Original Instructions
DCM00051 - REV. 10

EMERSON

Ultraseal 20
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 Ultraseal 20 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:

WARNING	Indicates a possible damaging situation
	If these risks are not avoided, death or severe injury might result.

CAUTION	Indicates a possible danger
	If these risks are not avoided, slight or minor injury might result.

NOTICE	Indicates a possible damaging situation
	If this situation is not avoided, the system or something in its vicinity might get damaged. Application types and other important or useful information are emphasized.

1.1.2 Symbols Found on the Product

The Ultraseal 20 Actuator has several warning labels on it to alert the user of items of concern or hazard. The following warning symbols appear on the Ultraseal 20 Actuator:

Figure 1.1 Safety Label found on the Ultraseal 20 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
- Keep hands from under the horn. Up force (pressure) and ultrasonic vibrations can cause injury
- Do not cycle the welding system if either the RF cable or converter is disconnected
- Avoid situations where fingers could be pinched 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 Ultraseal 20 Actuator are components of an ultrasonic welding system. These are designed to crimp, cut and seal copper tubing.

1.2.2 Regulatory Compliance

The Branson Ultraseal 20 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 Ultraseal 20 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 2014/35/EU
- EMC Directive 2014/30/EU
- BS EN ISO 13850 Safety of Machinery - Emergency stop equipment, Functional aspects - Principles for design
- EN ISO 12100 Safety of Machinery - Risk assessment - Part 1: Principles
- EN 13849-1 Safety of Machinery - Safety Related Parts of Control Systems.
- 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 61000-6-2 Electromagnetic Compatibility - Generic standards - Immunity for industrial environments
- EN 61310-2 Safety of Machinery - Indication, marking, actuation

All Ultraseal 20 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:

1. Your company name and location
2. Your return telephone number
3. Have your manual with you
4. 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
5. What tooling (horn) and booster are being used?
6. What are the setup parameters and mode?
7. Is your equipment in an automated system? If so, what is supplying the "start" signal?
8. 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)?
9. List the steps you have already taken
10. What is your application, including the materials being processed?
11. Have a list of service or spare parts you have on hand (tips, horns, etc.)
12. 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.

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 Ultraseal 20 Actuator

2.1 Models Covered

This manual contains instructions for installing, setting up and operating the following Ultraseal 20 Actuators.

An Ultraseal 20 Actuator requires a compatible Branson Metal Welding Controller to function, that is covered in separate manuals and user documents.

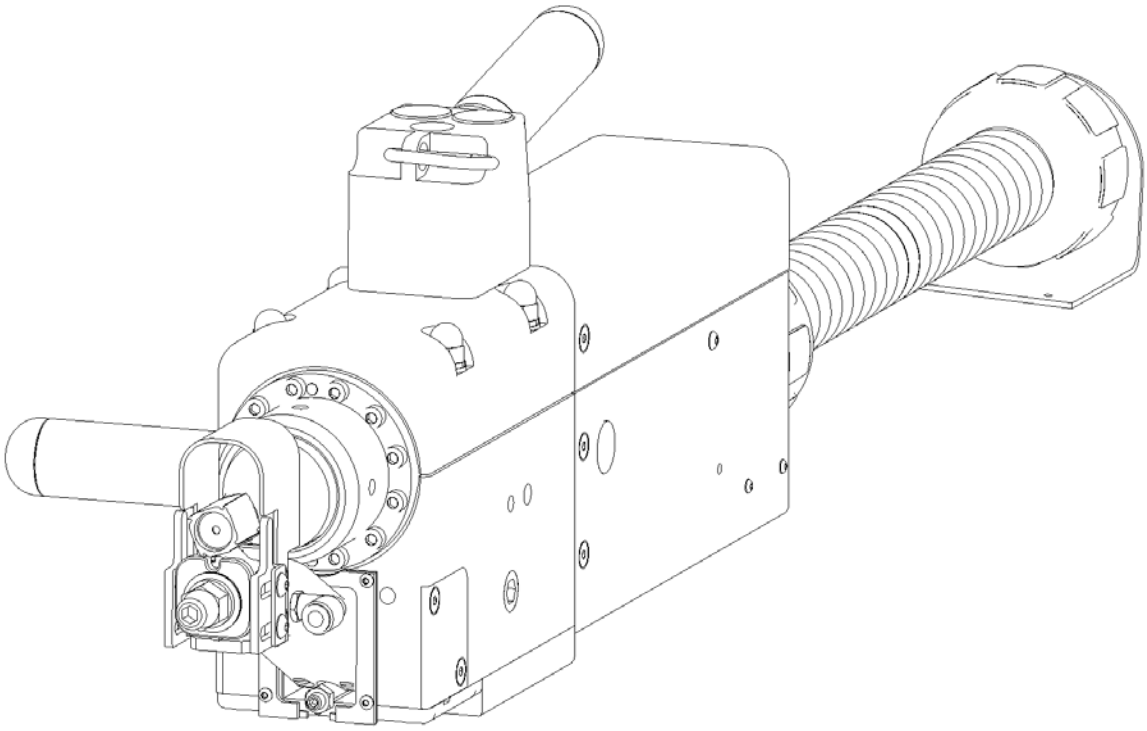
2.1.1 Controller Manual Set

The Following documentation is available for Branson Metal Welding Controllers that are compatible with Ultraseal 20 Actuators:

- Ultraseal 20 VersaGraphix Controller Instruction Manual (DCM00062)
- Ultraseal 20 Touch Screen Controller Instruction Manual (DCM00002)

2.2 Overview of These Models

Figure 2.1 The Ultraseal 20 Actuator



The Branson Ultraseal 20 system is comprised of a Controller, ultrasonic stack assembly, application tooling, and mechanical actuator. The mechanical actuator is the subject of this Instruction Set. It rigidly holds the converter and horn assembly known as the ultrasonic stack (Figure 2.1). A pneumatic cylinder drives the anvil towards the horn to apply precise pressure to the tube being sealed. The application tooling (i.e. anvil & replaceable tip) is designed for easy replacement.

The Ultraseal 20 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.

2.2.1 The Pneumatic System

The pneumatic system included on the Ultraseal 20 actuator consists of a pneumatic cylinder who drives the anvil towards the horn to apply precise pressure to the tube being sealed.

2.2.2 The Linear Encoder

The linear encoder is a sensing device that tracks polar block movement. The accuracy of the encoder is ±0.002 in (±0.05mm).

2.2.3 Converter

The 20 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 current expands and contracts. The converter's efficiency of changing electrical energy to mechanical vibrations exceeds ninety-five percent.

2.2.4 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 and is designed to resonate at the same frequency as the converter with which it is to be used. A booster has two functions:

- As a rigid mounting for the converter/booster/horn stack and
- As an amplitude-of-vibration increaser 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

2.2.5 Horn

The horn is a half-wave length resonant metal device that transfers the ultrasonic vibrations from the booster to the weld tip. The horn is made of titanium and is designed to resonate at 20 kHz. The acoustical efficiency of titanium helps to maintain constant amplitude throughout the operating temperature of the welder. Since the horn is a vital part of the ultrasonic assembly system, it should not be altered without proper training and advice from Branson. The horn with a tip, can be rotated or replaced.

2.2.6 Welding Tip

The welding tip is designed to flatten (crimp) the tube and deliver the ultrasonic vibrations into the bonding area while cutting the tube off just past the sealing point. Replaceable welding tips are fabricated from high-grade tool steel and heat-treated to precise specifications to provide maximum life. The tip is coated to further enhance tool life and provide corrosion resistance.

2.2.7 Anvil

The anvil is made of high grade tool steel and coated for maximum wear and corrosion resistance.

2.3 Features

The Ultraseal 20 actuator is a portable, heavy duty 20 kHz ultrasonic welder tooled to seal and cut off charge tubes used in refrigerators, air conditioners and capillary and bulb temperature sensors.

The Ultraseal 20 offers:

- Ergonomic, light-weight design for operation on the assembly line
- Quick change tooling with multiple weld surfaces for low cost operation
- Automatic process monitoring ensures each seal falls within preset quality limits of weld power, time and final height
- Automatic tube measurement to assure proper placement of tubes within the tooling
- Weld-to-height mode to compensate for tube material variations
- Various tube sizes may be sealed in any sequence through automatic setup of weld parameters
- Parallel printer port for data collection and weld graphs
- RS232 port for computer interfacing and SPC monitoring
- 8 hours on-site setup and training

2.4 Controls

- **Tube Stop:** The tube stop is mounted just behind the anvil and provides a back-stop for positioning of the tube.

2.5 Ultrasonic Theory

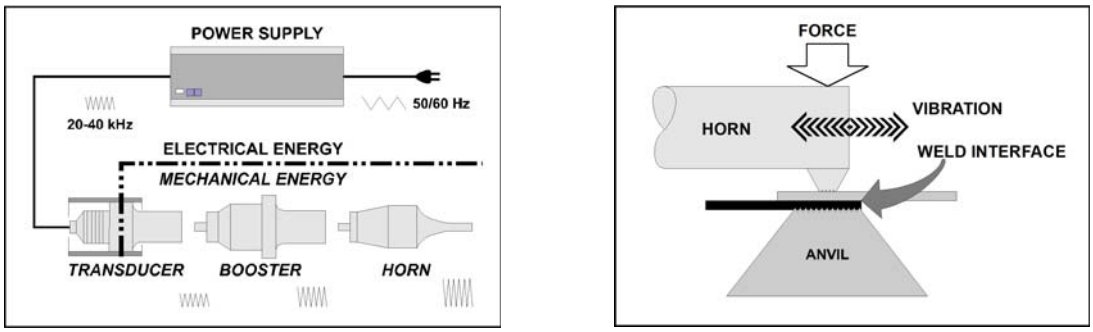
2.5.1 What Is an Ultrasonic Weld?

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 2.2 How does Ultrasonic Welding Work?



2.5.2 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

2.5.3 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.

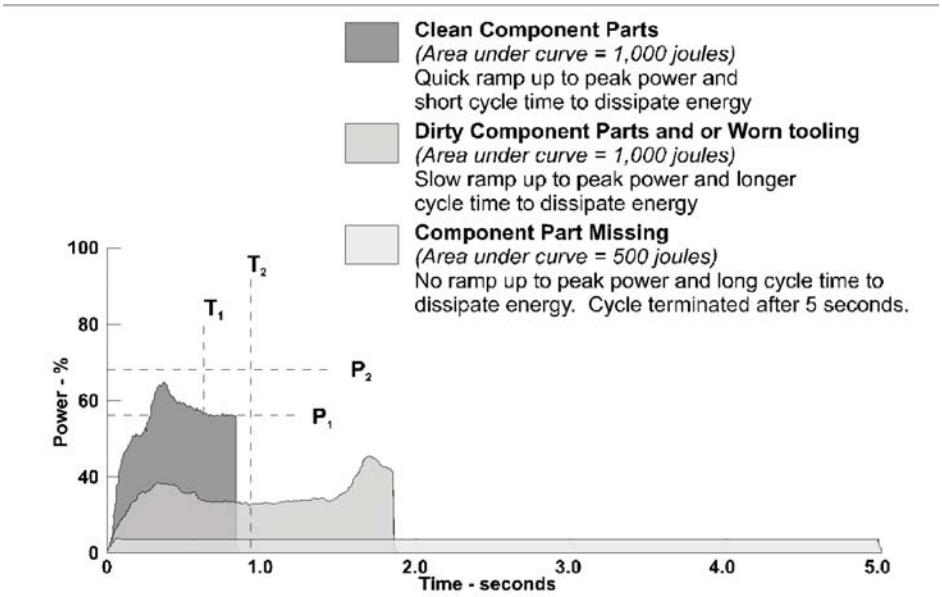
2.5.4 Welding to Energy - Why?

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 2.3) 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 2.3 Weld Power Graph for clean components, dirty components and when part is missing

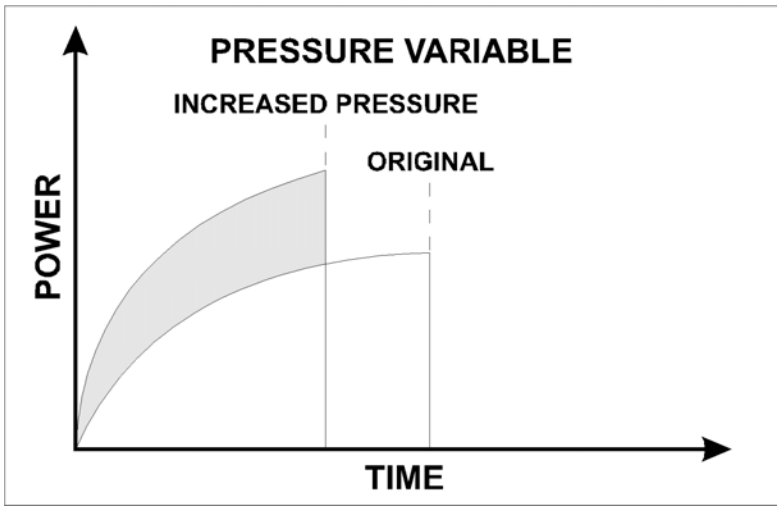


2.5.5 Power

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 2.4.

Figure 2.4 Pressure Variable with Increased Power

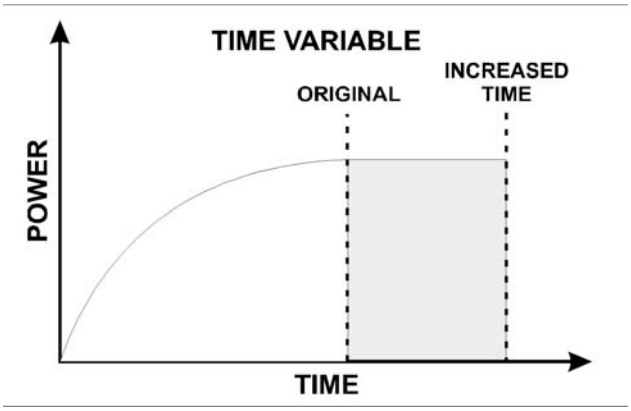


The difference in the appearance of each of the above weld graphs is the result of increased Power loading. Based upon an increase in Pressure, additional Power is required to maintain the motion of vibration. Thus, the same amount of energy is delivered in less time. This approach is typically used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

2.5.6 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 2.5).

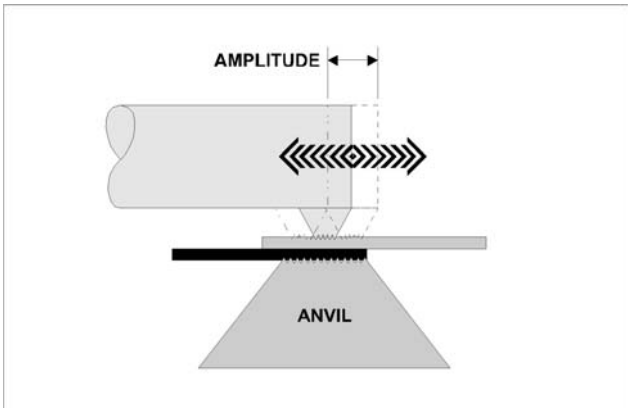
Figure 2.5 Pressure Variable with Increased Time



2.5.7 Amplitude

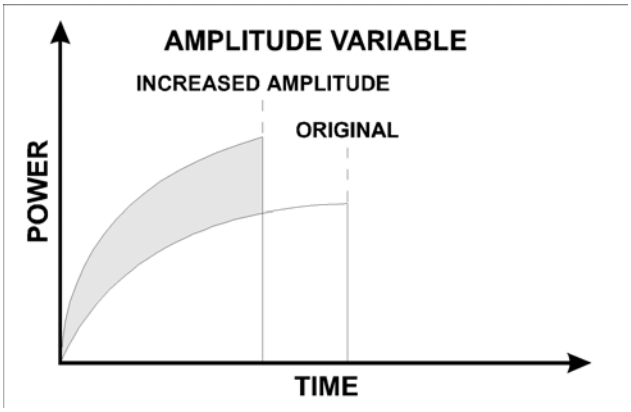
An ultrasonic tool is a resonant acoustical device. The term Amplitude is used to describe the amount of longitudinal expansion and contraction that the tooling endures as it vibrates (Figure 2.6). The amplitude correlates to the scrubbing action at the weld interface. This scrubbing action combined with pressure is what advances the weld by a diffusing or mixing of the base materials.

Figure 2.6 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 2.7):

Figure 2.7 Amplitude's Influence on Weld Power and Time

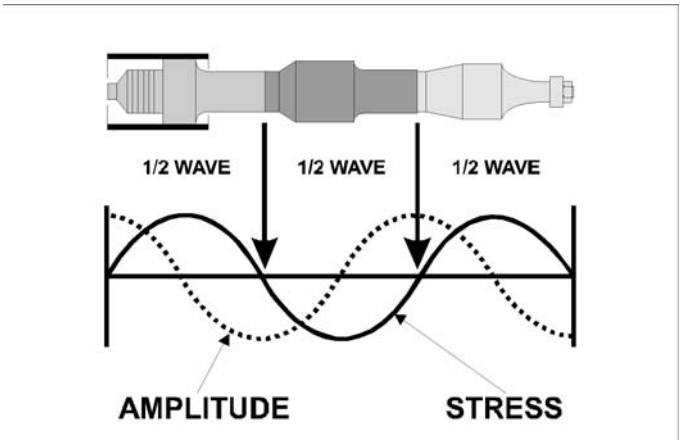


2.5.8 Resonant Frequency

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 2.8). 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 2.8 Harmonic Resonance on Ultrasonic Tooling.



2.5.9 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.

2.5.10 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

2.5.11 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 - 2 seconds.

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 Ultraseal 20 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 Ultraseal 20 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 Ultraseal 20 Actuator when it is delivered

Table 3.2 Inspecting the Ultraseal 20 Actuator upon delivery

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 covers 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 Ultraseal 20 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 Ultraseal 20 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 Ultraseal 20 Actuator

The actuator, is assembled and ready to install. The actuator weights approximately 8 kg (26.5 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
101-118-039	WRENCH, SPANNER	2	MTS-20 Toolkit
101-053-002	LUBRICANT	1	
211-111	WRENCH,10MM	1	
211-218	SOCKET, 13MM DEEP	1	
211-219	SOCKET, ADAPTER	1	
211-247	WRENCH, ALLEN 3MM	1	
211-248	WRENCH, ALLEN 4MM	1	
211-636	CANVAS BAG LOGO	1	
11008-09-001	HANDLE, EXTENSION	2	
11008-09-002	SOCKET, 5/8" MODIFIED	1	
48000-03-011	WRENCH, SPANNER	1	
G4A50A26	CUT-OFF CLEARANCE GAGE	2	
G6A00A10	WRENCH, TIP ASSY	1	
M1A50A45	SPACER, 1MM	1	
X3A50325	SPACER, 6MM	1	
11003-02-033	Booster 1:1, 20 kHz	N/A	(Optional Item) Purchase Separately
159-135-269	Converter 503	N/A	
M1A00137	Footswitch Assembly	N/A	
M1A00A10	Dual Palm Button	N/A	
101-478R	Bar Code Reader	N/A	

4.3.1 Cables

Three cables connect the Controller and actuator: the analog data cable, the touchscreen control 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.

4.4 Installation Requirements

4.4.1 Location

The actuator may be installed in a variety of positions. The Ultraseal 20 is often manually operated using a foot switch, and so it can be suspended at a safe and comfortable work height (approximately 30-36 inches) with the operator standing in front of the system.The Controller may be located up to 3.5 feet away from the Ultraseal 20 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 4.2 Environmental Specifications

Environmental Concern	Acceptable Range
Humidity	30% to 90%, non-condensing
Ambient Operating Temperature	+5°C to +50°C (41°F to 131°F)
Storage / Shipping Temperature	-25°C to +55°C (-13°F to +131°F)
Operating Altitude	1000 m (3280 ft)
IP Rating	2X

Figure 4.1 Controller Dimensional Drawing (VersaGraphiX)

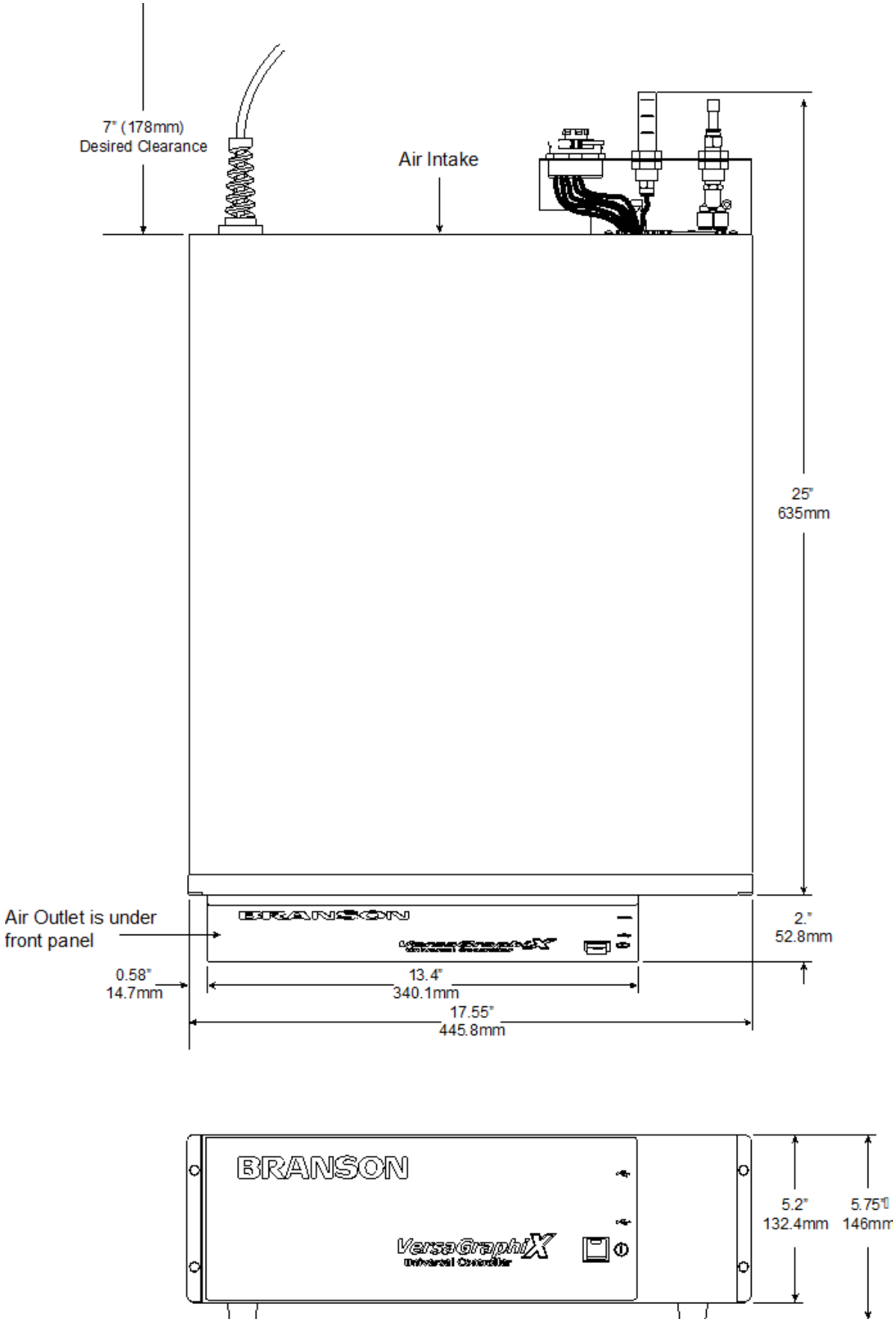


Figure 4.2 Controller Dimensional Drawing (Touch Screen)

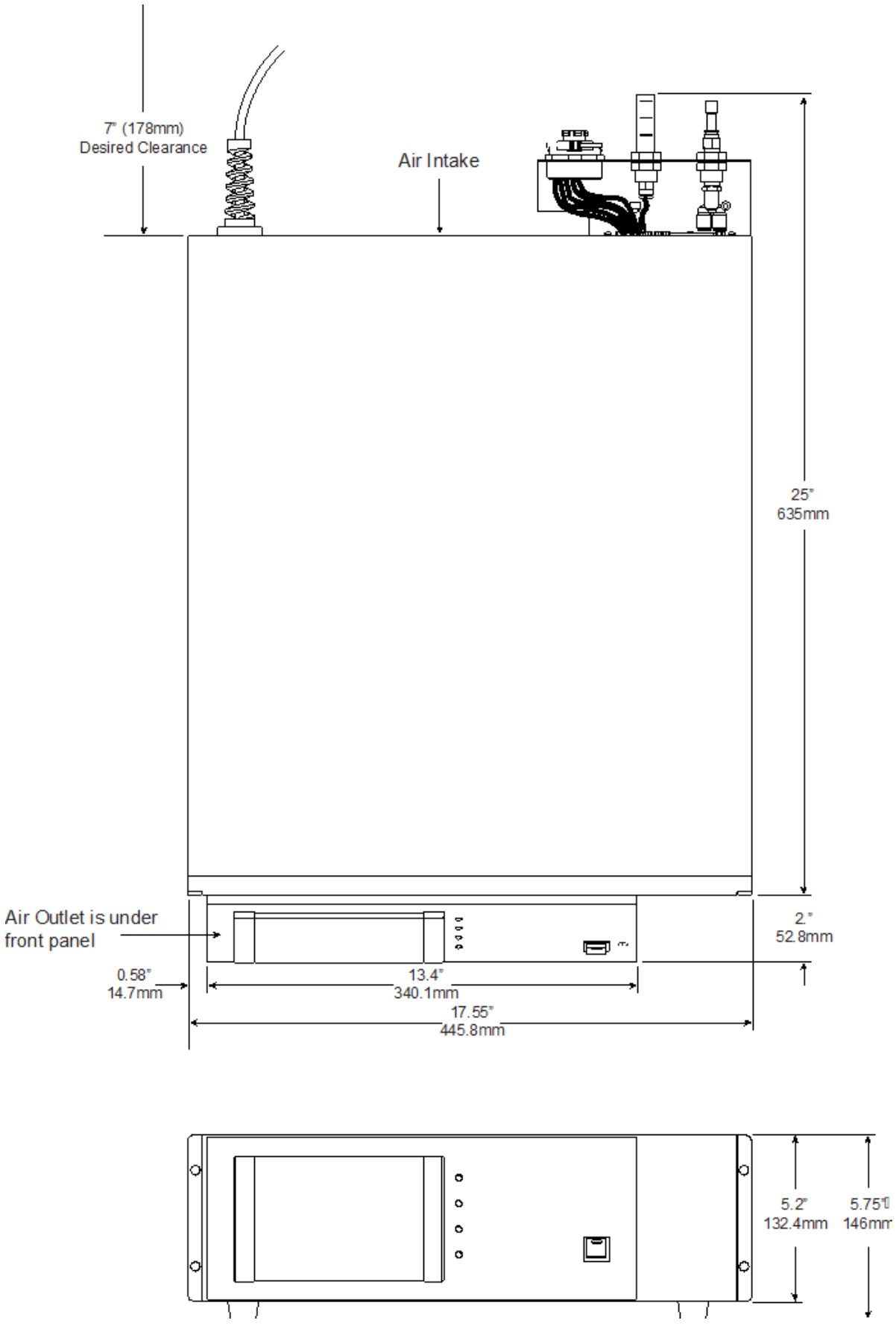
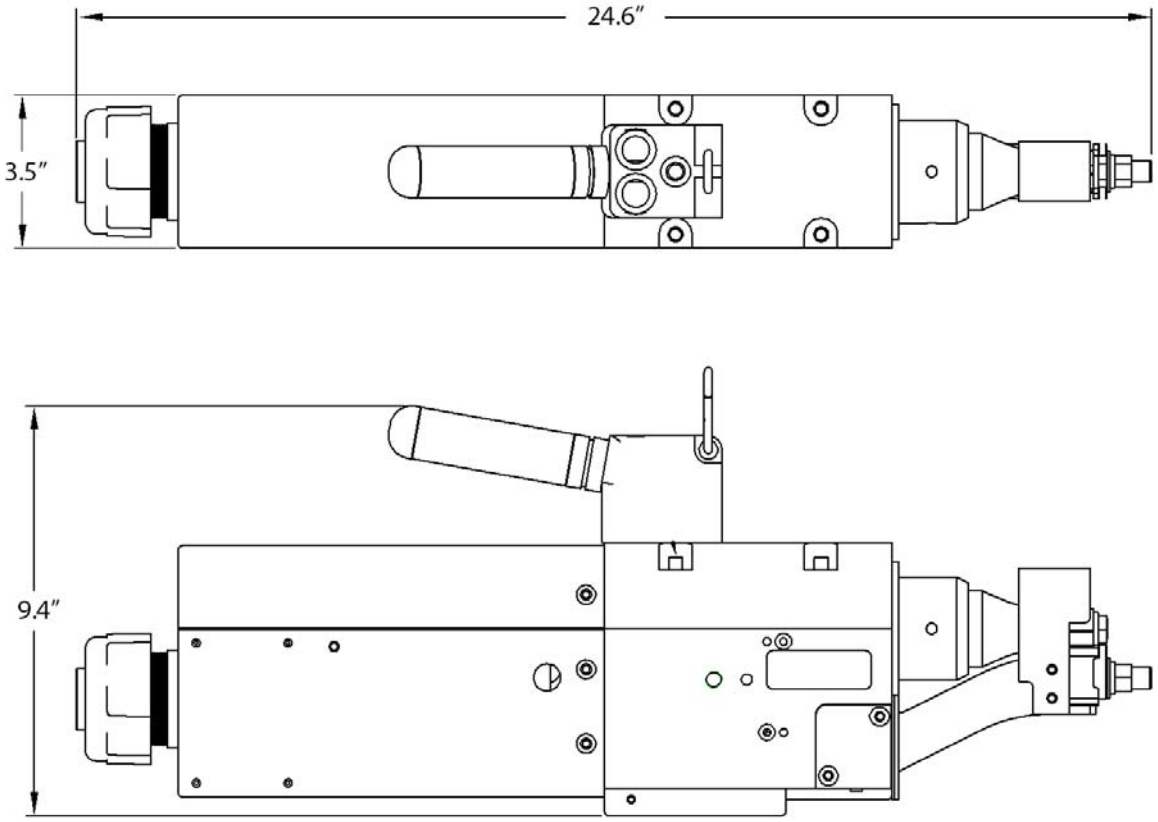


Figure 4.3 Ultraseal 20 Actuator Dimensional Drawing



4.4.3 Electrical Input Power Ratings

Plug the Controller into a single-phase, grounded, 3-wire, 50 or 60 Hz power source. Table 4.3 lists the current and fuse ratings for the various models.

Table 4.3 Input Power requirements

Model	Power	Current Rating	NEMA Connector
20 kHz models	3300W (200V-240V)	21 Amp Max. @ 200 V / 20 Amp fuse	NEMA L-20P Plug
	4000W (200V-240V)	25 Amp Max. @ 220V / 25 Amp fuse	NEMA L6-30P 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 Pneumatic Connections to Actuator

Air connection to the Ultraseal 20 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 4.2 and Figure 4.3 for dimensional drawing of compatible Controllers.

Figure 4.4 Connections on Rear of a VersaGraphiX Controller

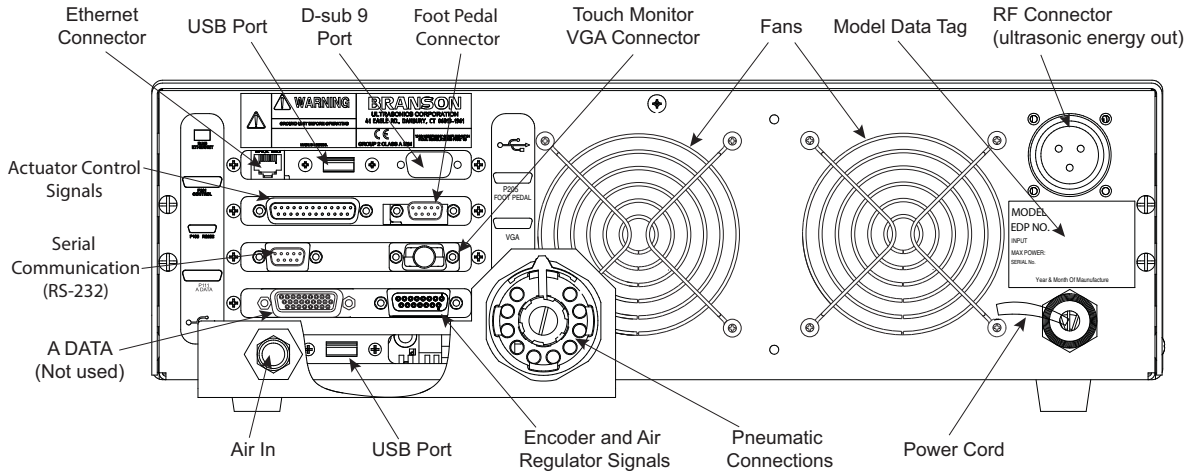
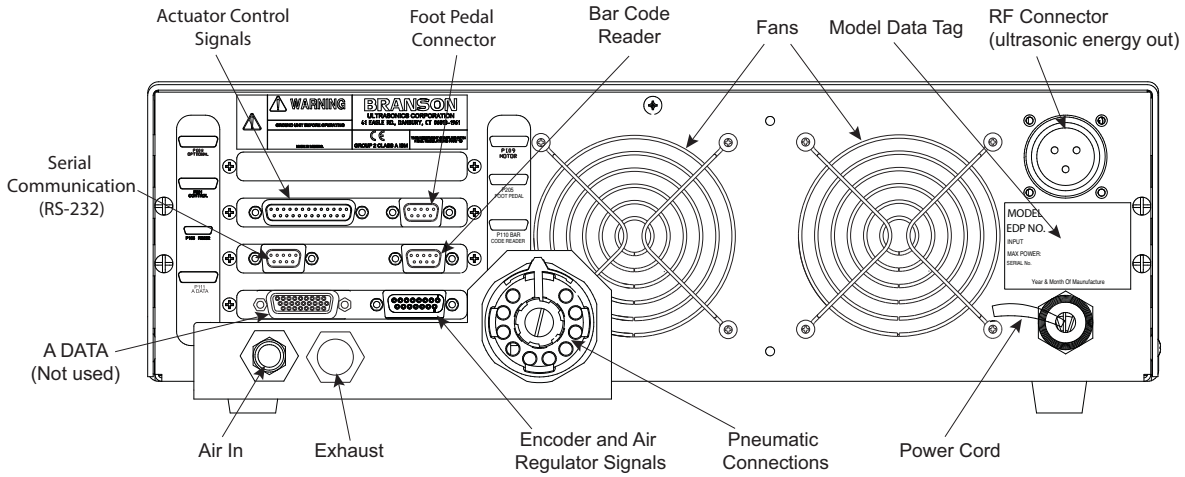


Figure 4.5 Connections on Rear of a Touch Screen Controller



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 4.3 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 Ultraseal 20 Actuator.

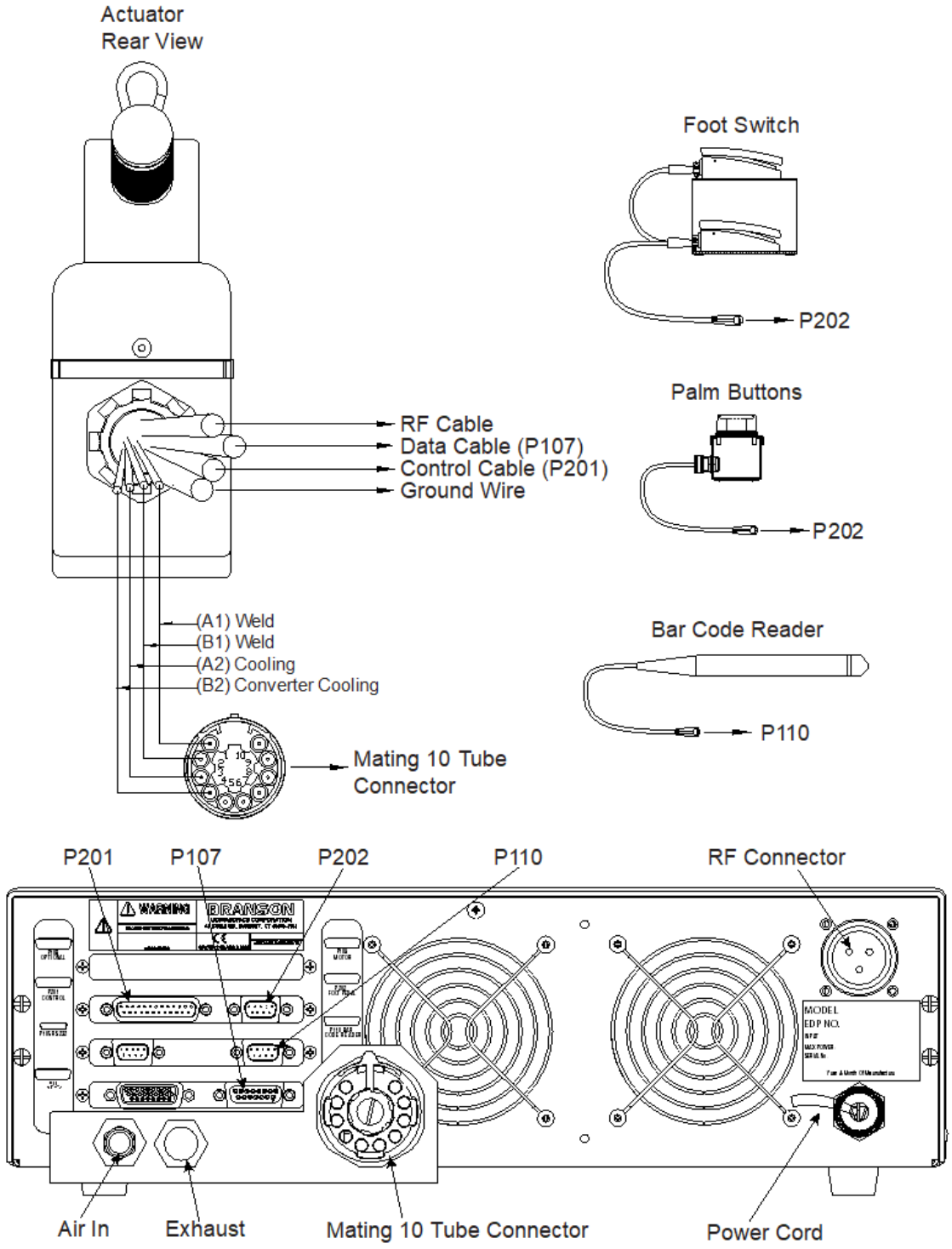
WARNING	
	Never operate the System with the RF Cable disconnected or if the RF Cable is damaged.

4.5.4 Interconnect Between Controller and Actuator

The Ultraseal 20 Actuator has three electrical connections between the Controller and the Actuator: the RF Cable, the Control Data Cable, and the Touchscreen Control Cable.

There can be other connections to the Actuator, and other connections to the Controller, but these are the three standard connections, depicted in Figure 4.6.

Figure 4.6 Electrical Connections from Controller to an Ultraseal 20 Actuator



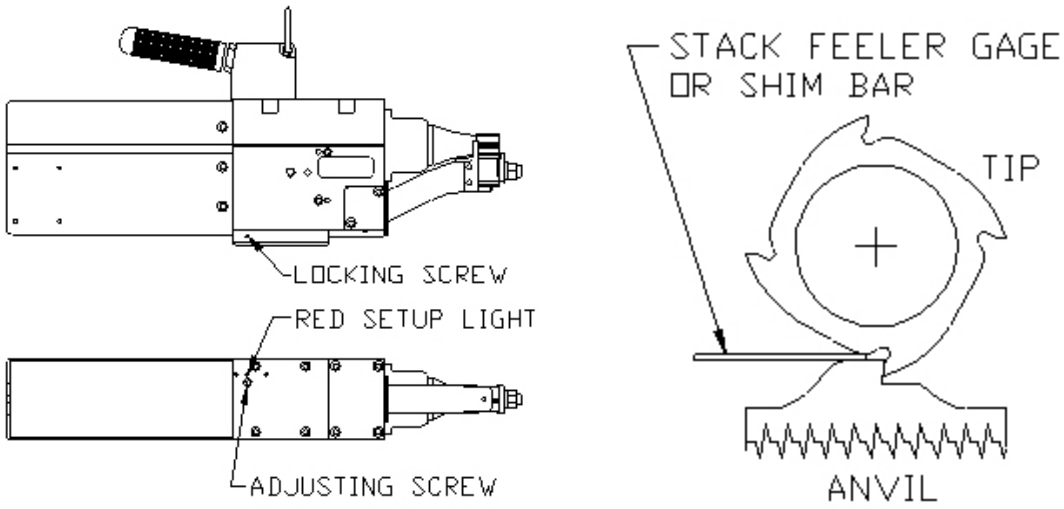
4.5.5 Setting Weld Height Proximity Switch

Tools Required-2mm Allen wrench, 2.5mm Allen wrench, Feeler gauge set, Dial caliper.

Parameter Settings- System must be setup to run in the energy mode.

The preheight and height are used for quality monitoring. Refer to Touchscreen Controller Instruction Set portion of this manual for more information.

Figure 4.7 Setting Height Proximity Switch



- Turn system on its right side (tooling facing toward you)
- Set/Stack feeler gage to final seal height target as required (recommended starting height target = 1.0-1.2 times tubing single wall thickness)
- Carefully position feeler gage stack into tooling
- Raise the anvil (step reference- Menu> Maintain> Anvil) to contact feeler gage stack
- Loosen lock set screw on side of bottom plate
- Carefully adjust prox switch screw on bottom plate until height switch "Red Light" illuminates
- Tighten prox switch lock set screw on side of bottom plate
- Lower the anvil (step reference- Anvil)
- Verify that setting is correct via a GO/NO GO check
- "GO" = Feeler gage height (1.0-1.2 times tubing single wall thickness) – (.05mm)
- "NO GO" = Feeler gage height (1.0-1.2 times tubing single wall thickness) + (.05mm)
- Carefully position "GO" gage in tooling
- Raise the anvil (step reference- Anvil) to contact feeler gage stack
- Height switch (Red light) should illuminate. If not, lower the anvil (step reference- Anvil), remove "GO" gage and repeat setting procedure
- Lower the anvil (step reference- Anvil)
- Carefully position "NO GO" gage in tooling
- Raise the anvil (step reference- Anvil) to contact feeler gage stack
- Height switch (Red light) should not illuminate. If illuminated, lower the anvil (step reference- Anvil), remove "NO GO" gage and repeat setting procedure
- Lower the anvil (step reference- Anvil)
- Store all gages
- Turn system upright
- Return to run mode (step reference- Exit> Exit)

Produces samples, evaluate sealed tube final height and test as required. Repeat this procedure as necessary.

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 Stops

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 Covers

The Ultraseal 20 actuator is equipped with covers which should only be removed for maintenance and installation purposes.

4.7 Ultrasonic Stack Assembly

Refer to Figure 4.8 Exploded Ultrasonic Stack Assembly for item listings when assembling the ultrasonic stack.

Be sure that the mating surfaces of the horn, booster, and converter are clean and smooth. Any minor scratches or discolorations can be polished away using Scotch Bright or 600 grit emery or similar mild abrasive pads. Any gouges, scratches, or chips in any place on any of the stack components should be analyzed by Branson Metal Welding personnel.

NOTICE	
	Never use emery less than 600 grit, sandpaper, harsh abrasives, grinding equipment, engraving equipment, or debossing equipment on the stack components. This can cause severe damage to the machine.

1. Spread an EXTREMELY thin film of silicone lubricant (Branson P/N 101-053-002) across the mating surfaces of the horn, booster, and the converter.
2. Hand tighten the converter and horn to the booster. (Make sure that the front and rear diaphragm springs, the polar mount clamp rings and the nut rings are in place)
3. If the Ultraseal 20 welder is not available to use as a polar mount clamp, then clamp the stack in a padded vise. (Clamping should be done on the back section of the horn which is approximately 2 inches (50.8mm) in diameter. A moderate clamping force is all that is necessary for this procedure)
4. Insert the ½" drive torque wrench into the square hole in the spanner wrench, adapter (Branson P/N 48000-03-011).
5. Set the torque of the wrench to 85 ft-lbs.
6. Place the spanner wrench on the booster and apply torque until the wrench clicks once.
7. The booster is now properly fastened to the horn.
8. Set the torque of the wrench to 55 ft-lbs (75 Newton/Meters).
9. Place the spanner wrench on the converter and apply torque until the wrench clicks once.
10. Attach the clamp rings to the nut rings with the two sets of 12 (M5 X 20mm) socket head bolts. Torque these bolts to 110 inch pounds (12.4 Newton/Meters).
11. The ultrasonic stack is now assembled.

Figure 4.8 Exploded Ultrasonic Stack Assembly

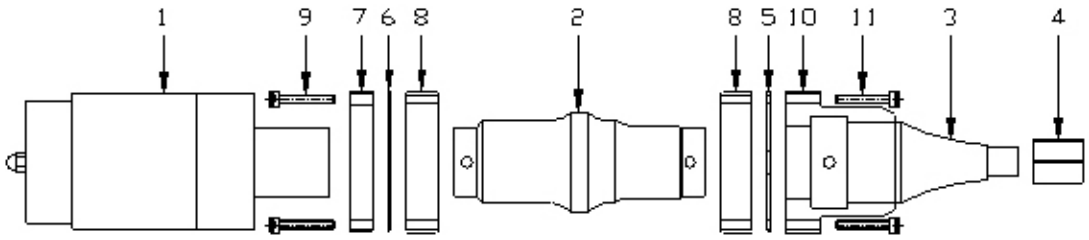


Table 4.4 Ultrasonic Stack Assembly Parts

Item	Description	Item	Description
1	Converter	6	Rear Diaphragm Spring
2	Booster	7	Spring Retainer
3	Horn	8	Nut Ring
4	Tip	9	M5 x 20 mm SHCS
5	Front Diaphragm Spring	10	Nodal Support
		11	M5 x 30 mm SHCS

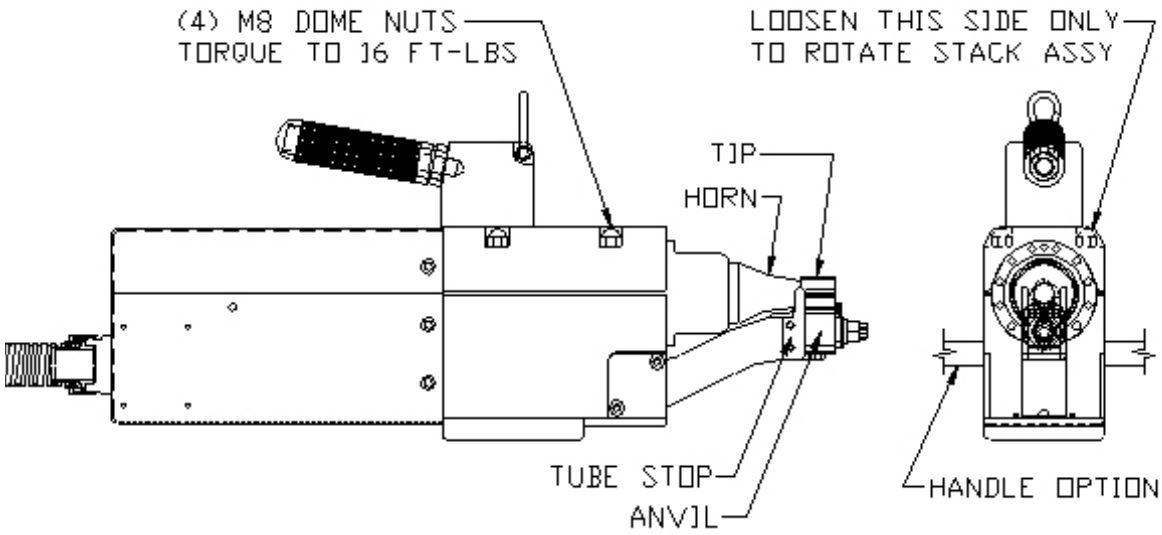
WARNING	
	Do not operate ultrasonics while the tip is loose.

WARNING	
	Do not operate ultrasonics without connecting the converter lead wire and ground.

4.7.1 Installing the Stack in the Actuator

The ultrasonic stack is mounted into a cast aluminum housing. An air cylinder through a linkage to the anvil drives the anvil upwards towards the horn to apply a precise force to the tube being sealed and cut.

Figure 4.9 Mounting the Stack on the Ultraseal 20 Actuator



4.8 Testing the Installation

Ensure that nothing is touching the tip on all four sides. With the tooling disengaged and unloaded, test the sonics no longer than one second (step reference- Menu> Maintain> Sonic> 100% Test). If there is a loud squealing noise, the problem may be in the following areas:

- The Tip may not be secured properly
- The Horn may not be 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 Ultraseal 20 system, call your local Branson Metal Welding representative or contact the Branson customer service. See 1.5.3 Contact Information.

Chapter 5: Technical Specifications

5.1 Technical Specifications

5.1.1 Requirement Specifications

The Ultraseal 20 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 +131ºF)
Storage / Shipping Temperature	-25ºC to +55ºC (-13ºF to +131ºF)
Storage Temperature Gradient	+15ºC/hour (+59ºF/hour) max
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 Ultraseal 20 Actuator.

Table 5.2 Ultraseal 20 Actuator Performance Specifications

Height Encoder Accuracy	+/-0.05 mm (0.002 in)
Max. Tube Diameter	12 mm (0.47 in)

Chapter 6: Operation

6.1 Actuator Controls

This section describes how to operate a weld cycle using the Ultraseal 20 Actuator. For more detailed information on making and altering settings, refer to your Controller Manual.

CAUTION	
	Keep hands away from under the horn when setting up and operating the Actuator. Up force (pressure) and ultrasonic vibrations can cause injury.

The Ultraseal 20 Actuator is controlled by the Controller. Refer to your Controller manual for tuning testing, setup and operating instructions

6.2 Initial Actuator Settings

When properly set up the Ultraseal 20 System will produce quality seals by simply placing the appropriate tubing against both tube stops and actuating the start switch. Consistent quality tubing is important to maintaining a reliable process. The following material specification is recommended and will produce the most reliable results.

6.2.1 Tube Specifications

Table 6.1 Preferred Copper Tube Properties

Material	Cu%	P%	Total Bi, Pb, P content%
C12200	99.9 (min)	0.015-0.040	Not to exceed 0.10

The material should conform to ASTM B 280-88 or 95A

Temper:

"O" Soft annealed to 50-60

Tensile strength 17,000 psi

Yield Strength 11,000-13,000 psi

% Elongation 40-50

Grain size 0.1 micron max.

Hardness, Rockwell 15T scale 42-46

- The tube should be free from cracks or tears on the outer surface when bent 180° around a plate with thickness 1.5 times the I.D. of the tube
- The tube should be free from excessive porosity or grain boundary inherent to hydrogen embrittlement or physical structure indicating any segregation of grain boundary, when subject to the following:
- Tubing shall be heated at 850 +/- 25° C for 30 minutes in a hydrogen environment. It may be etched with $FeCl_3$ if necessary
- The location of the weld should ideally be at least 3" (75mm) away from any brazed joint in the refrigeration system. This will minimize the effect of the heat hardening and oxidation which takes place during brazing

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 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 6.2 Tooling Torque Check

Area	Suggested Torque
Horn to Booster	85 ft-lbs (115 N-m)
Converter to Booster	55 ft-lbs (75 N)
Anvil Nut	60 ft-lbs (81 N-m)
Horn Tip	70 ft-lbs (91 N-m)

6.2.4 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.

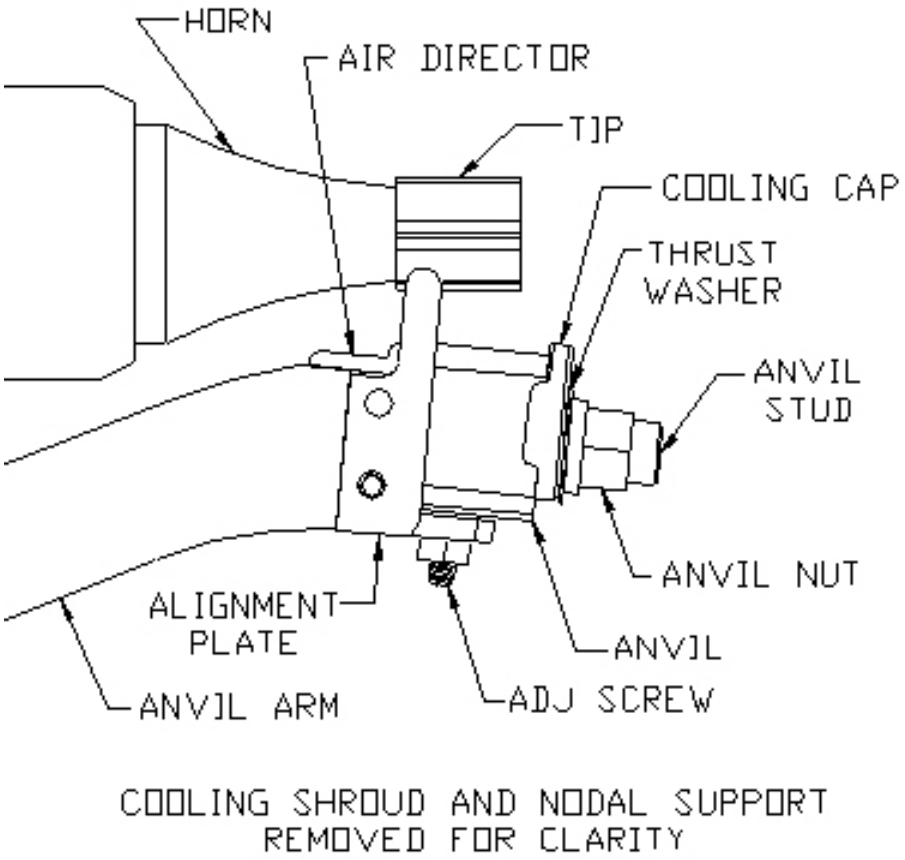
6.2.5 Tool Gap Requirements

Tooling includes the Horn, Tip, Anvil and all surfaces that contact the tube to be sealed during processing. The tooling should be inspected to confirm a proper gap. If the tooling is in contact during the application of ultrasonic energy, severe damage may result to the tooling and power supply.

NOTICE	
	This test should be checked whenever the tooling is changed. Also perform this test whenever you suspect tool contact.

NOTICE	
	The tooling that contacts the tube is designed with several weld surfaces. When one surface is worn and no longer useful, an alternate surface may be used resulting in extended tool life.

Figure 6.1 Tool Gap Setting



6.3 Operating the Actuator

For detailed information about Ultraseal 20 Actuator controls, refer to 2.4 Controls.

6.3.1 Check Sealer Performance

Ensure that nothing is touching the tip on all four sides. With the tooling disengaged and unloaded, test the sonics no longer than one second (step reference- Menu> Maintain> Sonic> 100% Test). If there is a loud squealing noise, the problem may be in the following areas:

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

NOTICE	
	For information on locating the "TEST" button on your particular Controller model please refer to your Controller manual.

6.3.2 Establishing Seal Parameters

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

- Height (mm)
- Trigger Pressure ("Force", psi/bar)
- Weld Pressure, Pressure During Sonics (psi/bar)
- Amplitude (Microns)
- Energy (Joules)
- Time (Seconds)
- Power (Watts)
- Seal Height (mm)

Table 6.3 Start Point Reference for Various Tube Sizes

Tube Size	Wall Thickness	Seal Height	Weld = Trigger Pressure	Amplitude	Energy	Time Range	Power
Capillary	.028" .70mm	.030" - .038" .75mm- .95mm	≈ 20 psi	45 - 55 microns	1500 joules	0.25 - 1.75 sec	≈ 600 watts
1/4" 6.4mm O.D	.028" .70mm	.030" - .038" .75mm- .95mm	≈ 50 psi	50 - 60 microns	2400 joules	0.25 - 1.75 sec	≈ 1500 watts

Table 6.3 Start Point Reference for Various Tube Sizes

Tube Size	Wall Thickness	Seal Height	Weld = Trigger Pressure	Amplitude	Energy	Time Range	Power
5/16″ 8.0mm O.D	.028″ .70mm	.030″ - .038″ .75mm- .95mm	≈ 65 psi	50 - 60 microns	3200 joules	0.25 - 1.75 sec	≈ 2200 watts
3/8″ 9.5mm O.D	.028″ .70mm	.030″ - .038″ .75mm- .95mm	≈ 75 psi	55 - 65 microns	4200 joules	0.25 - 1.75 sec	≈ 3200 watts
1/2″ 12.7mm O.D	.028″ .70mm	.030″ - .038″ .75mm- .95mm	≈ 80 psi	60 - 70 microns	7000 joules	0.25 - 2.25 sec	≈ 4000 watts

For all tube sizes:

Squeeze Time- 0.25 sec

Hold Time- 0.30 sec

Pre Height min/max- 1.5mm – 15 mm

Height min/max- 0.5mm- 15mm

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 in addition to those found in the General Information Instruction Set under Periodic Maintenance.

7.1.2.1 Daily Maintenance:

- Check cut gap (Figure 7.1)
- Check crash gap (Figure 7.1)
- Perform Height Span Adjustment. See 7.2.1.2 Height Calibration
- Check weld parameters energy, height, and time
- Inspect and clean tooling. Look for excessive wear, chips, or cracking. If found, tooling should be rotated and the stack should be re-tuned. If the stack cannot be tuned, the tip should be replaced. This will prevent poor sealing in production
- Measure the final weld thickness of sample parts to determine if they are within predetermined tolerance range. Adjust proximity switch as necessary to achieve final weld thickness. See 4.5.5 Setting Weld Height Proximity Switch

7.1.2.2 Once a Month

- Inspect all cables and connections for any twisting or stress on the connectors

7.1.2.3 Every Three Months

- Service stack. Disassemble, clean interfaces and re-assemble tightening to the proper torque

7.1.2.4 On Every Tool Setup, Rotation and Replacement

- 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
- For best performance, rotate tooling each 5,000 cycles

Note: Replace or maintain anvil first.

Anvil Replacement

- Power OFF
- Remove anvil nut, thrust washers, cooling cap, and anvil
- Remove air deflection plate and wipe off any excess copper dust, oil, etc

- Replace deflection plate, new anvil, cooling cap, thrust washers and anvil nut
- Set up anvil per "Anvil Rotation" below

Anvil Rotation

- Remove anvil nut and thrust washers
- Flip anvil over and orient the cutting edge to the desired side
- Ensure that air deflection plate located behind anvil is down as far as possible
- Replace thrust washers and anvil nut
- Set cut and crash gap as described in Horn Tip Rotation
- Torque anvil nut to 60 ft. lbs

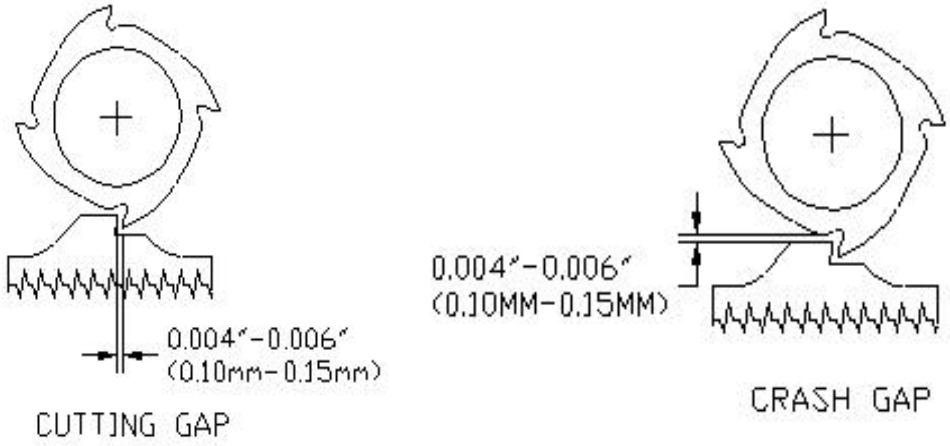
Horn Tip Replacement

- Power OFF
- Remove the sealing tip using the tip adapter wrench included in the tool kit
- Clean the horn/tip interface removing any copper residue, oil, etc
- Apply a small amount of anti-seize compound to the horn threads
- Replace and torque the tip to 70 ft-lbs using the tip adapter wrench. Verify cutting edge orientation
- Set cut and crash gap as described in Horn Tip Rotation

Horn Tip Rotation

- Note tooling orientation before removing
- Power ON
- Loosen the anvil nut and 6mm jam nut. Turn the set screw counter-clockwise to lower the anvil
- Loosen two 13mm jam nuts located on right side of handle assembly
- Raise anvil (step reference Menu> Maintain> Anvil)
- Rotate horn tip to a new lobe and raise the anvil into position so that cut gap can be temporarily set to between .004" and .006" (.10mm - .15mm)
- Torque the two right 13mm dome nuts to 16 ft-lbs
- Set the crash gap between .004" and .006" (.10mm - .15mm) and torque anvil nut to 60 ft-lbs
- Loosen the two right 13 mm dome nuts and rotate the horn tip. Set a .004" to .006" (.10mm - .15mm) cut gap, and torque the loose dome nuts to 16 ft-lbs
- Perform Height Encoder Zero Set. See 4.5.5 Setting Weld Height Proximity Switch
- Verify weld height prox switch is set correctly and readjust if necessary

Figure 7.1 Cutting and Crash Gap



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

The transmission of ultrasonic energy along the stack requires a tight and clean interface between the Converter, Booster, Diaphragm Springs and Horn.

7.1.3.1 Ultrasonic Stack Disassembly

- Be sure that Controller is off to prevent any possible electrical shock from the high voltage contact on the converter
- Remove three screws from the back cover
- Remove the four dome nuts on the handle/ main housing top
- Clamp the ULTRASEAL 20 in a soft-jawed vise, and using the spanner wrench, unscrew the horn from the stack
- Remove the remaining parts of the ultrasonic stack from the actuator body
- Remove the two sets of M5 X 20 mm bolts from the two polar mount clamp rings and remove the polar mount clamp rings
- The converter can now be removed from the booster by placing one spanner wrench on the converter and one on the booster and turning in opposite directions
- The stack is now disassembled into three main components
- The Ultrasonic Horn
- The Booster
- The Converter
- The reassembly of the ultrasonic stack is the reverse of this procedure. A torque of 85 ft-lbs is required for the threaded connections between the horn and booster and 55 ft-lbs between the booster and converter

Figure 7.2 Exploded Ultrasonic Stack Assembly

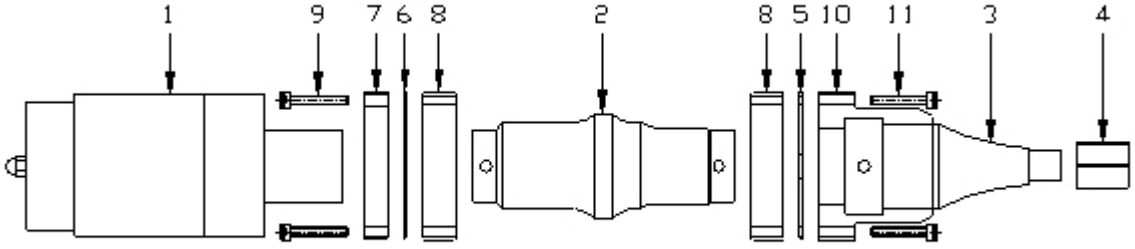


Table 7.1 Ultrasonic Stack Assembly items

Item	Description	Item	Description
1	Converter	6	Rear Diaphragm Spring
2	Booster	7	Spring Retainer
3	Horn	8	Nut Ring
4	Tip	9	M5 x 20 mm SHCS
5	Front Diaphragm Spring	10	Nodal Support
		11	M5 x 30 mm SHCS

7.1.3.2 Ultrasonic Stack Assembly

Refer to 4.7 Ultrasonic Stack Assembly.

7.2 Calibration

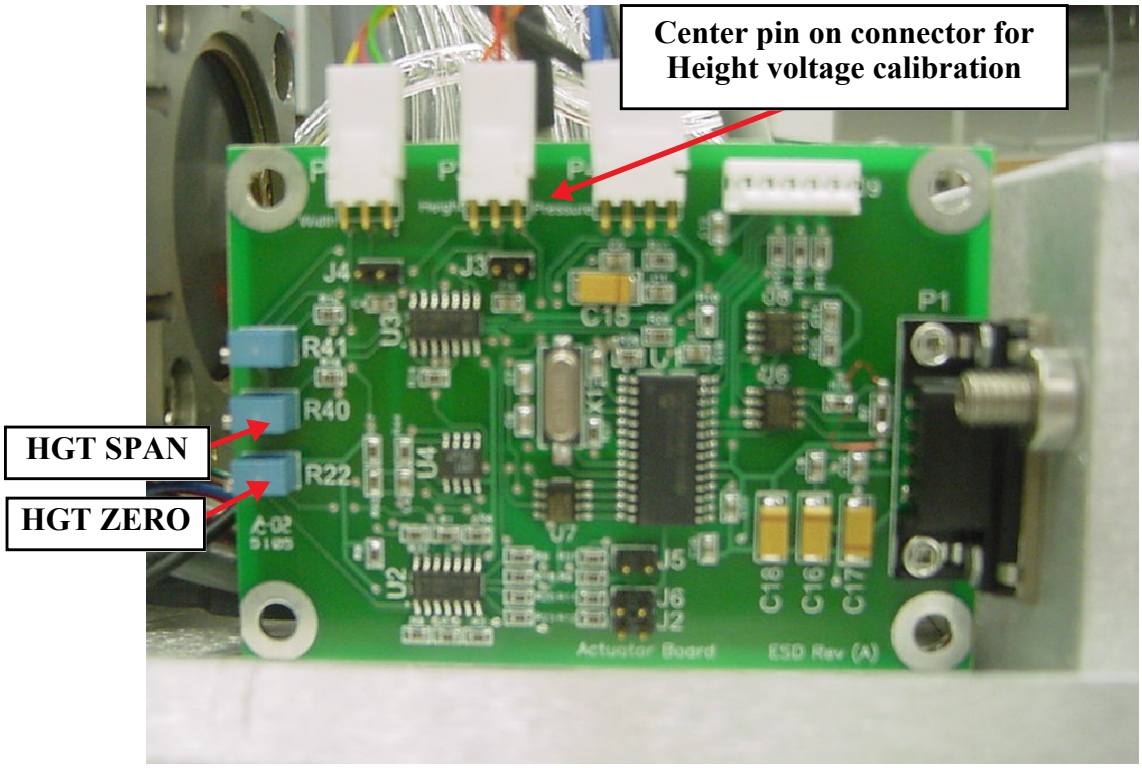
This product does not require scheduled calibration. However, if you are operating under requirements that mandate periodic calibration, for example, the FDA's Good Manufacturing Practices, contact your Branson Metal Welding representative for additional information.

7.2.1 Encoder Board Calibration

To be performed when either the encoder or actuator board is replaced.

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 the Touchscreen Controller Instruction Set). 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).

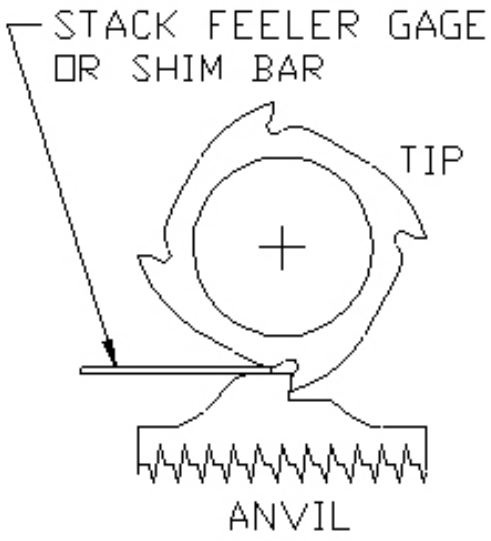
7.2.1.2 Height Calibration

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.

Figure 7.4 Stack Feeler Gage



7.3 Troubleshooting

This section shows how to fix some of the possible errors and problems which may occur in normal use of the Ultraseal 20 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 7.2 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.

Table 7.2 Troubleshooting Chart

Problem	Solution
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.
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 Controller 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 7.2 Troubleshooting Chart

Problem	Solution
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.
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 Controller 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 7.2 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 7.2 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 arm 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 tables list the available Accessories (Table 7.3) and Parts (Table 7.4) for the Ultraseal 20 Actuator:

Table 7.3 Available Accessories

Description	EDP Number
1 to 1 Gain Booster (1 : 1)	11003-02-033
Converter 503	159-135-269
3/16 - 1/2” Dia. Tip	G3A90A73
TIP, MTS 20	G3A90A36
TIP, NON-CUTTING THREADED	G3A90A71
TIP, SYMMETRICAL	G6A90000

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

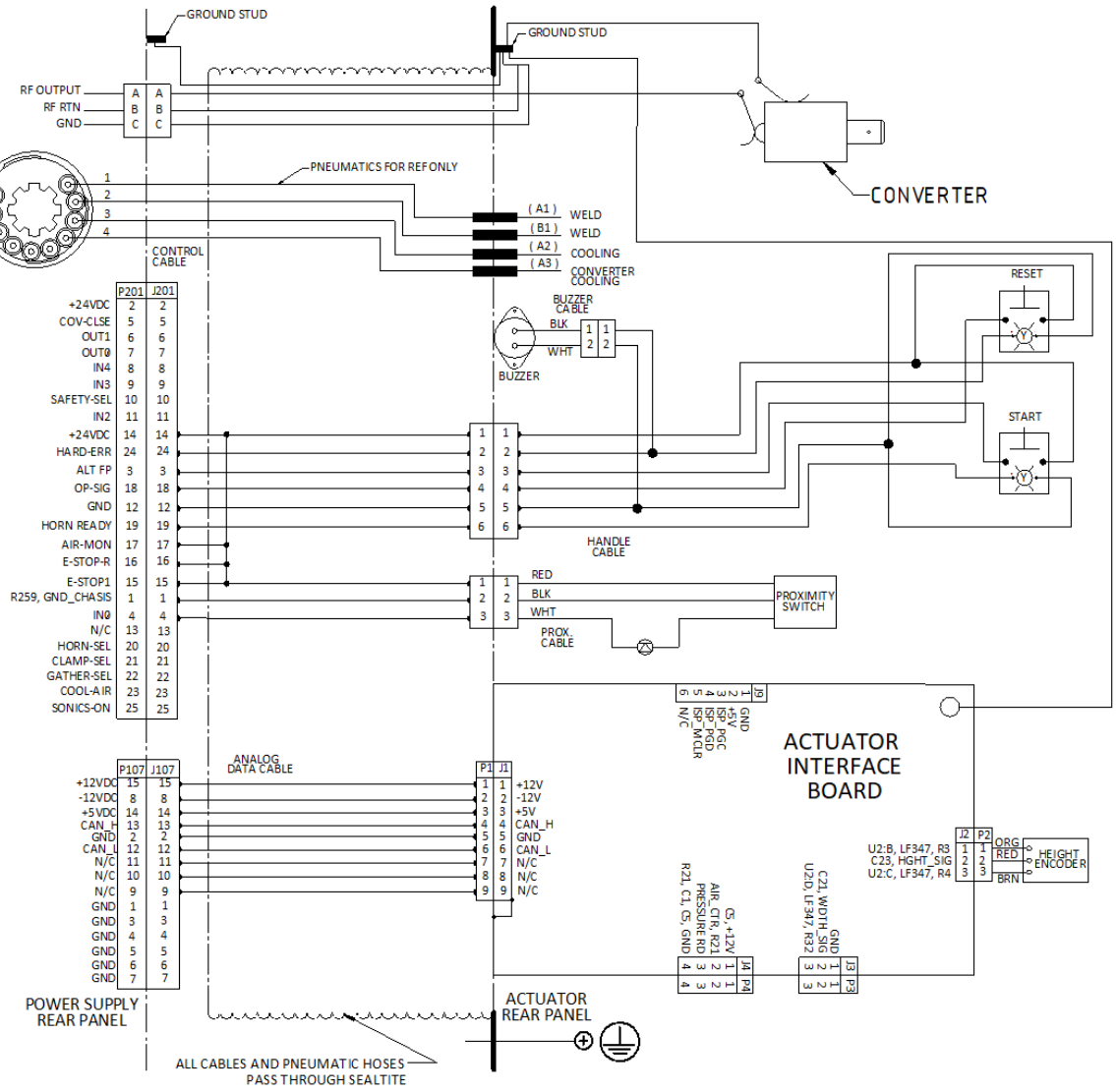
Table 7.4 Primary Spare Items

Description	EDP Number
Actuator Board	102-242-632R
Linear Encoder	103-088
Spring, Front Diaphragm	N5A50A46
Spring, Rear Diaphragm	N5A50A47
Air Cylinder	205-035

Appendix A: Ultraseal 20 Interconnect Diagram

A.1 Ultraseal 20 Interconnect Diagram

Figure A.1 Ultraseal 20 Interconnect Diagram



Appendix B: Declaration of Conformity

B.1 Declaration of Conformity

Figure B.1 Declaration of Conformity

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EC DECLARATION OF CONFORMITY
According to the Machinery Directive 2006/42/EC
the EMC Directive 2014/30/EU.

We, the manufacturer

BRANSON ULTRASONICS CORPORATION
120 Park Ridge Rd.
Brookfield, CT 06804
USA

represented in the community by

BRANSON ULTRASONICS, a.s.
Piestanska 1202
915 01 Nove Mesto nad Vahom
Slovak Republic

expressly declare under our sole responsibility that the equipment Ultrasonic Tube Welding system consisting of**:**

Branson tube sealer model ULTRASEAL 20 or ULTRASEAL 20 EX used with a Branson ultrasonic power supply model (TS or VGX) (USL or USL EX) (20:3.3 or 20:4.0) and associated cables

in the state in which it was placed on the market, fulfills all the relevant provisions of the Machinery Directive **2006/42/EC** and the EMC Directive **2014/30/EU**. The safety objectives set out in the Low Voltage Directive **2014/35/EU** were kept in accordance Annex 1 No. 1.5.1 of the Machinery Directive 2006/42/EC.

The object of this declaration is in conformity with relevant Union harmonization legislation. The equipment, to which this declaration relates, is in conformity with the following standards:

EN 60204-1:2018
EN ISO 12100:2010
EN ISO 13849-1:2015
EN ISO 13849-2:2012
EN ISO 13850:2015
EN 55011:2016/A1:2017
EN 61000-6-2:2005

DocuSigned by:
Luis Benavides
018235BFCDE147C...

Brookfield, CT, USA
April 8, 2022

Luis Benavides
Branson Product Safety Officer

CE Marking Affixed: 2022

CE

CC: Technical Publications

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