximum power required during a weld cycle is 'Peak Power.

By increasing Pressure and maintaining all other parameters, the mechanical load or force on the weld joint increases, therefore, the amount of Power required to maintain the vibration of the stack increases. Subsequently, because of the increased Power Level, less time is required deliver the same amount of Energy. This relationship is illustrated on Figure 2.6.

Figure 2.6 Pressure Variable with Increased Power

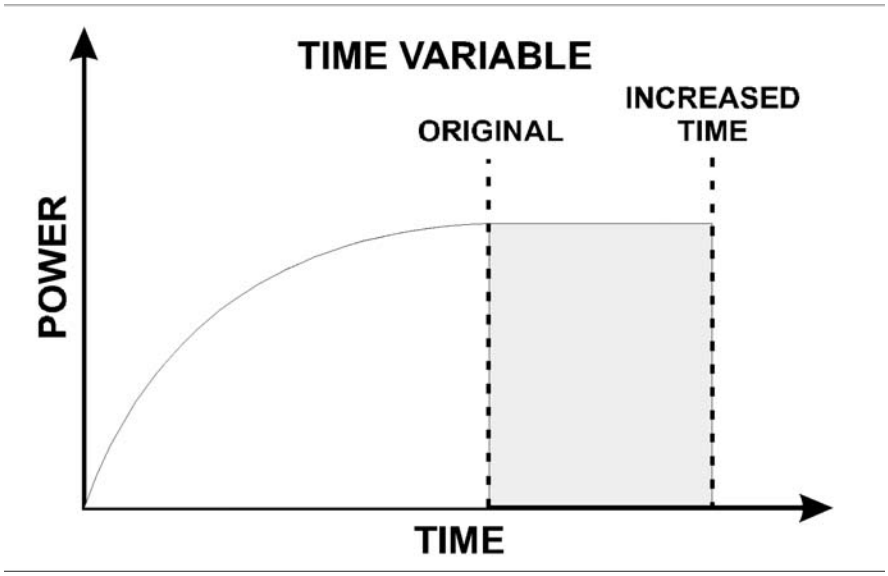


The difference in the appearance of each of the above weld graphs is the result of increased Power loading. Based upon an increase in Pressure, additional Power is required to maintain the motion of vibration. Thus, the same amount of energy is delivered in less time. This approach is typically used to raise the loading of the power supply during a weld cycle to the desired level as determined by the application.

2.5.5 Time

The time required to deliver the necessary energy is defined as the Weld Time. For most welds, the time required will be less than one second. If more energy is required and all other weld parameters are maintained, the weld time will increase (Figure 2.7).

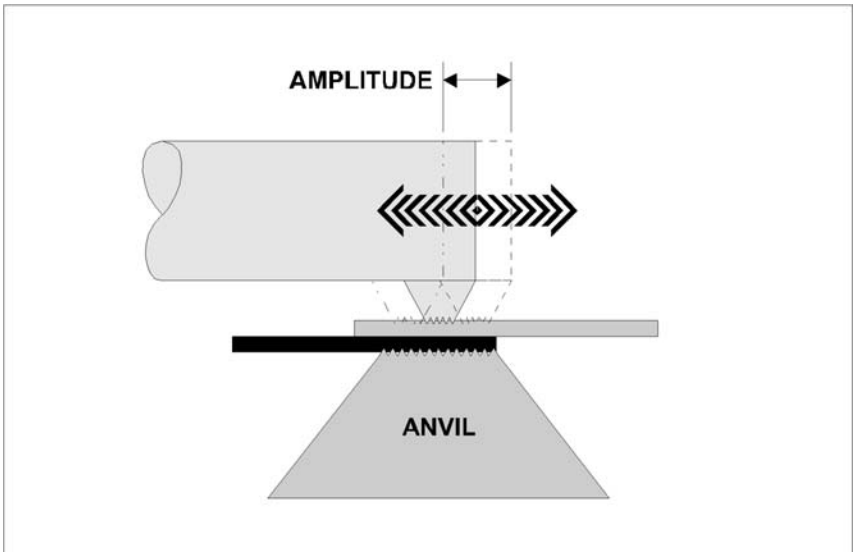
Figure 2.7 Pressure Variable with Increased Time



2.5.6 Amplitude

An ultrasonic tool is a resonant acoustical device. The term Amplitude is used to describe the amount of longitudinal expansion and contraction that the tooling endures as it vibrates (Figure 2.8). The amplitude correlates to the scrubbing action at the weld interface. This scrubbing action combined with pressure is what advances the weld by a diffusing or mixing of the base materials.

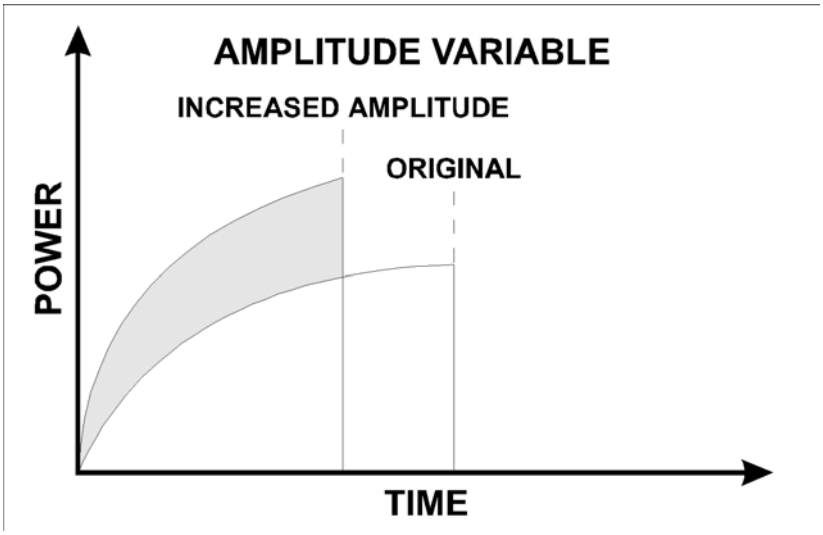
Figure 2.8 Scrubbing Action on Weld Interface



As previously mentioned, the converter/ booster/ horn, (stack assembly), requires minimal electrical power to initiate and maintain vibration in a ‘no-load’ condition. As the amplitude increases, the power required to maintain the increased velocity of vibration

also increases. Subsequently, because of the increased Power less time is required deliver the same amount of Energy. This relationship is illustrated in the following power diagram (Figure 2.9):

Figure 2.9 Amplitude's Influence on Weld Power and Time

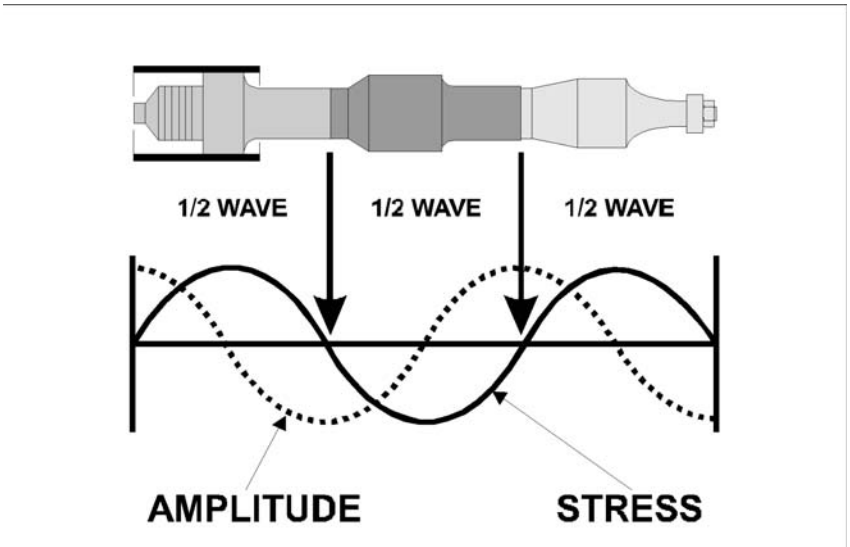


2.5.7 Resonant Frequency

The ultrasonic tooling acts as a spring having node points and anti-node points. The mechanical energy used to vibrate the tool is created by the converter. As the vibrations are propagated through the acoustical tool, a harmonic resonance is established consisting of nodes and antinodes. This action results in a resonant wave being transferred through the tooling (Figure 2.10). The efficiency of the resonant wave transfer depends on the natural resonant frequency of the horn and is determined by two factors:

- The speed of sound through the material
- The geometric shape of the object

Figure 2.10 Harmonic Resonance on Ultrasonic Tooling.



2.5.8 Avoiding an Overload Condition

It is possible to increase the Amplitude and or the Pressure to a point where the power available is not adequate to initiate or maintain vibration under the given mechanical load. At this point, the power supply will stall resulting in an Overload condition.

NOTICE	
	Electronic circuits in the system will protect the power supply if an overload condition exists.

2.5.9 Welding to Time

In specific applications, 'Welding To Time' may be desired. As previously mentioned, there are three primary variables that interact; they are:

- **TIME:** The duration of applied ultrasonic vibration
- **AMPLITUDE:** The longitudinal displacement of the vibration
- **FORCE:** The compressive force applied perpendicular (normal) to the direction of vibration

Generally, welding for a specific time will produce acceptable results when:

- The equipment is installed on an automated production line and each station must complete its process within a certain time limit
- Very small low energy welds on clean components are being made

2.5.10 Welding Temperature

Ultrasonic welding produces a localized temperature rise from the combined effects of elastic hysteresis, interfacial slip and plastic deformation. The weld interfaces reach approximately 1/3 the temperatures needed to melt the metals. Since the temperature does not reach the melting point of the material, the physical properties of the welded material are preserved. As the ultrasonic welding process is an exothermic reaction, as welding time increases so does weld temperature.

2.6 Terminology

Actuator: A mechanical device which houses the converter/booster/horn (stack) assembly in a rigid mounting and is utilized to move the stack up or down. This allows for precise control of welding pressure while delivering mechanical vibrations from the ultrasonic stack to the work piece(s).

After Burst: A short duration (burst) of ultrasonic energy that begins after completion of the AFTER BURST DELAY. (Also see AFTER BURST DELAY & AFTER BURST DURATION).

After Burst Delay: The amount of time, in seconds, between the completion of the ultrasonic welding cycle and the start of the AFTER BURST. (Also see AFTER BURST & AFTER BURST DURATION).

Amplitude: Amplitude is the peak-to-peak displacement of mechanical motion as measured at the face of the horn tip. Amplitude is measured either in thousandths of an inch or in microns (e.g. a standard 40 kHz *Converter* produces approximately 0.0004" or 10 microns of amplitude), Inches x 25.4 = microns. -- This is adjustable depending on system frequency and application tooling.

Anti-Node: The anti-node is the area of the horn and booster that exhibits maximum longitudinal displacement and where the internal dynamic forces are equal to zero. This area is at the face and back surface on half-wave technology.

Anvil: A device specially designed to grip the lower component and hold it stationary against the energy of vibration(s) which allows a weld to be created.

BBR: Nonvolatile random access memory (battery back-up random access memory). Equipped with long life built in batteries, this memory area preserves weld parameters and menu settings when the system is powered off. (Also known as BRAM.)

Booster: The central component of an ultrasonic stack assembly. A device which transfers mechanical energy from the *Converter* to the ultrasonic horn. The booster will, depending on design, increase, decrease, or maintain the specific amplitude as received from the converter.

Calibration: The process of adjusting a device to a known position for purposes of inspection and/or monitoring position, direction, speed, and/or velocity.

Consumable Spare Tooling: The tooling portion of the ultrasonic system that wears and requires replacement due to production use. This includes but is not limited to ultrasonic horns, replaceable tips, anvil, and positioning mask. A Spare Tooling Specification Sheet is included within the Actuator Operation Manual to document the spare tooling for a specific metal welding application.

Controller: The portion of the welding system that provides specific settings & instruction(s) to the overall welding system.

Converter: A device which utilizes a PZT (lead-zirconate-titanate) electrostrictive element to change high frequency electrical energy into high frequency mechanical energy.

Counter: A programmable device used to monitor system cycles and alert personnel when specific conditions are met.

Data: Any representation(s) of instructions, characters, information, or analog quantities to which meaning may be assigned.

Default: A chosen system setting or parameter in which the system does not require external data input. In some cases the default value will be changed based upon equipment use.

Dynamic Spring: An, adjustable, energy storage mechanism (shock absorber) which allows for stack follow through upon engagement of application tooling with the work pieces to be welded.

Energy: Energy is the area beneath the ultrasonic power curve and is calculated in joules, (Watts X Seconds = Joules). When the ultrasonic welding system is setup in the "Weld In Energy" mode the system will deliver the amount of energy as programmed. **NOTE:** The maximum (default) time allowed for delivering ultrasonic energy is five (5) seconds.

Energy Mode: A welding method in which the ultrasonic power supply is active until the required amount of energy is delivered (see ENERGY).

Fixture: A device for positioning and or holding a component for assembly.

Force: The amount of mechanical pressure that is used to deliver (bring down) the mechanical actuator. This programmed force is also called TRIGGER FORCE and is used to engage the knurl pattern into the component part(s) prior to the initiation of ultrasonic energy.

Frequency: The number of complete oscillations per second expressed in Hertz (Hz) or kilohertz (1 kilohertz = 1000 Hz). Typically 20 kHz or 40 kHz.

Gain: The ratio of the amplitude of motion produced by the *Converter* and delivered by the horn is called the gain. It is determined by the difference in mass on either side of the nodal point.

Height: A value, in millimeters (mm), as registered by a linear encoder upon completion of an ultrasonic welding cycle. -- Programmable, in millimeters, with Upper Control Limit & Lower Control Limit.

Height Encoder: A device utilized to monitor position, direction, speed, and/or velocity.

Horn: An acoustically designed metal tool that delivers mechanical energy from the converter/ booster into the work piece. Most applications utilize half wave technology.

Hold Time: The amount of time after delivery of ultrasonic energy until the stack tooling begins to retract from the component material(s).

Joint: The area where the surfaces are welded together.

Linear Height Encoder: See Height Encoder.

Loading Meter: A meter which indicates the power drawn from the ultrasonic power supply.

Maintenance Counter: Used to alert production personnel of the need to review/ inspect application tooling and/or the ultrasonic system for preventive maintenance purposes. (See Counters.)

Mode: The method of operating the system (also see WELDING MODE).

Node: The node is the area of the horn, (and booster), that exhibits no longitudinal displacement and where the internal dynamic forces are at the maximum. This area is in the center location on half-wave technology.

Parameter(s): Programmable units used to control and or monitor the ultrasonic process. --Include but not limited to ENERGY, FORCE, PRESSURE, AMPLITUDE.

Parts Counter: Used to monitor system cycles and alert personnel when specific conditions are met. (See Counters.)

Peak Power: Peak power is the maximum amount of power in watts that was required to keep the ultrasonic stack in motion during the weld cycle.

Power: Power, measured in watts, is a function of pressure and amplitude. The amount of power, (watts) required to keep the ultrasonic stack in motion is monitored and used to develop a power curve. This power curve is used to calculate the amount of energy delivered/ dissipated, (Watts = Joules / Time). The power as displayed on the control box is peak power.

Power Supply (Ultrasonic): An electronic device that converts 50/60 cycle electrical current into 20 kHz, (20,000), 40 kHz (40,000), or 60 kHz, (60,000) cycles per second high frequency electrical energy.

Power Supply Overload (Ultrasonic): The point or limit at which the amount of power in watts, required to keep the ultrasonic stack in motion, exceeds the available power from the power supply. The system will go into an overload condition in order to prevent system damage.

Pre-height: A pre-sonic inspection display, in millimeters (mm), as registered by a linear encoder prior to initiation of the ultrasonic welding cycle. -- Programmable, in millimeters, with Upper Control Limit & Lower Control Limit.

Presets: Welding parameters stored in the controller memory.

Pressure: The amount of mechanical pressure supplied to the ultrasonic stack assembly while delivering ultrasonic energy to the components.

Quality Widows & Limits: Programmable values used by the system to compare actual process data. Actual process data must be within limits or an alarm be issued.

Squeeze Time: The amount of time after the ultrasonic tooling engages the component(s) and before delivery of ultrasonic energy. -- Adjustable from 0 - 2seconds.

Stress: Stress is the amount of dynamic force per cross sectional area.

Time: Time is the duration of the ultrasonic, mechanical, activity. Time is a component used to calculate the amount of ultrasonic energy delivered during a weld cycle, (Time = Joules / Watts).

Tip: Device specially designed to grip the upper component, to be welded, and to direct the ultrasonic energy into the work piece, (Also Horn Tip & Replaceable Horn Tip).

Tip Nut: Device specially designed to securely clamp a replaceable tip onto the horn.

Trigger Force: See Force.

Tuning: Adjusting to optimize power supply performance according to resonance frequency, especially with regard to the horn and converter.

Velocity: The rate of motion at a specific time [velocity = distance time] Also referred to as speed.

Chapter 3: Shipping and Handling

3.1 Shipping and Handling

The Ultrasplice 40 actuator is a system of metal and electro-pneumatic components that move the ultrasonic tooling in the ultrasonic welding system and control aspects of the weld process. Many of its components can be harmed if the unit is dropped, shipped under improper conditions, or otherwise mishandled.

3.1.1 Environmental Specifications

The following environmental guidelines should be respected in the shipping of the Ultrasplice 40 Actuator unit.

Table 3.1 Environmental Requirements

Environment	Range
Storage / Shipping Temperature	-13ºF to +131ºF (-25ºC to +55ºC)
Humidity	30% to 90% non condensing

3.2 Receiving and Unpacking

Branson Metal Welding actuator units are carefully checked and packed before dispatch. It is recommended, however, that you follow the inspection procedure below after delivery.

To inspect the Ultrasplice 40 Actuator when it is delivered:

Table 3.2 Receiving and Unpacking

Step	Action
1	Verify that all parts are complete according to the packing slip.
2	Check the equipment immediately after delivery to ensure that it has not been damaged during transport.
3	Remove the actuator cover to check if any components became loose during shipping.
4	Report any damage claims to your carrier immediately.
5	Determine if any component has become loose during shipping and, if necessary, tighten screws.

NOTICE	
	If the goods delivered have been damaged during shipping, please contact the forwarding agent immediately. Retain packing material (for possible inspection or for sending back the unit).

CAUTION	
	The Controller is heavy. Handling, unpacking, and installation might require assistance of a colleague or the use of a lifting device.

3.3 Returning Equipment

If you are returning equipment to Branson, please call your Branson Metal Welding Representative or Customer Service to receive approval to return goods to Branson.

If you are returning equipment for repair refer to Chapter 1: Safety and Support, 1.5 Returning Equipment for Repair of this manual, for the appropriate procedure.

Chapter 4: Installation and Setup

4.1 About Installation

This chapter is intended to help the installer with the basic installation and setup of your new Ultrasplice 40 system. This chapter will bring the reader to the point at which the system is functionally “ready to weld”.

CAUTION	
	The Controller is heavy. Handling, unpacking, and installation can require help or the use of lifting platforms or hoists.

International safety labels are found on the Controller and Actuator. Those that are of importance during installation of the system are identified in the figures in this and other chapters of the manuals.

4.2 Handling and Unpacking

If there are any visible signs of damage to the shipping containers or the product, or you later discover hidden damage, take pictures, and NOTIFY YOUR CARRIER IMMEDIATELY. Save the packing material.

1. Unpack the Ultrasplice 40 components as soon as they arrive. Refer to the following procedures.
2. Verify you have all of the equipment ordered. Some components are packed inside other boxes.
3. Inspect the controls, indicators, and surfaces for signs of damage.
4. Save all packing material. Evaluation systems will be returned using this material.

4.2.1 Unpack the Controller

Controllers are shipped in a cardboard carton. Controllers weight approximately 16 kg (36 lb).

1. Open the box, remove foam top packing half and lift the Controller out.
2. Remove the toolkit(s) and other components shipped with the Controller. These items may be shipped in small, separate boxes, or underneath the Controller in the box.
3. Save the packing material; evaluation systems will be returned using this packing material.

4.2.2 Unpack the Ultrasplice 40 Actuator

The actuator, is assembled and ready to install. The actuator weights approximately 3 kg (8 lb). Move the shipping container close to the intended installation location, leave it on the floor.

1. Open the top of the cardboard box, remove the insert from the top of the box and set it aside.
2. The toolkit, mounting bolts, and converter and/or booster are shipped with the actuator but in separate shipping box(es). Unpack the converter, booster, toolkit and bolts from their packages.
3. Save the packing material.

4.3 Take Inventory of Small Parts

Table 4.1 Standard small parts included with Controller and/or Actuator

Part or Kit	Description	Qty	Comments
211-127	40 kHz Torque Wrench	N/A	(Optional Item) Purchase Separately
X3A50252	Dial Indicator with Modified Magnetic Base	N/A	(Optional Item) Purchase Separately
201-118-024	Spanner Wrench	1	Toolkit
106-089A	Spanner Wrench, Modified	1	Toolkit
11008-09-001	Handle, Extension	1	Toolkit
211-099	Molykote GN Metal Paste	1	Toolkit
211-658	Set, Allen 1.5-5mm, Hex	1	Toolkit
211-636	Canvas Bag	1	Toolkit
M1A00137	Footswitch Assembly	N/A	(Optional Item) Purchase Separately

4.3.1 Cables

Two cables connect the Controller and Actuator: the analog data cable, and the RF cable. If the system is to be automated, you may also need a remote start cable. Check your invoice for cable types and cable lengths.

Table 4.2 List of Cables

EDP number	Description	Comments
101-240-179	RF, CE - 8’ (J934C)	Standard
101-266R	Cable analog data, 10’	Standard

4.4 Installation Requirements

4.4.1 Location

The actuator may be installed in a variety of positions. The Ultrasplice 40 is often manually operated using a foot switch, and so it can be installed at a safe and comfortable workbench height (approximately 30-36 inches) with the operator sitting or standing in front of the system. The Controller may be located up to 8 feet away from the Ultrasplice 40 actuator.

The Controller must be accessible for user parameter changes and settings, and must be placed in a horizontal orientation. The Controller should be positioned so it does not draw in dust, dirt or material via its rear fans. Refer to the illustrations on the pages that follow for a dimensional drawing of each component.

4.4.2 Environmental Specifications

Table 4.3 Environmental Specifications

Environmental concern	Acceptable Range
Humidity	30% to 90%, (non-condensing)
Ambient Operating Temperature	+5°C to +50°C (41°F to 122°F)
Operating Altitude	1000 m (3280 ft)
IP Rating	2X

Figure 4.1 Controller Dimensional Drawing (VersaGraphiX)

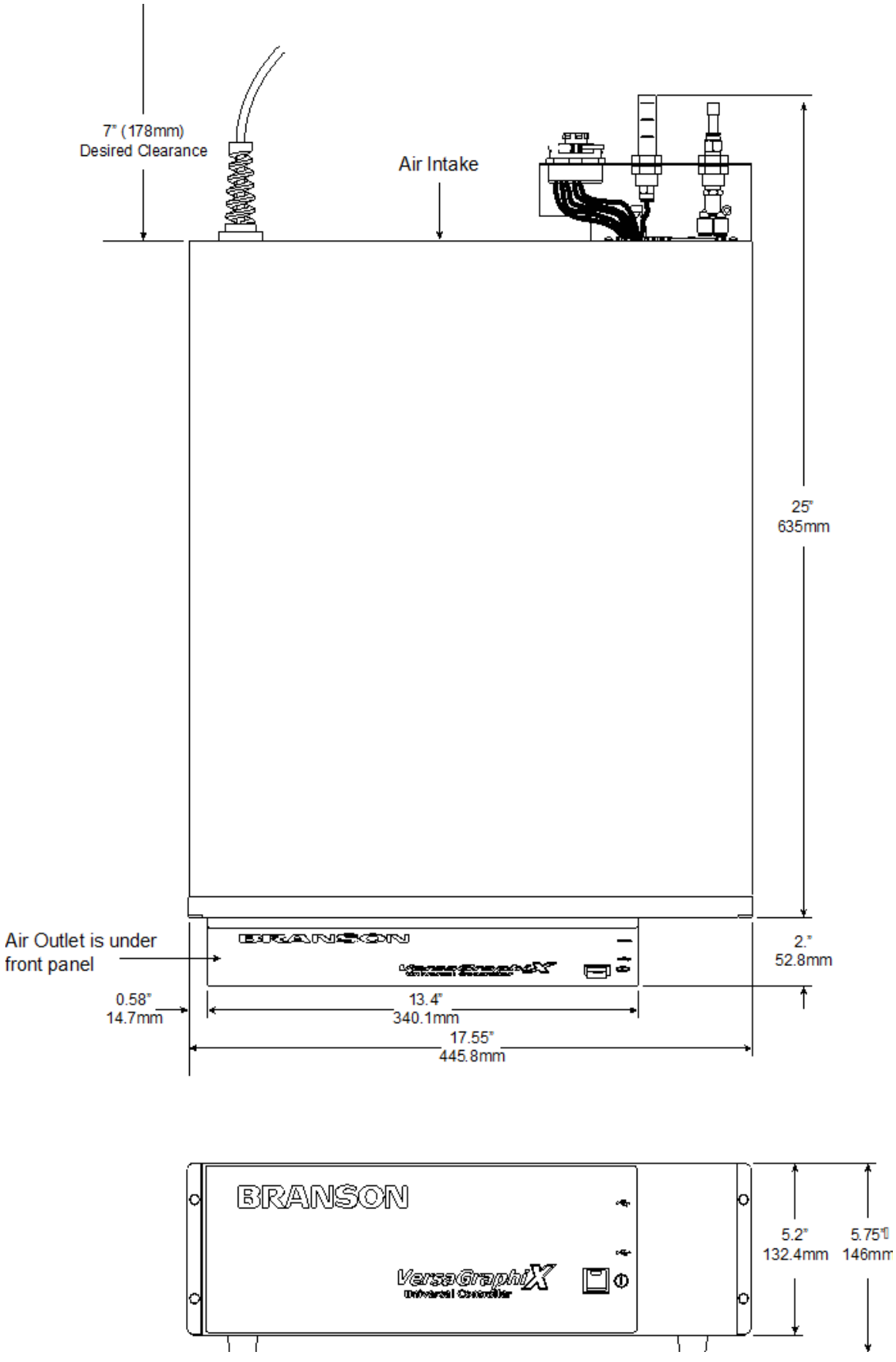
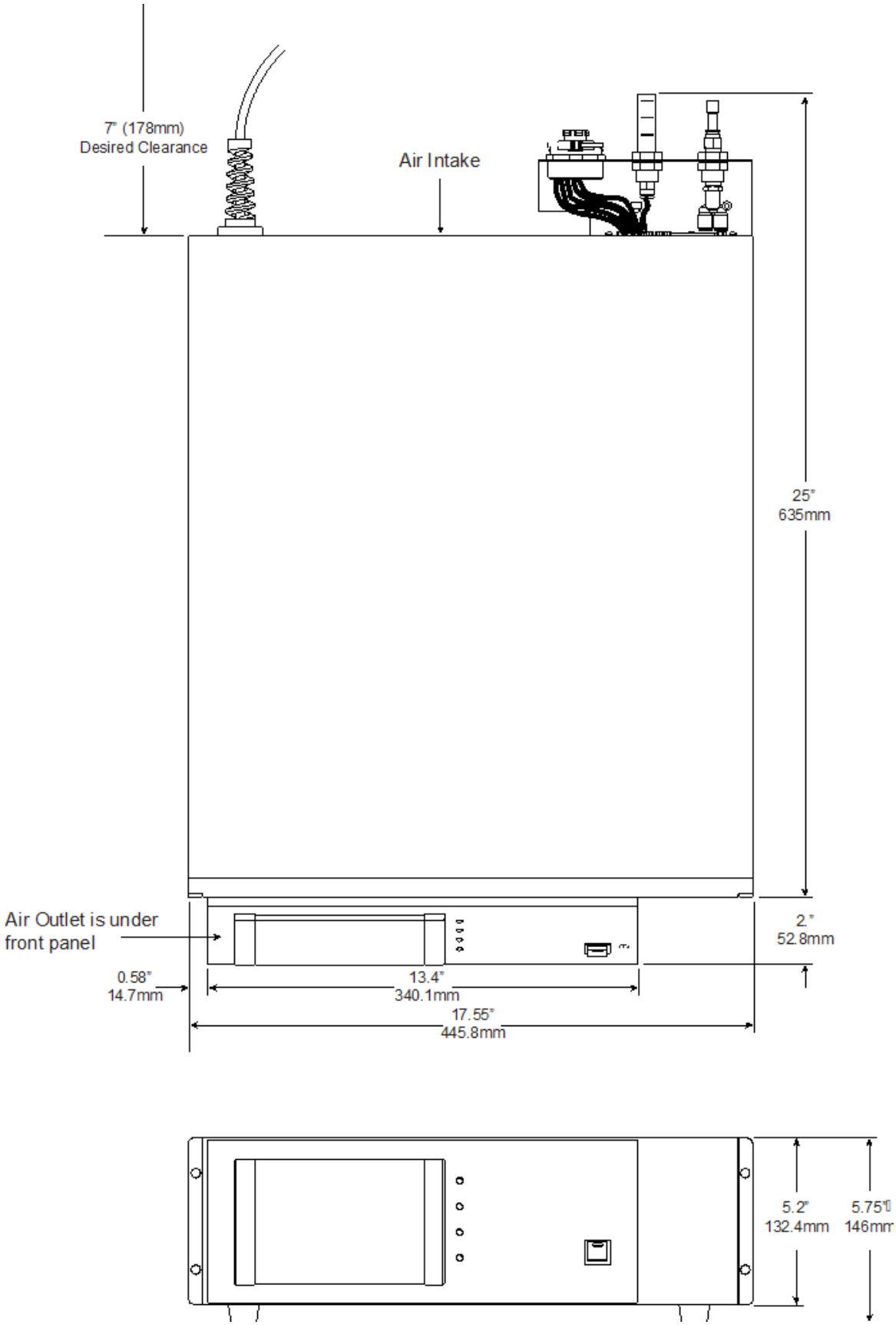


Figure 4.2 Controller Dimensional Drawing (Touch Screen)



4.4.3 Electrical Input Power Ratings

Plug the Controller into a single-phase, grounded, 3-wire, 50 or 60 Hz power source. Table 4.4 lists the current and fuse ratings for the various models.

Table 4.4 Input Power requirements

Model	Power	Current Rating	NEMA Connector
40 KHz models	400 W 90V - 110V	10 Amp Max. @ 100V / 20 Amp fuse	NEMA 5-15P Plug
	800W 200V - 230V	6 Amp Max. @ 200V / 20 Amp fuse	NEMA L6-20P Plug

4.4.4 Factory Air

The factory compressed air supply must be “clean, dry and unlubricated” air with a regulated maximum pressure of 100 psig (690 kPa). Depending on your application, the actuator requires between 70 to 80 psi. Use a lockout device on the air line if required.

WARNING	
	Synthetic air compressor lubricants containing Silicone or WD-40 will cause internal actuator damage and failure due to the solvents contained within these types of lubricants.

4.4.4.1 Air Filter

Controllers for Ultrasplice 40 Actuators have an input air filter which protects from particulate matter of 5 microns or larger.

Polycarbonate bowls are suitable for use in normal industrial environments, but should not be located in areas where they could be subjected to direct sunlight, an impact blow, nor temperatures outside of the rated range: 40ºF to 125ºF (4ºC to 52ºC). As with most plastics, some chemicals can cause damage. Polycarbonate bowls and sight dome should not be exposed to chlorinated hydro-carbons, ketones, esters and certain alcohols. They should not be used in air systems where compressors are lubricated with fire-resistant fluids such as phosphate ester and di-ester types.

CAUTION	
	TO CLEAN POLYCARBONATE BOWLS USE MILD SOAP AND WATER ONLY! DO NOT use cleansing agents such as acetone, benzene, carbon tetrachloride, gasoline, toluene, etc., which are damaging to this plastic.

4.4.4.2 Pneumatic Connections to Actuator

Air connection to the Ultrasplice 40 actuator is made to the air line connector on the rear of the Controller using the UltraSplice 40 airline harness.

4.5 Installation Steps

4.5.1 Mounting the Controller

The Controller is designed to be placed on a workbench (rubber feet on bottom) within cable length limits of the actuator. It has two rear-mounted fans which draw cooling air from rear to front, which must be free from obstruction. Do not place the Controller on the floor or in other locations that will allow dust, dirt or contaminants to be drawn into the Controller.

The controls on the front of the Controller must be accessible and readable for setup changes (touchscreen models).

All electrical connections are made to the rear of the Controller, which should be positioned in your workspace with adequate clearance (approximately 4 inches or more on either side, and 7 inches to the rear) for cable access and ventilation. Do not place anything on top of the Controller case.

In the event the system is to be installed in a high dust environment, the use of a fan filter kit (101-063-614) is required.

See Figure 4.1 and Figure 4.2 for dimensional drawing of compatible Power Supplies.

Figure 4.3 Connections on Rear of a VersaGraphiX Controller

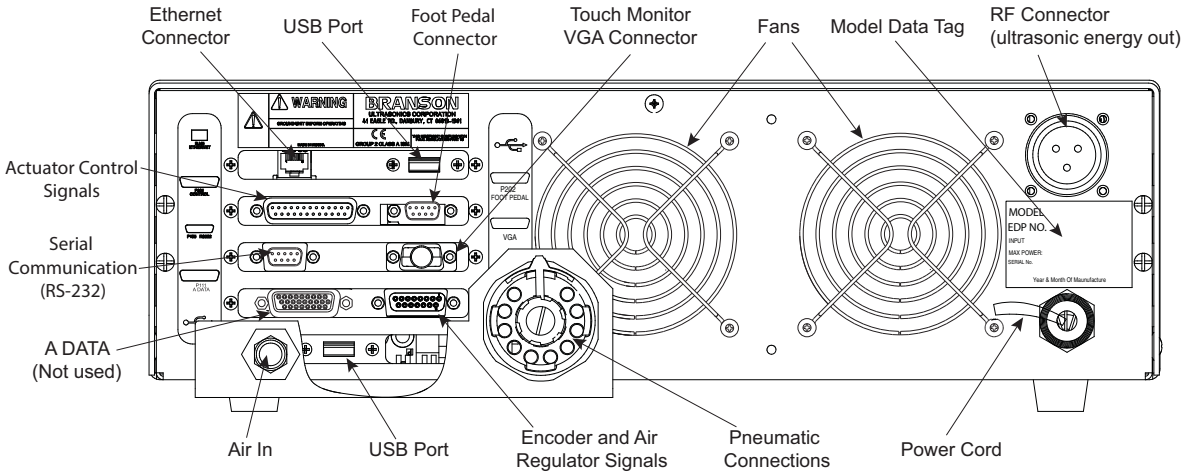
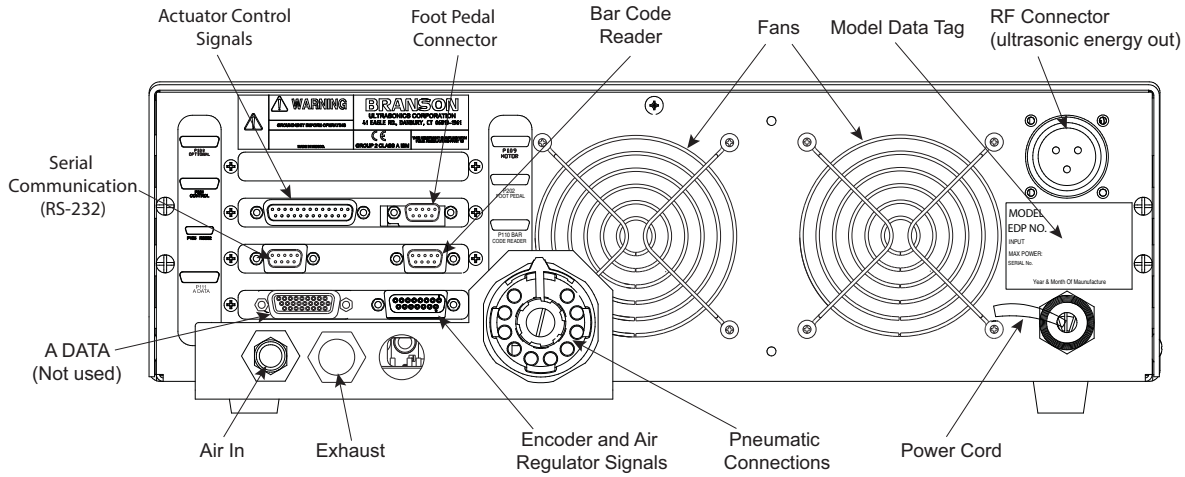


Figure 4.4 Connections on Rear of a Touch Screen Controller



The cable lengths are limited based on the operating frequency of the welding system. Performance and results can suffer if the RF cable is crushed, pinched, damaged or modified. Contact your Branson Representative if you have special cable requirements. In some cases, remote operation from a User I/O or a Remote Terminal can be used to solve a distance limitation.

4.5.2 Input Power (Main)

The system requires single-phase input power, which you connect to the Controller using the integral power cord. See Table 4.4 Input Power requirements for plug and receptacle requirements for your specific power level.

Refer to the unit's Model Data Tag to be sure of the power rating of the Model in your system.

4.5.3 Output Power (RF Cable)

Ultrasonic Energy is delivered to a screw-on MS receptacle connection on the rear of the Controller, which is connected to the Ultrasplice 40 Actuator.

WARNING	
	Never operate the System with the RF Cable disconnected or if the RF Cable is damaged.

4.5.4 Interconnect Between Controller and Actuator

The Ultrasplice 40 Actuator has two electrical connections between the Controller and the Actuator: the RF Cable, and the Analog Data Cable.

There can be other connections to the Actuator, and other connections to the Controller, but these are the two standard connections.

4.6 Safety Devices

The removal, bridging or disabling of safety devices is not condoned for production operation. Individual safety devices mentioned below may only be disabled if super-ordinate safety devices are employed in their place.

4.6.1 Emergency Stop

In case of danger, hit the red, emergency stop Which is found on the red, top portion of the foot pedal. The actuator, controller, and related fixtures are returned to the “Home” position. Twist the emergency stop to reset the system. If dual anti-tie start buttons are used, there must be a red emergency stop associated in line. Free access to the emergency stop button must be maintained.

4.6.2 Actuator Cover

The Ultrasplice 40 actuator is equipped with a cover which should only be removed for maintenance and installation purposes.

4.7 Ultrasonic Stack Assembly

Table 4.5 Ultrasonic Stack Assembly Procedure

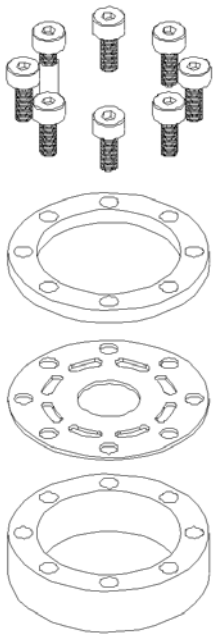
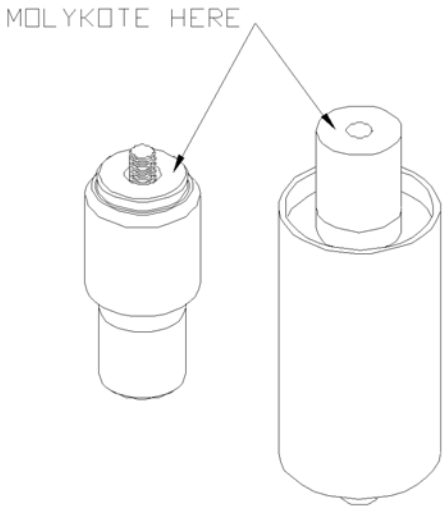
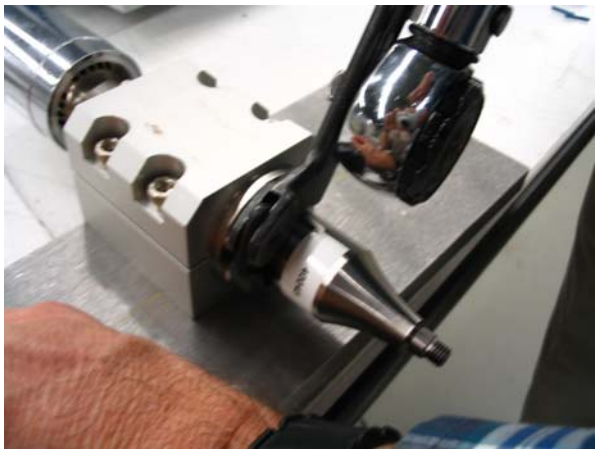
Action	Reference
• Clean shell, booster and converter faces and diaphragm surfaces with solvent to remove all contaminants and previously used paste • Place shell on clean bench, either flat side down • Place front diaphragm (½" center hole) over shell face • Place end cap, over diaphragm • Align end cap and diaphragm with shell holes and assemble the socket head screws each in an alternating pattern • Repeat for rear diaphragm spring	
• Apply and spread out an even coat of Molykote G-n paste (about equal to half a paper match head) to the booster face (the side with the stud) and the converter face. A very thin film of paste is all that is required. Do NOT apply paste to threaded opening, or to stud threads, or to diaphragm surfaces. Do NOT use silicone grease	

Table 4.5 Ultrasonic Stack Assembly Procedure

Action	Reference
• Place the assembled stack in a (optional) Benchtop stack mounting block • Using a spanner wrench on the horn, tighten to 175 in-lbs. • Tighten the converter to Booster to 150 in-lbs.	
• If the tip needs to be installed, put tip in position and thread on the Tip Nut **NOTICE** **Tip Nut has LEFT HAND THREADS** (to prevent loosing during the weld cycle.) • Torque the tip to 125 in-lbs	
• Completed Stack Assembly	

4.7.1 Installing the Stack in the Actuator

The ultrasonic stack must first be assembled. To install the stack:.

WARNING	
	Make sure that the system power is turned off by disconnecting the power plug.

Table 4.6 Mounting the Stack on the UltraSplice 40 Actuator

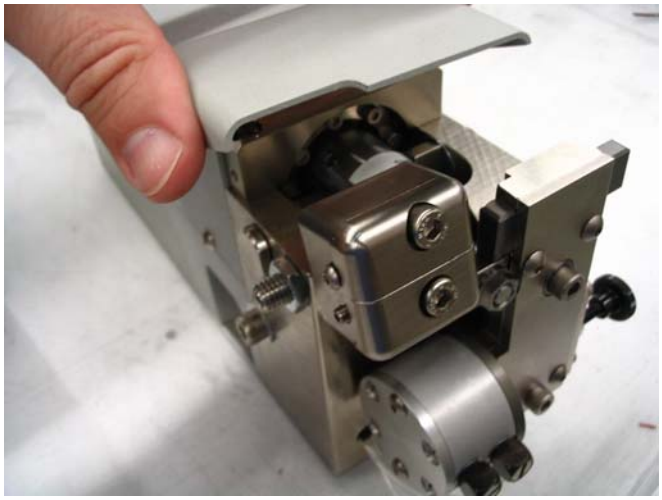
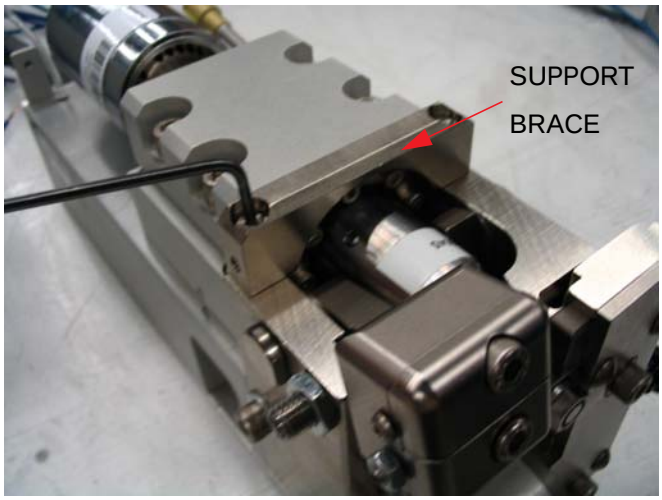
Action	Reference
• Remove the top cover and horn cover	
• Remove the Support Brace	

Table 4.6 Mounting the Stack on the UltraSplice 40 Actuator

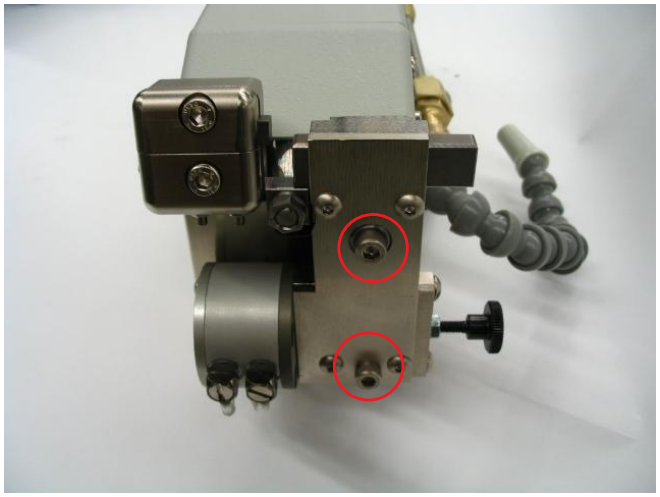
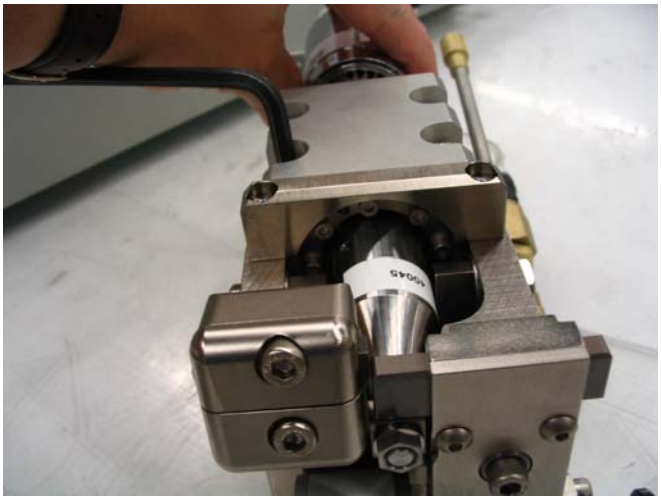
Action	Reference
• Loosen the gather assembly retaining screws but do not remove • Slide the gather assembly up and snug one screw to hold the gather assembly in its upper position	
• Remove the four stack hold down bolts.	

Table 4.6 Mounting the Stack on the UltraSplice 40 Actuator

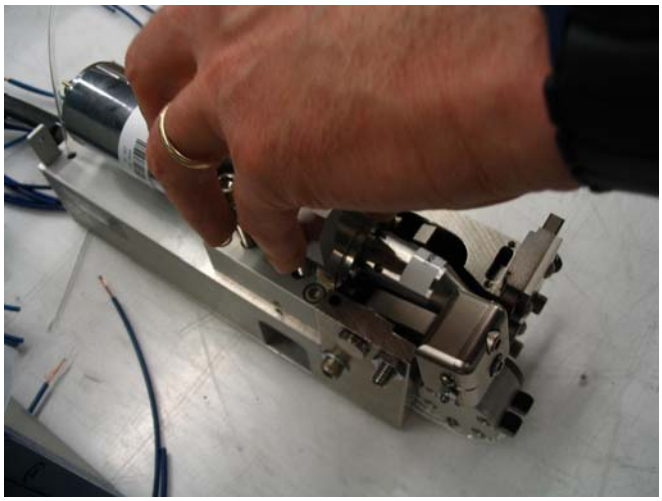
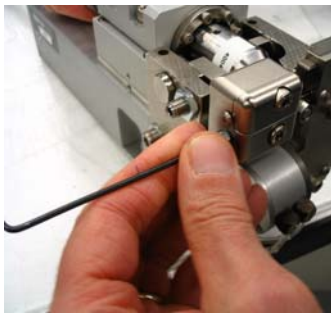
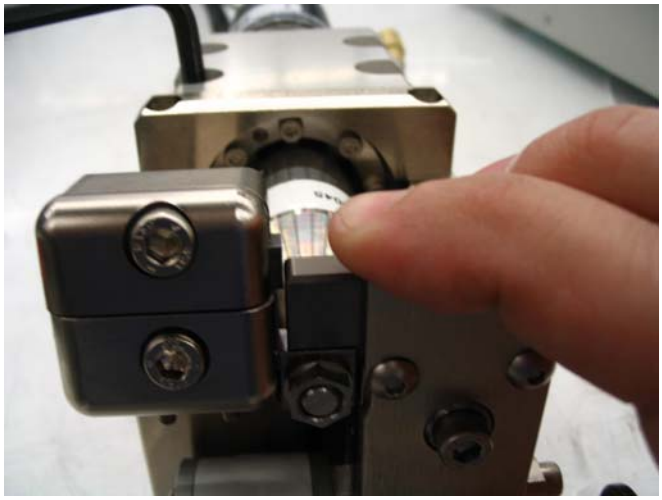
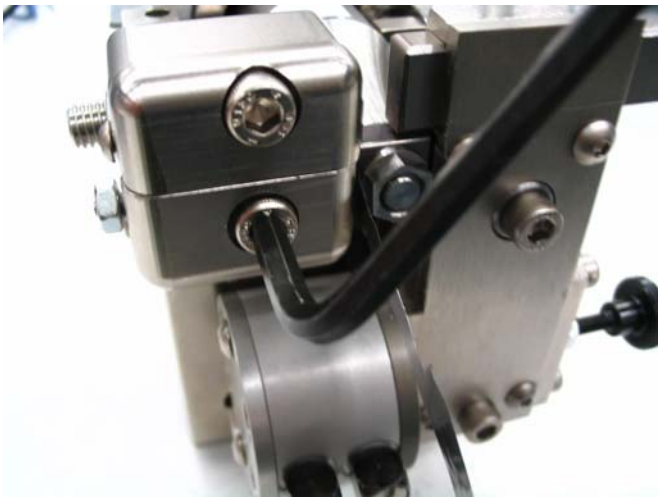
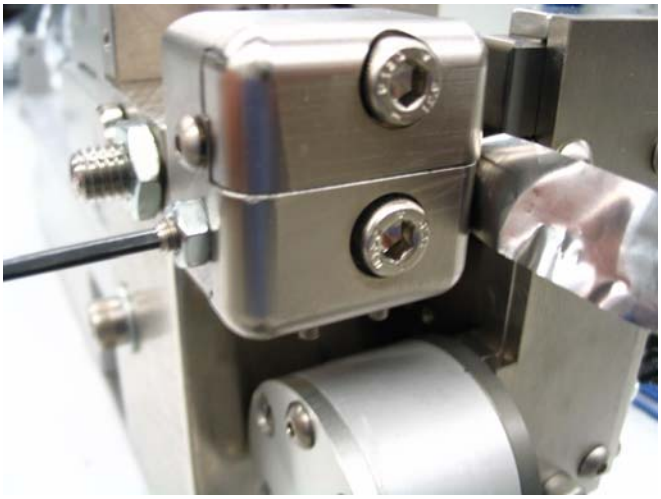
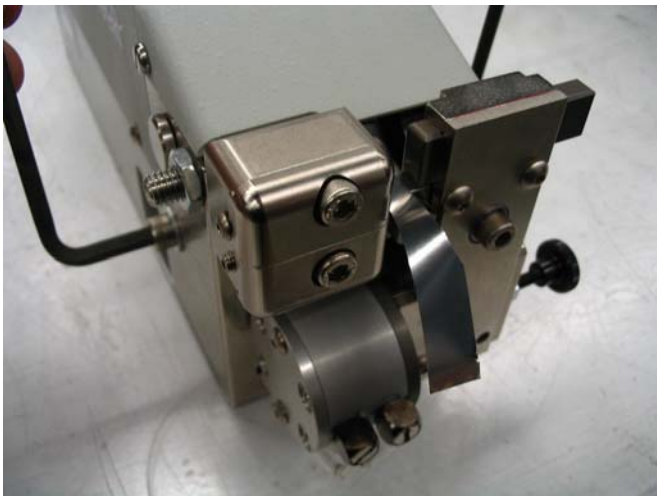
Action	Reference
• Place Stack into the actuator • Carefully bring the tip portion under the gather block • Install the following: -Stack Space Plate -Upper Stack Mount & -Upper Brace • Then tighten the side with Spacer and hand tighten other side	
• With the Anvil Arm in the down position, slowly rotate the stack as the Tip Guide screw is turned in • When the stack can no longer rotate, proceed to the next step	 
• With Tip to Tip Guide Squared up, Loosen the Gather screws and manually press the Gather Block down onto the Tip • The hand tightened Stack mount screws can now be tightened securely. Be sure that all four Stack screws are tightened evenly	

Table 4.6 Mounting the Stack on the UltraSplice 40 Actuator

Action	Reference
• Set tip guide gap by slightly loosening the Tip Glide clamp • Place a 0.001” Shim between the Tip and Tip Guide, as shown	
• Loosen the Tip Guide lock nut and slowly bring in the set screw until a slight drag is obtained on the shim • Tighten lock nut and Tip Guide Clamp	

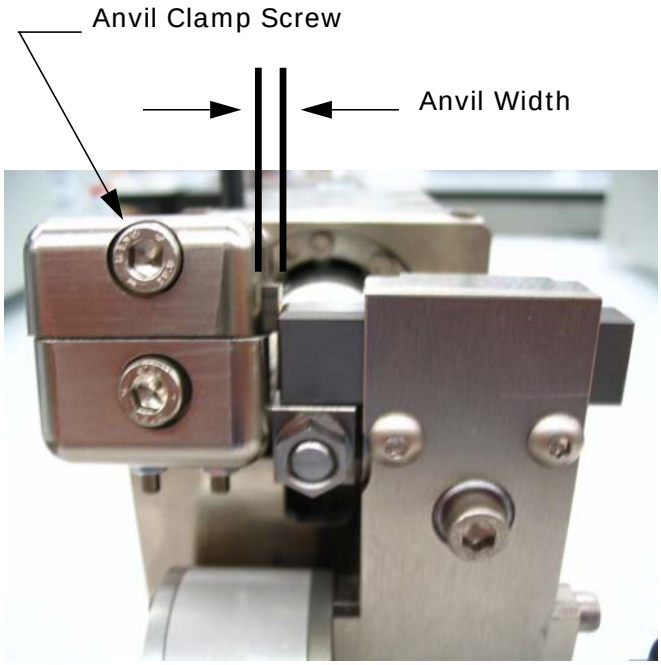
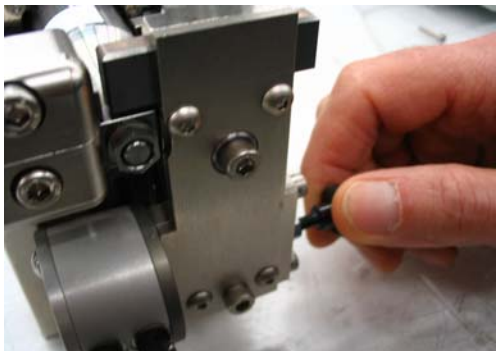
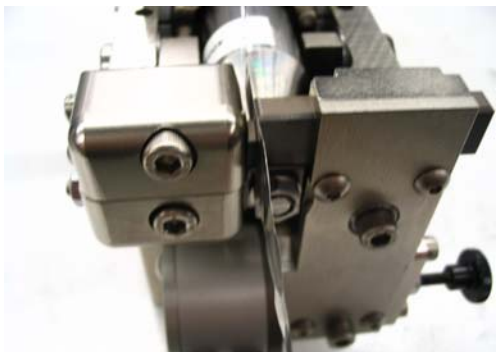
4.7.2 Down Stop Adjustment

Table 4.7 Adjusting the Down Stop

Action	Reference
• To adjust the anvil down stop, place a 0.001” to 0.002” shim between the tip and anvil as using a hex key wrench - turn the larger of the (2) socket head cap screws located on the side of the unit clockwise as needed • This will rotate the eccentric down stop shaft within the actuator • For best results, turn slowly until there is a slight drag on the shim	
• Set the Gather to Tip gap Start by loosing the (2) Gather Housing Socket head Cap Screws • Place a 0.001” shim between the tip and bottom of the Gather Block. Let the anvil drop into the shim and tighten the (2) gather screws	

4.7.3 Setting Anvil Width

Table 4.8 Setting Anvil Width

Action	Reference
• Depending on the application, the anvil will need to be set accordingly • Feeler Gages, Gage Pins and Drill Blanks are recommended for setting the required Anvil Width • The anvil spring will drive the anvil out. Manually position the anvil where needed and Tighten the Anvil Clamp Screw	
• Gather to Anvil Gap • Place a 0.001” shim between the Anvil and side of the gather block • Loosen the Gather adjusting Screw locknut • With the Gather Adjusting Screw, bring in the Gather Block until a slight drag is obtained • Then tighten the lock screw	 

4.7.4 Other Tooling Gaps

Table 4.9 Other Tooling Gaps

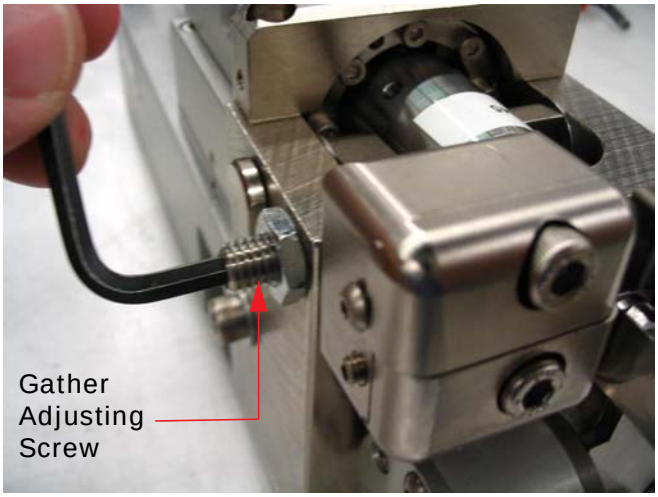
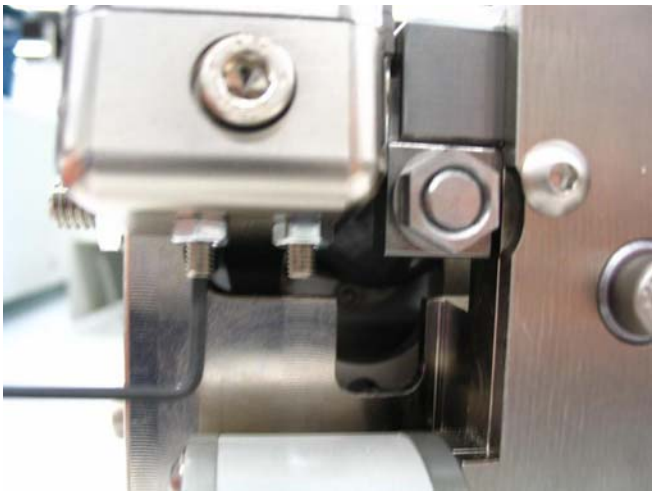
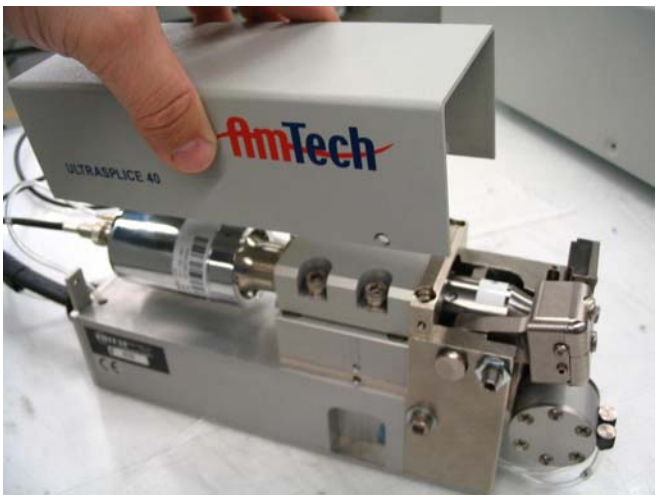
Action	Reference
• If needed, the Anvil Arm support screw can be adjusted, as shown to set the Anvil to tip gap • This is generally factory set	
• If the tip guide vertical adjustment is required. Loosen the Tip Clamp Screw and (2) Jack screw jam nuts • Turn the (2) Jack screws until the Tip Guide is even with the bottom of the Anvil. For adjustment, only tighten enough to allow the anvil slide slightly • Tighten the (2) Jam nuts and the Tip Guide Clamp screw	
• Re-install Top Cover and Horn Cover • Reconnect R.F. cable	

Table 4.9 Other Tooling Gaps

Action	Reference
• Completed Assembly	

4.7.5 Rotating Tip

Table 4.10 Rotating Tip

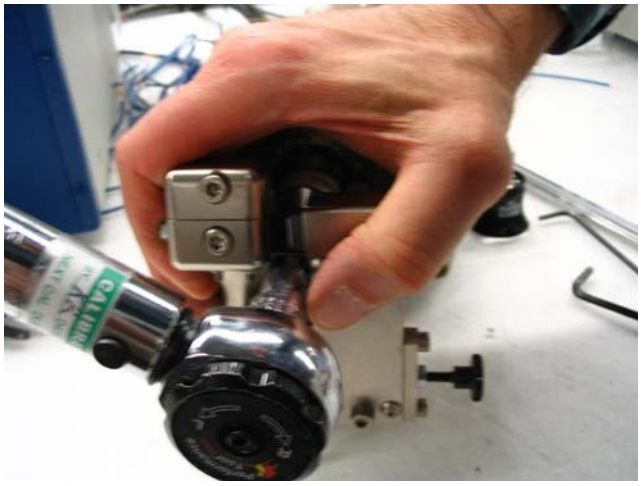
Action	Reference
• The Tip can also be rotated or replaced without removing the stack • Remove the Tip Nut, Rotate the keyed Tip and re-install the Tip Nut **NOTICE** LEFT HAND THREADS • Torque to 125 in-lbs	

Table 4.10 Rotating Tip

Action	Reference
• Completed Tooling Setup	

4.8 Testing the Installation

4.8.1 Check Splicer Performance

Ensure that nothing is touching the horn on all four sides. With the tooling disengaged and the welder unloaded, press the “SONICS” button on the Touchscreen controller for no longer than one second. If there is a loud squealing noise, the problem may be in the following areas:

- The Horn may be loose or not secured properly
- Tooling may be in contact with each other

4.9 Still Need Help?

Branson is pleased that you chose our product and we are here for you! If you need parts or technical assistance with your Ultrasplice 40 system, call your local Branson Metal Welding representative or contact the Branson customer service by calling the appropriate department as indicated in 1.5.3 Contact Information.

Chapter 5: Technical Specifications

5.1 Technical Specifications

5.1.1 Requirement Specifications

The Ultrasplice 40 actuator requires compressed air. The factory air source must be “clean and dry air”, that is, without moisture or lubricants. The Actuator requires 70 psi minimum pressure for operation and cooling, and can require up to 80 psi maximum, depending on the application. The following table lists environmental specifications for the ultrasonic welder. The following table lists environmental specifications for the ultrasonic welder.

Table 5.1 Environmental Specifications

Environment	Range
Humidity	30% to 90% non condensing
Ambient Operating Temperature	+5ºC to +50ºC (+41ºF to +122ºF)
Storage / Shipping Temperature	-25ºC to +55ºC (-13ºF to +131ºF)
Operating Altitude	1000 m (3280 ft)
Ip Rating	2X

All electrical input power connections are to the Controller.

5.1.2 Performance Specifications

The following table details some of the performance specifications associated with the Ultrasplice 40 Actuator.

Table 5.2 Ultrasplice 40 Actuator Performance Specifications

Maximum Welding Force (at 100 psi)	120 lbs of force
Height Encoder Accuracy	±0.05 mm
Maximum Splice Area	6 mm^2

Chapter 6: Operation

6.1 Actuator Controls

This section describes how to operate a weld cycle using the Ultrasplice 40 Actuator. For more detailed information on making and altering settings, refer to your Controller Manual.

CAUTION	
	Keep fingers away from the splicing nest when setting up and operating the Actuator. Down force (pressure) and ultrasonic vibrations can cause injury.

The Ultrasplice 40 Actuator is controlled by the Controller. Refer to your Controller manual for tuning testing, setup and operating instructions

6.2 Initial Actuator Settings

6.2.1 Weld parameters

To obtain quality welds each and every time, the correct combination of weld parameter settings must be developed. These parameters include:

- Energy (Joules)
- Weld Pressure, Pressure During Sonics (psi/bar)
- Amplitude (Microns)
- Splice Height to Width Ratio

6.2.2 Factory Air Source

Factory air must be turned on, supplying the Controller's air pressure regulator with air pressure. If factory air is too low (below 70 psi maintained) the actuator will not weld or operate reliably. Factory air is also used to provide cooling air to the converter.

Factory air input may affect weld results for applications requiring more weld pressure buildup.

NOTICE	
	Factory Air pressure must be higher than the maximum system requirements. The compressed air system must have sufficient capacity to serve all of the systems connected to it. The use of an accumulator may be required to provide continuous air flow.

6.2.3 Cooling Air

Cooling air is designed to keep the converter cooled to a reasonable temperature during welding.

6.2.4 Torque Check

Proper tightness of tooling is critical to assure efficient transmission of ultrasonic energy into the weld nugget. Please check the tightness of the following areas during a tool change or whenever looseness is suspected.

Table 6.1 Tooling Torque Check

Area	Suggested Torque
Horn to Booster	175 IN-LBS (19.8 N-M)
Converter to Booster	150 IN-LBS (16.9 N-M)
Tip Nut	125 IN-LBS (14.1 N-M) (Unless otherwise specified)

6.2.5 Emergency Stop

The emergency stop is found on the red, top portion of the foot pedal. When engaged it will prevent the actuator from running, and will also immediately terminate a weld cycle and cause the actuator to return to its “Home” position. It does not remove power from the system. The Controller will indicate that the system is in emergency stop mode and emit a beep sound when the emergency stop is engaged. Twist the emergency stop to reset the system.

6.3 Operating the Actuator

For detailed information about Ultrasplice 40 Actuator controls, refer to 2.4 Controls.

6.3.1 Check Welder Performance

Ensure that nothing is touching the horn on all four sides. With the tooling disengaged and the welder unloaded, press the “SONICS” button on the Touchscreen controller for no longer than one second. If there is a loud squealing noise, the problem may be in the following areas:

- The Horn may be loose or not secured properly
- Tooling may be in contact with each other

NOTICE	
	For information on locating the “SONICS” button on your particular Controller model please refer to your Controller manual.

6.3.2 Developing a Splice

Now that you have your new UltraSplice 40 ultrasonic wire splicer set up and ready to run let’s review a process to optimize the splice. This is a step by step process including suggestions and photographs of actual wire splices. The photographs illustrate the progression of poor splices from under welded to over welded ending with a representation of the perfect splice that will give excellent process capability (Cpk) values when destructively tested. Guidance is also provided for the proper procedure for destructive testing.

Place the wires into the target area of the splicer. Refer to Figure 6.1. It is recommended that larger wires be closest to the welding tip when there is a significant difference in wire sizes being spliced. The reason for this is that the larger wire takes more energy to weld each of its strands to its neighbor. If we tried to do this through the smaller wire there is a possibility the smaller wire could be damaged or overwelded before the larger wire was welded. It is also recommended that wires be placed on top of one another as much as possible to ensure good welding from wire to wire and to avoid the possibility of a “side splice”.

Activate the splicer and make a splice.

Examine the splice. Refer to Table 6.2 Wire Splice Comparison Based upon your observation make adjustments as follows:

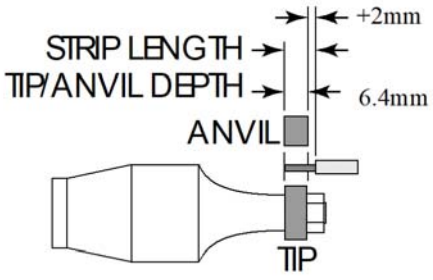
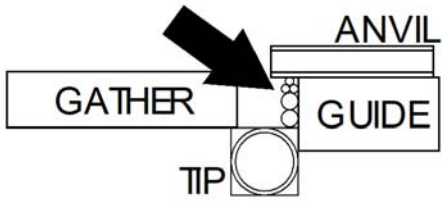
If you see loose strands (Ref. C) increase the welding pressure in 10% increments as you make additional splices. If, after increasing the welding pressure by 20% there are still loose strands increase the amplitude by 10%. Continue to follow this sequence until the splice looks good with no loose or broken strands. (Ref. H)

If you see broken strands or flash (Ref. D) reduce the amplitude by 10% and make a splice. If the splice is still overwelded, reduce the welding energy by 10% and make another splice. If the splice is still overwelded, reduce the welding pressure by another

10%. Continue to follow this sequence until the splice looks good with no broken strands or flash.

Once you have achieved a splice that appears good by following step 4 above, it is time to do some destructive testing. Pull test the splice according to recommended pull test technique. Fixturing of the splice for tensile testing is very important. Care must be taken to ensure no twisting of the nugget occurs. Testing should be on the smallest diameter wire and/or the wire closest to the anvil. The reason for this is that the anvil side of the nugget has received the least amount of ultrasonic energy and should be the weakest part. If this wire meets the tensile strength specification then it is safe to assume the splice is good. Wherever possible, it is a good idea to use multiple wires to anchor the test specimen and ensure an even pull on the wire being tested. If the splice meets specifications for strength make a minimum of 10 splices, pull test them and calculate the Cpk. If the Cpk is not satisfactory, examine the splice carefully to determine how it is failing. An underwelded splice will fail by separating at the weld. An overwelded splice will fail at the transition point of welded to unwelded wire. Based upon your observation return to step 4 and repeat the optimization process. Note that the best splices will fail at the transition but will do so at a consistent and predictable force. It is therefore necessary to pick weld parameters that meet this condition without excessive deformation of the wire strands.

Figure 6.1 Proper Wire Insertion

STRIP LENGTH		Wires should be stripped to a dimension 2 mm longer than the Tip/Anvil depth.
PLACEMENT IN WELDING ZONE		Care should be taken to stack the wires vertically wherever possible to ensure an optimum splice.

6.3.3 Evaluation of Splice

How to evaluate an ultrasonic splice is one of the first questions to be answered. A splice must withstand vibration, moisture, high current loads, heat, and cold. Extensive studies have shown that the ability to meet these requirements is directly related to the pull strength of the wire splice.

Peel strength is, of course, important. A minimum level of resistance to peel must be associated with each splice to allow handling of wire harnesses during manufacturing and installation without an adverse effect on the splice. However peel strength does not relate directly to the ability to pass the aforementioned requirements. In fact, such things as placement of the wire in the splice affect peel strength and the degree of extrusion experienced during welding. Indeed, over-welding or extruding a wire splice will increase

peel strength while decreasing the pull strength and therefore the ability of the splice to perform satisfactory.

Table 6.2 Wire Splice Comparison

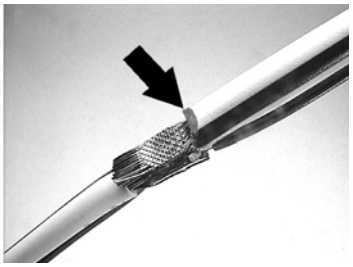
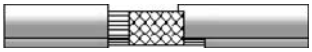
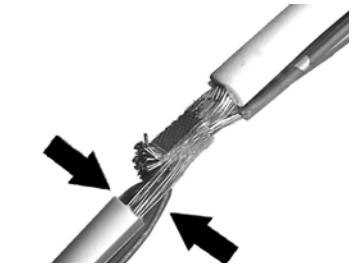
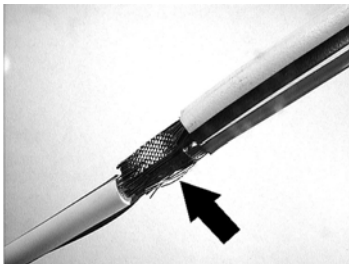
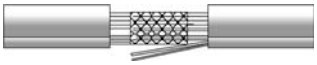
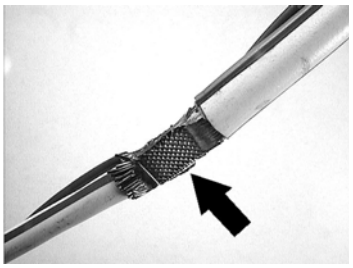
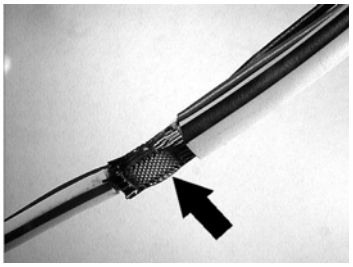
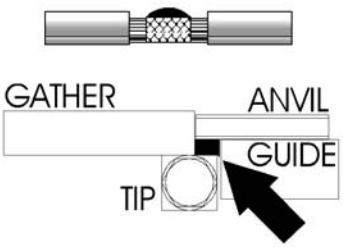
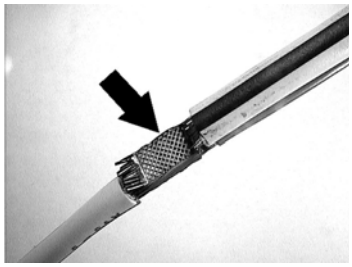
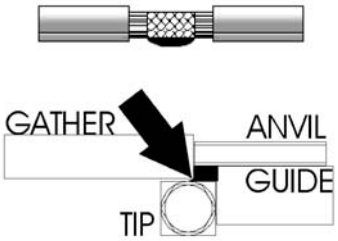
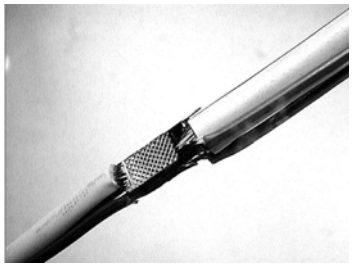
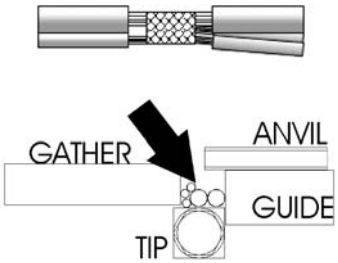
Ref	Photo of Condition	Schematic	Description
A			WIRE OVERLAP - Damaged or burnt insulation
B			OVER WELDED - Wire not fully inserted into weld pocket
C			UNDER WELDED - Pressure too low
D			OVER WELDED - Pressure and amplitude too high (flash & burning)
E			FLASH - Tip guide gap too big

Table 6.2 Wire Splice Comparison

Ref	Photo of Condition	Schematic	Description
F			FLASH - Gather gap too big
G			SIDE SPLICE - Incorrect wire stacking in weld pocket
H			GOOD SPLICE

6.3.4 Spliced Wire Pull-Testing

The weakest wire in tension of any splice is the wire with the smallest cross sectional area or gage. When all the wires in a splice are the same gage, the weakest wire in tension of any wire splice is the wire closest to the anvil. This is true since sonic vibration (amplitude) and energy begin at the horn tip and travel through the splice to the stationary (zero amplitude) anvil. Therefore, by pulling either the wire welded on the anvil side or the smallest gage wire, the operator will ensure that the machinery is transmitting a sufficient level of energy to achieve a quality splice.

The pull test value must meet the required value established by your customer for the smallest gage wire in the splice. In addition, the following conditions have always been cause for rejection:

- Broken strands
- One or more loose strands
- Excessively burnt insulation
- Excessively frayed ends
- Failed torsion (twist) test

6.3.5 Quality Monitoring

The Ultrasplice System is capable of monitoring two welding variables during each cycle; weld time (secs) and peak weld power (watts). Each variable can be set with upper and

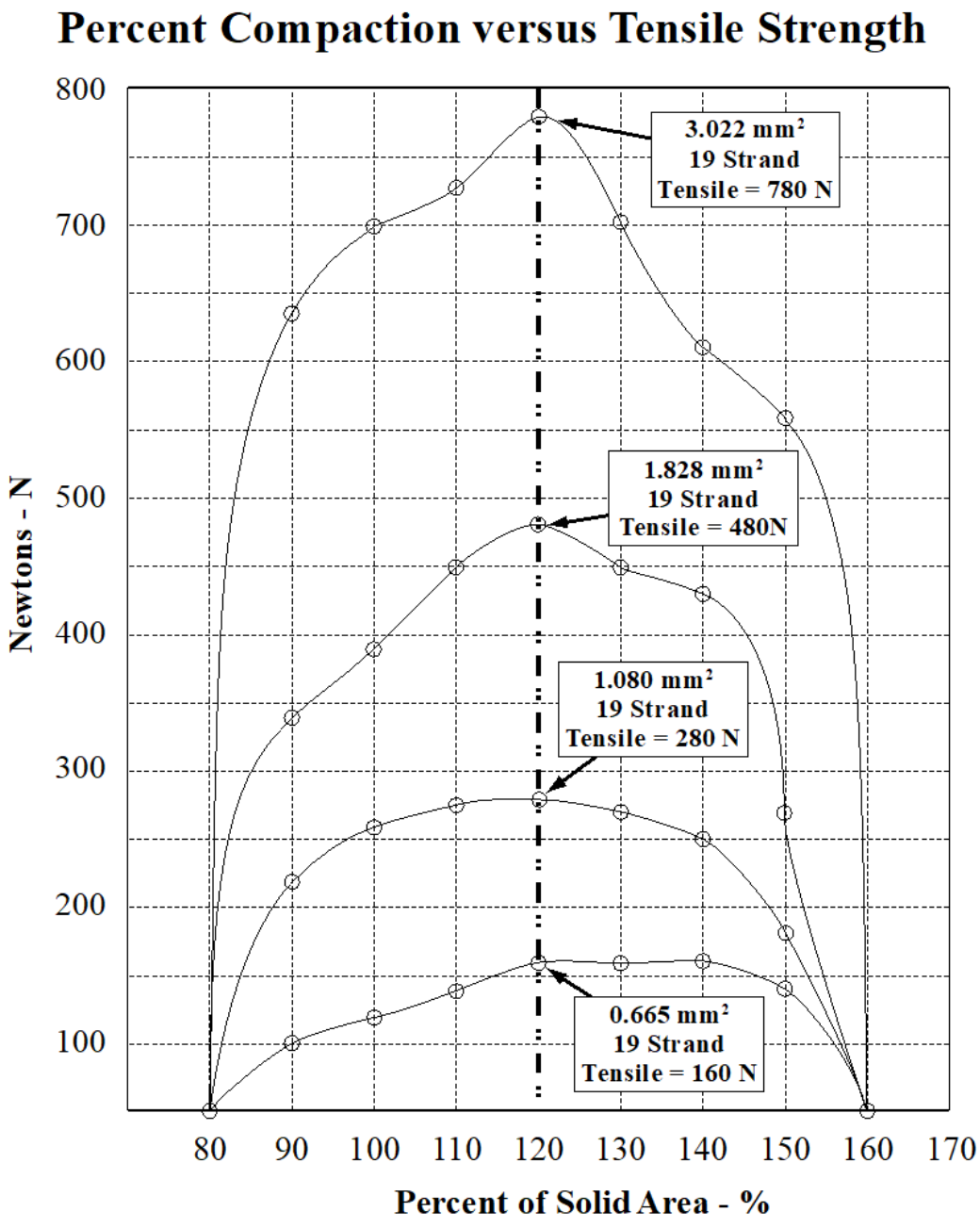
lower limits. When a limit or limits are violated, an audible alarm sounds. The type of alarm and associated value are displayed on the controller.

The setting of upper and lower quality limits is the responsibility of the end user. It is recommended that these limits be calculated using statistical methods.

6.3.6 Compaction vs. Tensile Strength

Knowing that pull strength (tensile strength) directly relates to the ability of the splice to meet performance criteria the question becomes, “How do I maximize tensile strength?” Studies at Branson on a range of wires in a 2 X 2 splice configuration clearly show that maximum tensile strength is achieved when the wires are welded and compacted to a dimension which is 20% greater than their solid copper cross section, (refer to Percent Compaction versus Tensile Strength graph, Figure 6.2).

Figure 6.2 Percent Compaction vs Tensile Strength



6.4 Safety Circuit Alarms

The Safety Control System within the Controller constantly monitors the system's safety related components for correct operation. When this system detects a fault condition, operation is interrupted and the system immediately goes to a safe state. A beeper is used to signal a safety system alarm.

Use the following procedure to troubleshoot safety circuit alarms:

1. Verify that the 9-pin footswitch cable is properly connected to the back of the Controller.
2. Power down and then power up the Controller to reset the system.
3. If the alarm persists, call Branson Support. See 1.5.3 Contact Information.

Chapter 7: Maintenance

7.1 Periodic and Preventive Maintenance

7.1.1 Maintenance Safety

Safety devices, especially covers, guards and ground cables should only be removed when it is absolutely essential for the completion of maintenance work. If safety devices were removed prior to starting maintenance work, be sure to re-install those devices after finishing the maintenance work. The following installation and maintenance operations must be performed prior to any disassembly of equipment:

WARNING	
	• All system components must be disconnected from the main electrical supply • Use LOTO (Lock Out Tag Out) lockable plug cover over line cord plug during any maintenance • Disconnect the air hose from the main air supply

7.1.2 Periodic Maintenance

In order to maintain optimum operating conditions, it is important to perform various maintenance and equipment inspections at periodic intervals. Please observe the following recommendations.

7.1.2.1 Daily Maintenance:

- Drain water and contaminants from the airline filters, if required

7.1.2.2 On Every Tool Rotation

- Inspect the clamping surfaces of the Tip, the Tip Nut and the Horn for fretting
- Vacuum and clean out any copper residue or dirt in the actuator

7.1.2.3 Filter/Filter/Regulator – Disassembly

Air Filter/Filter/Regulator (Optional component, Branson part# 207-020) should be serviced after 1 year or when a pressure drop of 15 psi is reached.

- Disconnect the air supply
- Relieve the air pressure in the FFR assembly by depressing the white button on bottom of the first filter until all air has been exhausted
- Pull down black button on first filter housing, rotate housing 1/8 turn until two marks line up and then pull housing down
- Clean out housing with a clean rag

CAUTION	
	DO NOT USE SOLVENT.

- Unscrew brass-colored filter element and the black water separator/nut combination

- Replace brass-colored filter element number 5 and reassemble in reverse order
- Remove housing on second filter in the same way in which the first housing was removed

CAUTION	
	DO NOT USE SOLVENT.

- UNSCREW WHITE FILTER ASSEMBLY AND DISCARD

NOTICE	
	The brass-colored filter element in the first assembly may be cleaned in solvent, dried and re-used, if necessary. The white filter element in the second assembly cannot be cleaned and must be replaced. Clogged filters will reduce the performance of equipment.

- Replace the white filter and re-assemble in the opposite order
- Reconnect air supply
- Turn air valve to the position marked “sup.”

7.1.3 Recondition the Stack (Converter, Booster, and Horn)

The transmission of ultrasonic energy along the stack (converter/booster/horn) requires a tight and clean interface between the components.

Please remove the stack and check the interfaces once every three months or whenever a problem is suspected.

7.1.3.1 Ultrasonic Stack Disassembly

WARNING	
	Be sure that the Controller is off to prevent any possible electrical shock from the high voltage contact on the converter.

Figure 7.1 Exploded Ultrasonic Stack Assembly

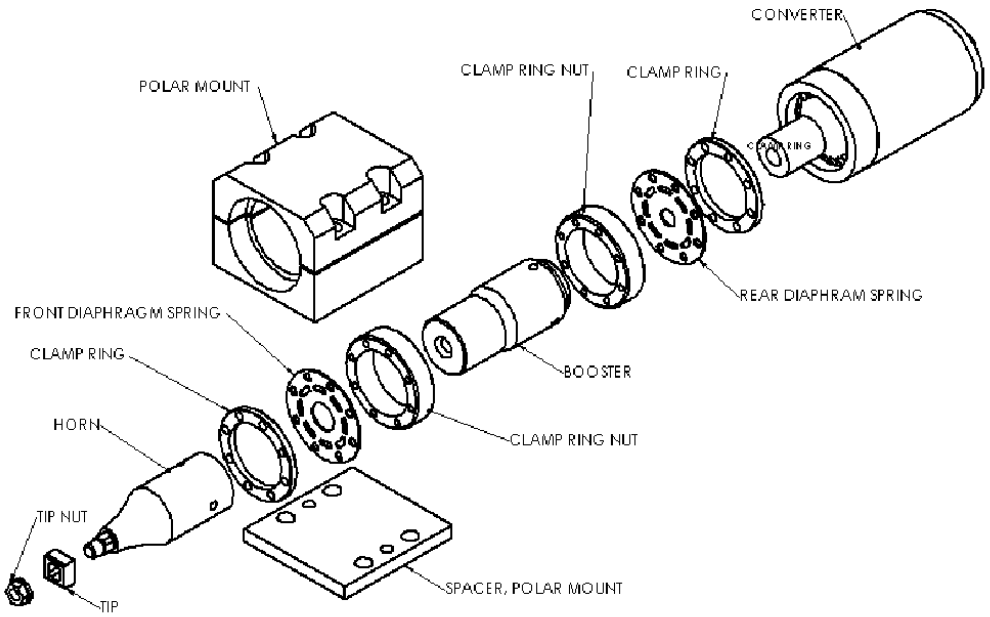


Table 7.1 Stack Removal Procedure

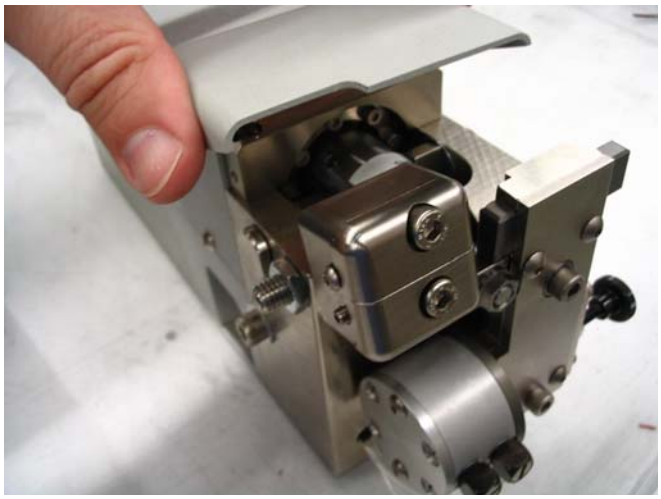
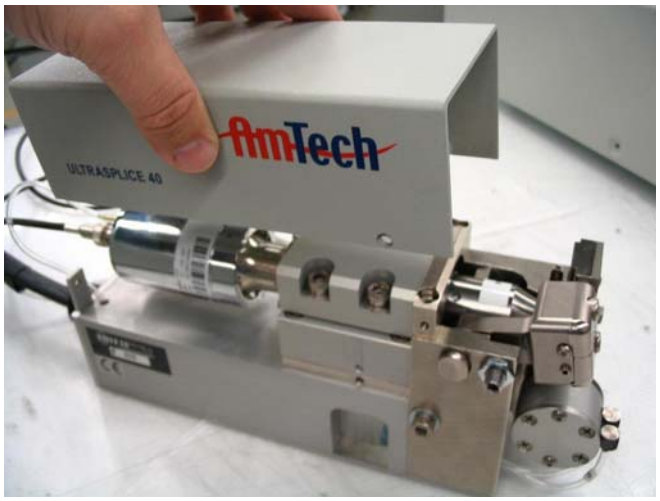
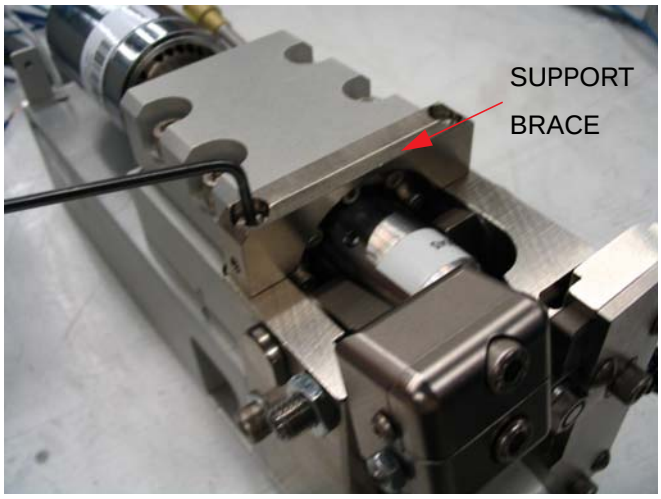
Action	Reference
• Disconnect the R.F. cable from the converter and the system air supply from the back of the touchscreen controller • Remove the top cover and horn cover	
	
• Remove the Support Brace	

Table 7.1 Stack Removal Procedure

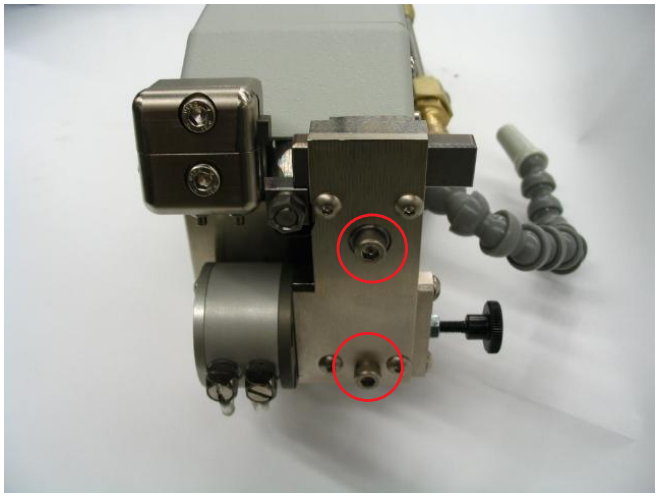
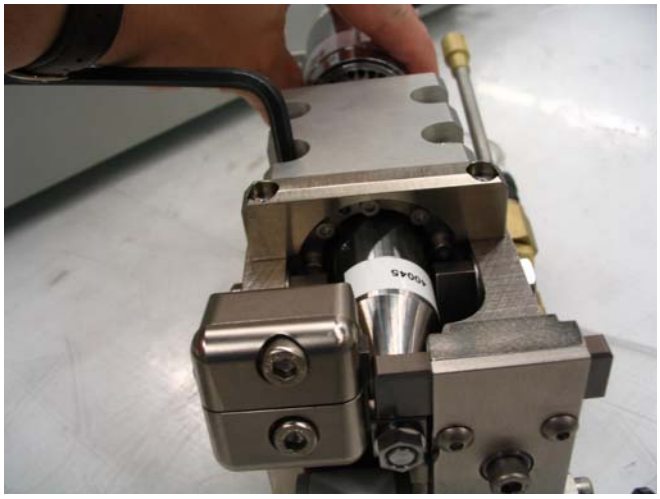
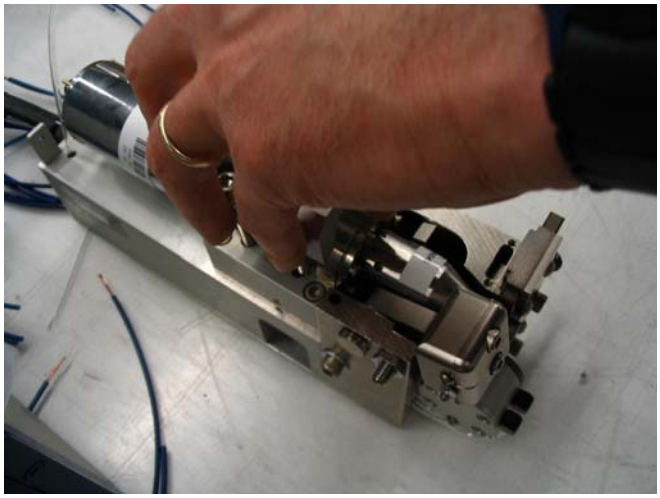
Action	Reference
• Loosen the gather assembly retaining screws but do not remove • Slide the gather assembly up and snug one screw to hold the gather assembly in its upper position	
• Remove the four stack hold down bolts	
• Carefully lift the stack out by raising the converter and then sliding the stack back to free the tip of the horn from the tool block	

Table 7.1 Stack Removal Procedure

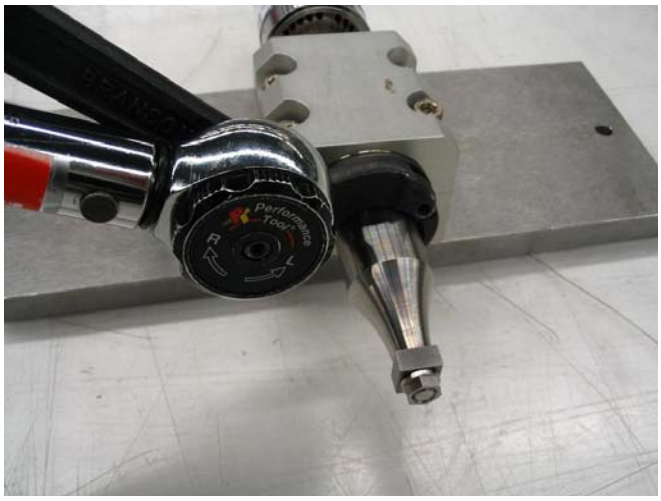
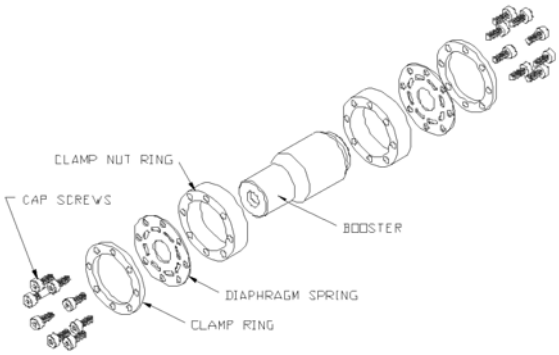
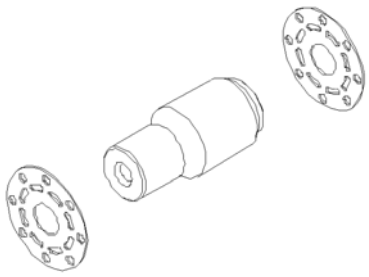
Action	Reference
• With the Stack removed, place it in the optional stack mount block [H4A50011] to remove the horn • Using a spanner wrench, turn the horn counter-clockwise and spin horn off	

Table 7.2 Disassembly of the Ultrasonic Stack

Action	Reference
• Remove stack from the mount block • Using the applicable hex wrench, remove the screws that retain the front and rear diaphragm springs	
• Clean, and polish away any roughness on the diaphragm springs or on the clamping faces of the booster	

7.1.3.2 Ultrasonic Stack Assembly

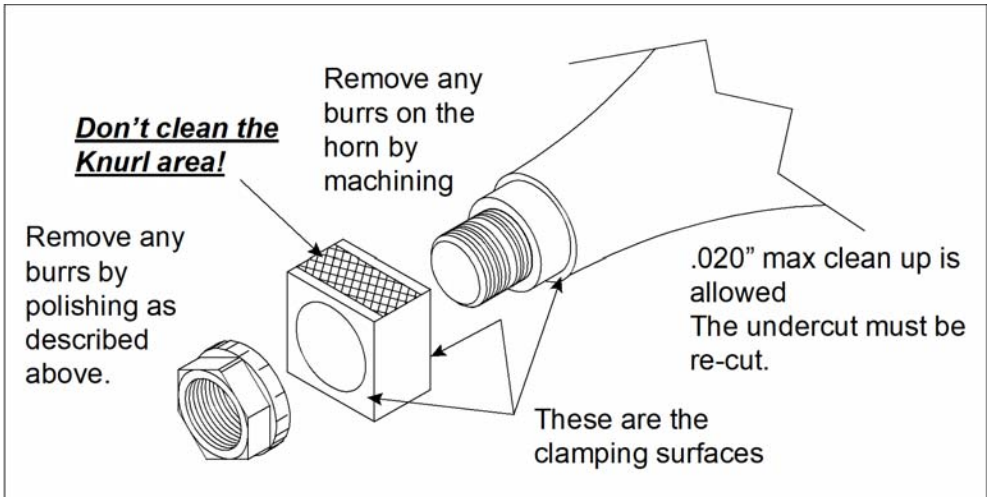
Refer to 4.7 Ultrasonic Stack Assembly.

7.1.3.3 Reconditioning Tip and Nut Clamping Surfaces (Replaceable Tip Horns Only)

After prolonged use, burrs may form on the clamping surfaces of the tooling. These burrs may be removed from the Tip and Tip Nut by polishing with 600 grit emery paper placed on a flat surface. With light pressure, polish the clamp faces in a figure 8 pattern.

The burrs on the horn clamping surface must be removed by machining back the Horn clamp surface. The least amount of material should be removed, but in no case should more than .020" be removed. The undercut at this clamping surface must also be re-cut.

Figure 7.2 Reconditioning Tip and Nut Clamping Surfaces

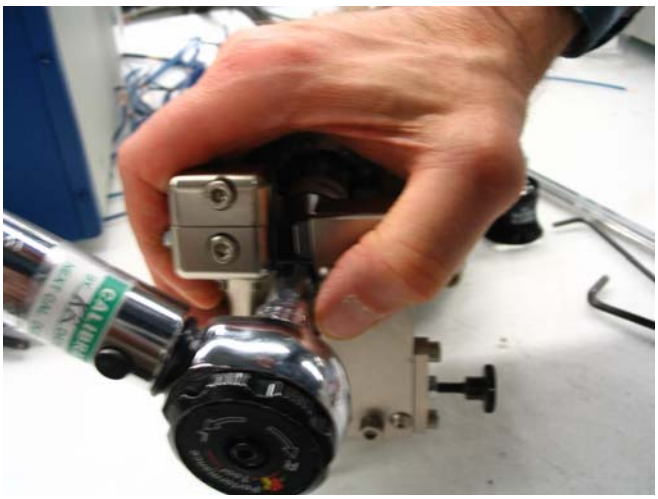


CAUTION	
	In no case should more than .020" of material be removed from the Horn clamp surface.

7.1.4 Rotating the Tip

The tip can also be rotated or replaced without removing the stack.

Table 7.3 Rotating the Tip

Action	Reference
Remove the Tip Nut, Rotate the keyed Tip and re-install the Tip Nut. NOTE: LEFT HAND THREADS Torque to 125 in-lbs.	
Completed Tooling Setup	

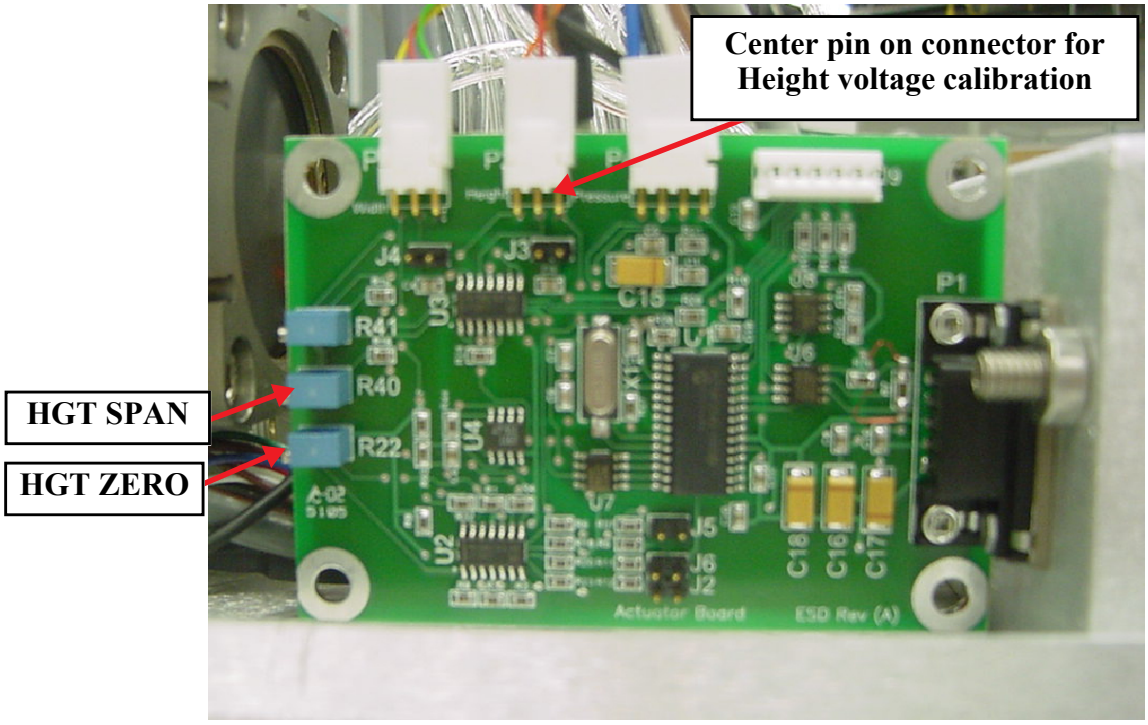
7.2 Calibration

This product does not require scheduled calibration. However, if you are operating under requirements that mandate periodic calibration, for example, the FDA's Good Manufacturing Practices, contact your Branson Metal Welding representative for additional information.

7.2.1 Encoder Board Calibration

Encoder board calibration is factory set and generally does not need to be changed. Any calibration required due to tool wear or adjustment is built into the controller software and may be accomplished using touchscreen commands (refer to your power supply manual). If a new encoder board is installed it will be necessary to calibrate Height as follows.

Figure 7.3 Encoder Board Calibration



7.2.1.1 Height Zero and Span Adjustment

1. From the Controller Maintenance Screen, enter the Height Calibration Screen.
2. Press **HORN** button to lower the horn.
3. Remove the top cover from the actuator and locate the actuator board.
4. Read voltage that is displayed on controller screen.
5. Voltage should read between +2 to +5 millivolts DC. If not, adjust the HGT ZERO (R22) potentiometer (see Figure 7.3) until the voltmeter reads between +2 to +5 millivolts DC (voltage must be positive).
6. From the Controller Maintenance Screen, raise the horn (press **HORN** button).
7. Turn the HGT SPAN (R40) potentiometer (see Figure 7.3) to achieve the maximum possible voltage on the screen, then turn the potentiometer to lower the voltage until the voltage on the screen starts to come back down (the voltage should come down a maximum of 5 mV from the maximum attained voltage).

7.2.1.2 Height Calibration

CAUTION	
	Read all steps completely and exercise caution as tooling moves during the calibration process.

NOTICE	
	Readings are consistently better if the calibration is done at 25 PSI.

1. Position a 1 mm shim on the tip.
2. From the controller press CALIBRATE. The horn comes down 8 times on the 1 mm shim. “Calibration Step 1 done” message is displayed.
3. Position a 6 mm shim on the tip.
4. From the controller press CALIBRATE. The horn comes down 8 times on the 6 mm shim. “Calibration done” message is displayed. If message “Unsuccessful Calibration” is displayed, repeat steps 1 through 4.
5. Disconnect the RF cable from the actuator.
6. Set the weld mode to Time:
    a. On a VersaGraphiX controller, on the Setup Screen go to Advanced Settings select Time as the weld mode.
    b. On a Touchscreen controller, go to the Weld Mode screen (MENU>SETTINGS>WELD-MODE) and select Time as the weld mode.
7. Set the weld time to 0.2 s:
    a. On a VersaGraphiX controller, on the Setup Screen, under Quality Settings press the button next to the time icon and enter a value of 0.2 s.
    b. On a Touchscreen controller, go to the Weld Settings screen (MENU>SETTINGS) and press on the Time button and enter a value of 0.2 s.
8. Perform a weld cycle on a 1 mm shim.
9. Adjust height readings to account for tooling variations:
    a. On a VersaGraphiX controller, on the Setup Screen go to Advanced Settings and enter a value of 1 to the measured height on the right-side column of the Height Off-set.
    b. On a Touchscreen controller, go to the Adjustment screen and enter a value of 1 by touching the ADJUST button.
10. Connect the RF cable to the actuator.

7.2.1.3 Calibrate Width

NOTICE	
	Readings are consistently better if the calibration is done at 25 PSI.

1. Remove the top cover from the actuator and locate the actuator board.
2. From the Controller Maintenance Screen, press Zero button. The Gather will move to the zero width point.
3. Use the "<<" (fast adjust) button to close the Gather completely.
4. Press the “Gather” button, the gather should be at the zero width position.
5. The voltage on screen should read 600 mV.
6. If the voltage from step 5 reads 600 mV:
    a. Insert a 6mm pin/shim, from the controller close the gather. Then press “CAL 1” button. (Use buttons “<< “ and “-“ to close the Gather and buttons “>>” and “+” to open the Gather.)
    b. Insert a 1mm pin/shim, from the controller close the gather. Then press “CAL 2” button. (Use buttons “<< “ and “-“ to close the Gather and buttons “>>” and “+” to open the Gather.)
7. Message “Calibration was successful” is displayed. If not, repeat the calibration procedure.

7.3 Troubleshooting

This section shows how to fix some of the possible errors and problems which may occur in normal use of the Ultrasplice 40 welding system.

7.3.1 Weld Overload

Weld overloads are premature shut downs of the power supply. Overloads signify excessive loads and must be corrected if continued reliability of the equipment is to be maintained. Hardware internal to the supply are controlling this function and it can not be defeated.

The control system analyzes the end of weld characteristics to check for overloads. If the system determines an overload an alarm occurs. The control halts action until the system is reset.

Some of the possible causes for overloads are:

- The tool clearances are too small, horn and anvil touch during welding
- Excessive air pressure with low amplitude
- Defective Stack assembly
- Defective Power Transistors in power supply

7.3.2 Low Air Pressure

The control system and its components were designed to run with a clean air supply of from 90 to 120 psi. The control system monitors the air pressure from the low air pressure switch (optional). The low pressure threshold is set from the controller. An alarm occurs when incoming line pressure the drops below the set pressure.

7.3.3 Ready Check

The system undergoes a Ready Check operation at every startup, the end of every weld, and at the exit of Setup mode. This procedure checks the height encoder position. If an incorrect height value is returned, an alarm occurs.

Some of the possible causes of a Ready Check alarm are:

- The Anvil is stuck in the closed position
- Maintenance has moved the height encoder to an out of limit condition
- Defective encoder or electronics
- Encoder not plugged in to its connector

7.3.4 Troubleshooting Chart

Table 7.4 Troubleshooting Chart

Problem	Solution
System will not turn on.	Power cable plugged in. Power turned on at the outlet. Check internal fuses on the Controller Line Board.
Plant fuse fails or circuit breaker trips when plugging the unit into an electrical outlet.	Inspect power cord, replace if shorted. Check line filter, replace if failed.

Table 7.4 Troubleshooting Chart

Problem	Solution
Plant fuse fails or circuit breaker trips during weld cycle	Check current rating of the plant fuse or the circuit breaker, replace if failed.
Line fuse fails.	Check fuse current rating, replace if incompatible. Check fan motor, replace if failed.
Anvil will not move down or up.	System not connected to air supply. Air not turned on.
Get Emergency Stop when system is turned on.	Check Emergency Stop Switch. All cables properly connected. Twist red switch on foot pedal. (if system is equipped with one)
No Sonics when test button is pressed.	RF Cable connected. Check RF cable for broken wire. Ribbon cable in power supply between SPM and programmer unplugged.
No sonics during weld cycle	Check all cable connections. Check start cable for broken wires. Check inside power supply for loose start cable from rear of unit to programmer board. Check thermal switch in power supply.
Overloads when welding	Stack not tuned properly. Tooling not set up properly. Crash gap not set properly. Tip nut cracked, replace if needed. Check weld parameters. Check stack interfaces for fretting. Check for loose or failed horn or booster, tighten or replace as necessary.
When touching the system you get a slight electrical shock.	Inspect power cord, replace if needed. Inspect system ground, repair if needed.
Tooling heats up after machine runs a while.	Cooling air is not turned on or is not on long enough.

Table 7.4 Troubleshooting Chart

Problem	Solution
Low weld strength.	Check weld parameters. Check tooling gaps. Check knurl on tooling. If worn replace tooling. Increase Energy. Check the Down stop adjustment. Check for part contamination. Ensure all hardware is tight.
Excessive welding.	Reset parameters. Reset amplitude. Reset pressure. Measure and re-calibrate amplitude display.
Time limit error or peak power error displayed after weld cycle.	Reset limits. Check tip, rotate or replace if worn. Check anvil for wear, rotate or replace if worn. Check air pressure setting. Check up stop for proper adjustment. Process settings have to be opened up due to part variance or limits should be adjusted according to the part/wire being run. Check anvil clamp for proper torque.
Squealing sound during welding or when test key is depressed.	Check plate screws and tighten or replace. Check cover plate screws and tighten. Reset gaps. Re-square horn/tip and reset gaps. Reset horn tip and gap.
Weld heights are inconsistent.	Re-calibrate encoders with 1mm gauge. Ensure the connector for the encoder is tightly plugged into the actuator card.
Anvil is stuck in down position.	Check air pressure. Ensure air lines are installed properly. Check for kinks in air lines.
Air leaking from machine.	Ensure all air line connections are tight. Check for cracked or broken air lines.

Table 7.4 Troubleshooting Chart

Problem	Solution
Unusual sound during weld cycle.	Check tooling gap. Check converter. Check stack assembly.
Squealing sound from Controller when unit is turned on.	Check cooling fans in rear of unit
Maintenance counter alarm.	Reset maintenance counter.
Actuator moves sluggish.	Check air lines for contamination. Air must be filtered to 5 microns and be oil and water free. Check solenoid valve, replace if needed. Check air regulator.
System has READY CHECK message.	The anvil is stuck in the closed position. Maintenance has moved the height encoder to an out of limit condition. Defective encoder or electronics. Encoder not plugged into the actuator card.
Time, height and energy inconsistent.	Switch to energy mode & open height window. Make some sample welds. Check the time and the height of the welds for consistency. If the time or weld thickness varies greatly, check the air regulator.

7.4 Parts Lists

The following table lists items that are highly recommended to have readily available to prevent extended equipment down time and/or setup time.

Table 7.5 Primary Spare Items

Description	EDP Number
Linear Encoder	H4A50029
Spring, Front Diaphragm	100-095-168
Spring, Rear Diaphragm	100-095-169
Converter Model 4TH	101-135-067R

Periodic Maintenance Signoff Sheet

Date Machine was First put into Operation:_____/_____/_____

Name:_____Signature:_____

Table 7.6 Periodic Maintenance Signoff Sheet

Date	Tool Rotation?	# of Cycles	Every Tool Rotation			Every One Million Cycles			
			Inspected Surfaces of Horn, Tip and Tip Nut (Initials)	Vacuumed and Cleaned Actuator (Initials)	Inspected Surfaces of Anvil, Anvil Block and Gather (Initials)	Vacuumed & Cleaned Power Supply (Initials)	Calibrated Pressure Regulator (Initials)	Cleaned & Torqued Stack Interface (Initials)	Calibrated Amplitude (Initials)

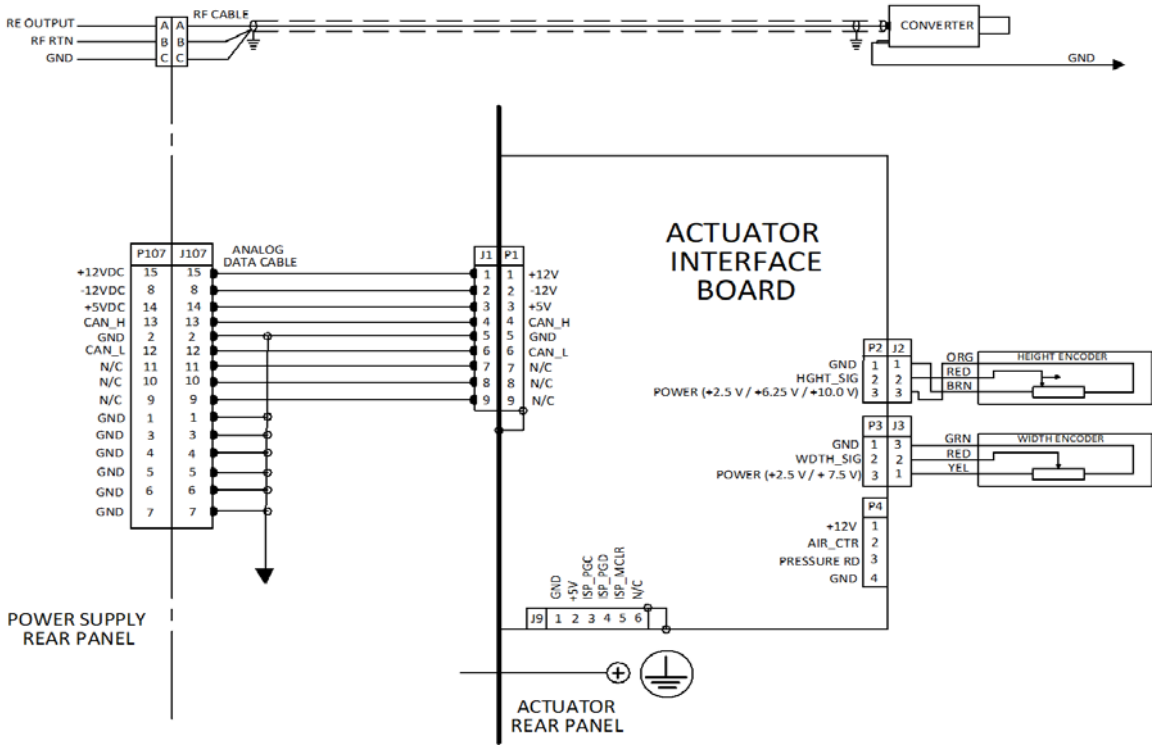
Weld Development and Quality

When properly set up the ULTRASPLICE System will produce quality welds by simply placing parts into the fixture and actuating the foot switch or actuator start switch.

Appendix A: Ultrasplice 40 Interconnect Diagram

A.1 Ultrasplice 40 Interconnect Diagram

Figure A.1 Ultrasplice 40 Interconnect Diagram



Appendix B: Declaration of Conformity

B.1 Declaration of Conformity

Figure B.1 Declaration of Conformity

EC DECLARATION OF CONFORMITY
according to the Machinery Directive 2006/42/EC Annex II A
EMC Directive 2004/108/EC, Annex IV 2

We, the manufacturer
BRANSON ULTRASONICS CORPORATION
41 Eagle Road
Danbury, CT USA 06813-1961

Represented in the community by
BRANSON ULTRASCHALL
Niederlassung der EMERSON Technolgies GmbH & Co. OHG
Waldstraß 53-55
D-63128 Dietzenbach

Expressly declare that the machinery, to which this declaration applies,
in the state in which it was placed on the market,
fulfills all the relevant provisions of the Machinery Directive 2006/42/EC.

We also declare that this machinery is in conformity with the EMC Directive 2004/108/EC
And the safety objectives set out in the Low Voltage Directive 2006/95/EC were kept in accordance
With Annex 1 No. 1.5.1 of the Machinery Directive 2006/42/EC.

The product:
Ultrasplice ® 40 Ultrasonic Splicing System
Consisting of a Branson Ultrasplice Model 40
Used with a
Branson 40 kHz Touchscreen or Versagraphix Power Supply
And interconnecting cables

to which this declaration relate are in conformity with the following harmonized standards:
EN ISO 12100-1: 2003/A1:2009, EN ISO 12100-2:2003/A1:2009, EN 60204-1:2006/A1:2009,
EN 13849-1:2008, EN 61310-1:2009, EN 61310-2:2009, EN 60529-1:2000, EN 14121-1:2007
EN ISO 13850:2008, EN 60664-1:2007, EN 61000-3-2:2006, EN 61000-3-3:2008,
EN 55011:2007 and EN 61000-6-2: 2005

Danbury, CT, USA Dec 2011

Roy Bullivant
Director, Engineering

Appendix C: Declaration of Incorporation

C.1 Declaration of Incorporation

Figure C.1 Declaration of Incorporation

DECLARATION OF INCORPORATION
according to the Low Voltage Directive 2006/95/EC Annex IIIB
EMC Directive 2004/108/EC, Annex IV 2

We, the manufacturer
BRANSON ULTRASONICS CORPORATION
41 Eagle Road
Danbury, CT USA 06813-1961

Represented in the community by
BRANSON ULTRASCHALL
Niederlassung der EMERSON Technolgies GmbH & Co. OHG
Waldstraß 53-55
D-63128 Dietzenbach

Expressly declare that the machinery, to which this declaration applies,
in the state in which it was placed on the market,
fulfills all the relevant provisions of the Low Voltage Directive 2006/95/EC
And the EMC Directive 2004/108/EC

The product:
Ultrasplice ® 40 Ultrasonic Splicing System
Consisting of a Branson Ultrasplice 40
Used with a
Branson 40 kHz Touchscreen or Versagraphix Power Supply
And interconnecting cables

to which this declaration relate are in conformity with the following harmonized standards:
EN ISO 12100-1:2003/A1:2009, EN ISO 12100-2:2003/A1:2009, EN 13849-1:2008
EN 60204-1:2006/A1:2009, EN 61310-1:2009, EN 61310-2:2009, EN 60529-1:2000, EN 14121-1:2007
EN ISO 13850:2008, EN 60664-1:2007, EN 61000-3-2:2006, EN 61000-3-3:2008,
EN 55011:2007 and EN 61000-6-2: 2005

IT IS FORBIDDEN TO PUT THIS EQUIPMENT INTO SERVICE UNTIL THE MACHINERY INTO WHICH IT IS TO BE INCORPORATED HAS BEEN DECLARED IN CONFORMITY WITH THE PROVISIONS OF THE MACHINERY DIRECTIVE

Danbury, CT, USA Dec 2011

Roy Bullivant
Director, Engineering

CE Marking Affixed: 06