Original Instructions
DCM01311 - REV. 04

EMERSON

Ultraseal 20, VGX

Metal Welding System

Product Manual

Branson Ultrasonics Corp.
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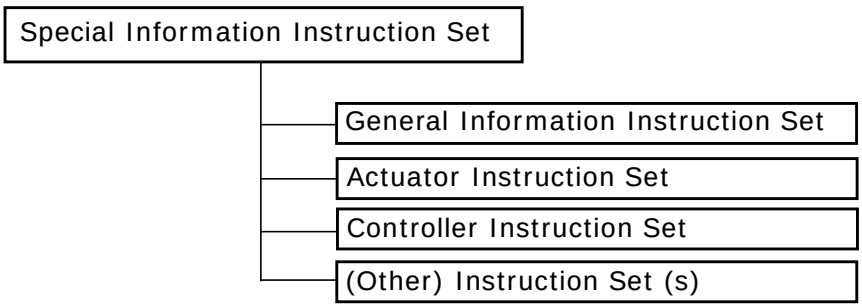
BRANSON

Introduction

This is the product manual for your BRANSON Metal Welding ultrasonic welding system.

Several combined Instruction Sets form the contents of this manual. This section contains information which relates most uniquely to you as the customer, your particular system and application. It also documents other Instruction Sets used in the manual. The figure below illustrates how the manual is organized.

Branson Metal Welding Product Manual



Using this manual

It is highly recommended that you read and understand the contents of this manual prior to operating your Branson Metal Welding system. Each Instruction Set has a table of contents and is intended to logically group information in a manner which the user will find convenient.

Classification of Hazards

The safety indications in this manual are divided into different classes. The figure below shows the assignment of symbols (pictograms) and signal words to the specific hazards and its potential consequence.

DANGER	
	A potentially dangerous situation that could cause injury to persons and serious damage to equipment.

CAUTION	
	A situation that may cause damage to the equipment.

NOTICE	
	Useful information, an application hint or other important or useful information.

Original Instructions
DCM00003 - REV. 06

EMERSON

MWX100 / Ultrasplice
Systems

Instruction Manual

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BRANSON

Introduction

This Instruction Set includes common information which relates to Branson products. It will help you in setting up your system and to understand the fundamentals of the ultrasonic metal welding process.

Thank You

Thank you, and congratulations on selecting Branson MWX100/ ULTRASPLICE Systems for your welding production. This system has been developed to produce the highest quality welds at the lowest cost per weld.

If you should experience difficulty or have any recommendations for improvement, please do not hesitate to contact us.

Trademarks

MWX100 and ULTRASPLICE are registered trademarks of Branson Ultrasonics Corp.

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Chapter 1: Safety and Support

1.1 Intended Use

This equipment is for the joining of metal parts using ultrasonic energy. A complete system includes an actuator, controller and tooling (which delivers mechanical energy to the work pieces). Some systems also include special fixturing and machine automation. Branson systems may only be utilized to weld soft, ductile, metal parts together with Branson-supplied weld tooling (such as horns, tips, anvils, and converters) unless an explicit, written, contrary agreement between the ordering party and Branson has been consummated.

1.2 Safety, Personal

1.2.1 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.

1.2.2 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, power supply and related fixturing are returned to the “Home” position. 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.

1.2.3 Controller Cover

The power supply is equipped with a top cover which should only be removed for maintenance and installation purposes.

1.2.4 Safety Guidelines

For operating safety, please observe the following precautions:

- Plug the power supply into a grounded electrical supply to avoid electrical shock
- Ensure that no one is in contact with system moving parts when operating
- Keep hands away from the horn tip as high force and ultrasonic vibration can cause injury to hands and fingers
- Do not test ultrasonics when the converter is removed from the actuator. Without the converter there is the danger of damage or shock
- Before adjusting or repairing the ultrasonic stack or power supply, disconnect the line power
- Any unauthorized modification of the units control circuitry or wiring may cause a malfunction, which could result in injury to operating personnel
- Do not operate the equipment until repairs and adjustments have been made and the equipment is in good working order

1.3 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:

- All system components must be disconnected from the main electrical supply
- Remove the plug from the main electrical supply and secure it from being re-inserted accidentally
- All system components must be disconnected from the main air supply
- Disconnect the air hose from the main air supply and release system air pressure via the pressure regulator

1.4 Safety, System

1.4.1 System Protection Monitoring (SPM)

The SPM (System Protection Monitoring) stops ultrasonics when the power supply has been overloaded or when inappropriate or defective horns are used.

1.4.2 Thermal Switch

A thermal switch is contained within the power supply to automatically disconnect power to the machine if the unit gets too hot. This will occur if the exhaust fans from the generator are inadvertently blocked or clogged.

1.4.3 Daily Functional Safety Checks

- Check the machine tip and anvil for any signs of grinding, cracking, or galling that could be the result of misalignment or tooling contact. Replace tooling that has excessive wear
- Check for any loose material or debris in the welding cavity, cleaning it out
- Check all parameter settings on the controller to ensure they are properly set for the weld to be made
- Drain water and contaminants from the airline filters as necessary

1.5 Contacting Branson

1.5.1 Spare Parts & Replacement Tooling

Spare parts or replacement tooling for the ultrasonic welding system may be ordered directly from Branson. A spare tooling specification sheet is included in the Special Information Instruction Set. Additional part listings are contained in the Actuator and Touchscreen Controller Instruction Set sections of this manual.

Branson will work with you and recommend components you need and should carry in inventory based upon your manufacturing philosophy and or production needs. We will quote price, delivery and can coordinate special arrangements such as expedited service or blanket orders.

When Ordering Spare or Replacement Parts, have the purchasing agent Fax the order to us with the following information provided:

- Purchase Order Number,
- Branson Part Number, Quantity, and Date Required,
- Ship To Information, (including “Ship to the Attention of”)
- Bill To Information
- Shipping Instructions, (such as air freight, truck, etc.)
- Special Instructions, (such as “Hold at Pick-Up Counter and Call” -- Be sure to provide a name and a phone number)

1.5.2 Questions or Problems

If you have any questions or are experiencing a problem, call the local Branson field sales and/or service representative. He or she will be familiar with your equipment and application and, in most cases, will be able to help you. He or she may have the replacement part you need, in stock, that will return your system to operation in the shortest possible time.

If necessary, the representative will contact Branson for additional service and, in some cases, will put you into contact with the appropriate personnel. If the local representative is unavailable, please call us directly.

Before you call, take the following steps:

- Have this manual with you
- Know how your system has been set up and equipped, including your MBOS version
- Be able to describe the situation or problem
- Have a list of steps that you have already taken
- Have a list of spare parts in your inventory
- Have the name and phone number of the Local Branson Representative

1.5.3 Returning Equipment

In order to properly and efficiently handle an equipment return to Branson, the following procedure must be followed. Contact your Local Sales Manager or Branson Customer Service for assistance. Proper handling and identification of your equipment will expedite servicing and/or return.

Call Branson and Receive a Return Authorization Number (RA#) from Branson Customer Service.

- Properly package the equipment to prevent damage
- Clearly mark the RA# on the outside of the package
- Include a copy of the completed Return Authorization Form inside the package
- Return general repairs by any convenient method. Send priority repairs via Air Freight
- Prepay the transportation charges, (FOB Brookfield, CT)

Complete the following in the Return Authorization Form:

- Customer Information Section
- Description of Problem
- Equipment Information

1.5.4 New Applications

Branson is always eager to work with you on a new ultrasonic application. Whether it be a manual workstation, a semi or fully automated system, Branson has the personnel and technical competence to support your requirements. Branson's application laboratory, product and automation engineering, customer service and manufacturing capabilities are second to none. Branson is the world leader in ultrasonic metal welding and our business philosophy is practiced to assure customer success.

Application assistance is always available. For initial application review, contact your Local Sales Manager who can indicate initial feasibility and assist you in completing an Ultrasonic Weld Evaluation Request For. Please complete one (1) request form for each application.

Please fill out the Ultrasonic Evaluation Request Form, complete the customer and application information section and forward it to Branson along with enough component material to produce 24 assemblies, (if this is not practical please advise). A feasibility evaluation will be performed and samples returned, for review, along with a system quotation/ proposal. Be sure to include drawings of the completed assembly and include the electrical, mechanical, and production requirements. Complete the form as completely as possible. The Branson Sales Representative can assist you.

1.6 Warranty

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

Chapter 2: Introduction

2.1 Ultrasonic Theory

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.

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 (Figure 2.1). The parts are “scrubbed” together under pressure at 20,000 or 40,000 cycles per second. This high frequency vibration, applied under force, disperses surface films and oxides, creating a clean, controlled, diffusion weld (Figure 2.2). As the atoms are combined between the parts to be welded, a true, metallurgical bond is produced.

Figure 2.1 Transforming Electrical Energy into high frequency mechanical vibration

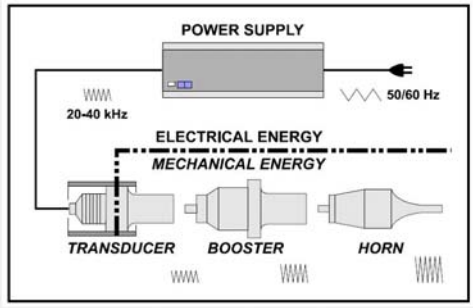
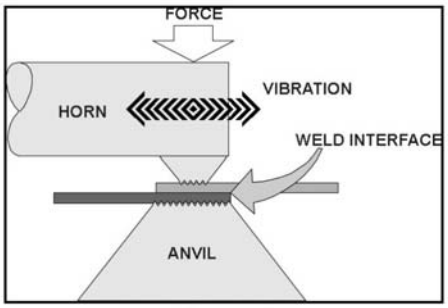


Figure 2.2 High frequency vibration Welding



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

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.

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

$$P = F \times A$$

Where:

- P = Power (watts)
- F = Force * (psi)
- A = Amplitude (microns)

NOTICE	
	Force is determined by multiplying: Force = (Surface Area of the Cylinder) X (Air Pressure) X (Mechanical Advantage)

Energy is calculated as:

$$E = P \times T$$

Where:

- E = Energy (joules)
- P = Power (watts)
- T = Time (seconds)

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

$$E = (F \times A) \times T$$

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.

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.

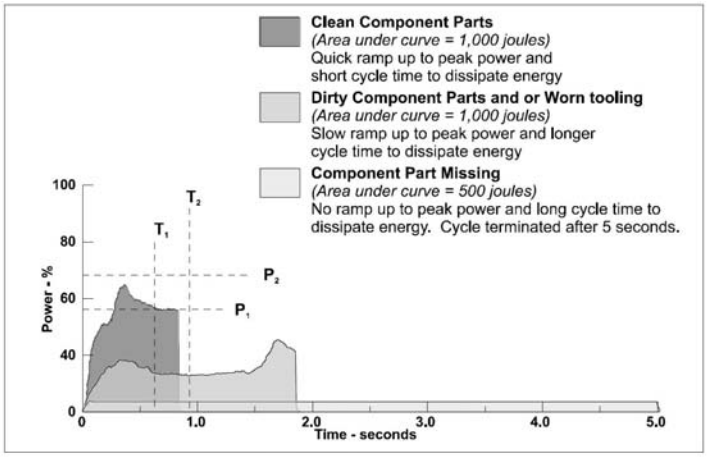
Welding to energy is necessary because of the non-metallic oxides that form on the metal's surface as well as other contaminates such as grease and dirt. To producing quality welds reliably it is necessary that the surfaces to be joined are clean. The high frequency scrubbing action, combined with pressure,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

Power

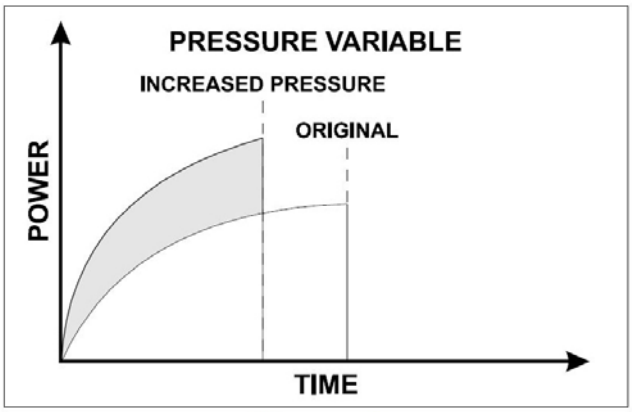
The converter/ booster/ horn, (stack assembly), requires minimal electrical power to initiate and maintain motion (vibration) at a 'no-load' condition. As the mechanical load increases, the power required to maintain the mechanical vibration also increases. The maximum power required during a weld cycle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

Figure 2.3 Weld 'power graph' (weld footprint)



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 to deliver the same amount of Energy. This relationship is illustrated in the following diagram (Figure 2.4):

Figure 2.4 Pressure, Power, and Time relationship

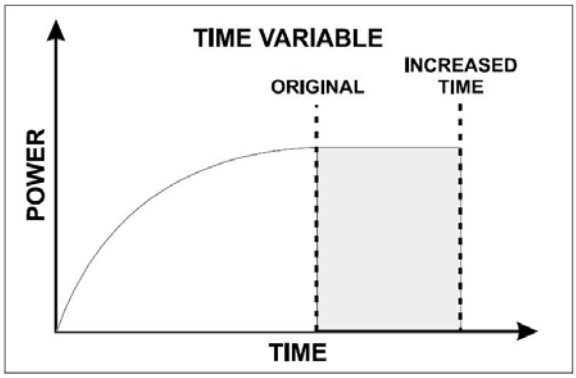


The difference in the appearance of each of the above weld graphs is the result of increased Power loading. Based upon an increase in Pressure, additional Power is required to maintain the motion of vibration. Thus, the same amount of energy is delivered in less time. This approach is typically used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

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).

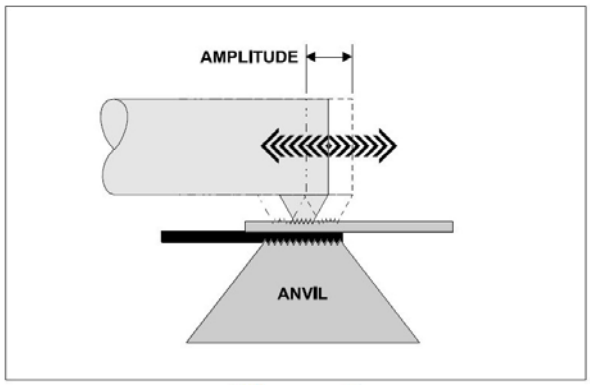
Figure 2.5 Weld Time



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.

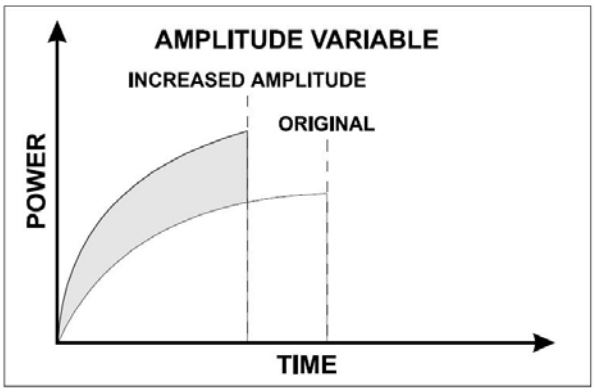
Figure 2.6 Amplitude



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 power diagram (Figure 2.7):

Figure 2.7 Power, Time, and Energy relationship

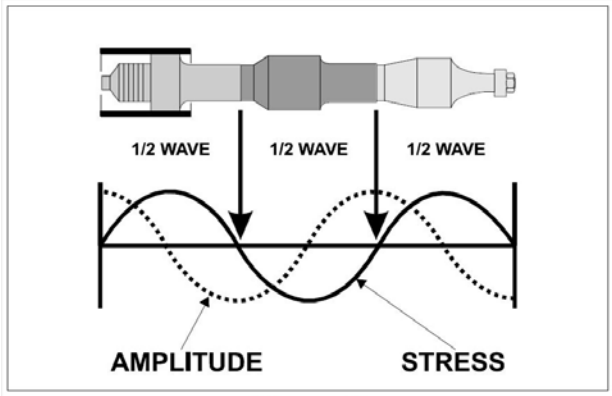


Resonant Frequency

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 anti-nodes. 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 Resonant Frequency



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. Electronic circuits in the system will protect the power supply if this condition exists.

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

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.

2.2 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 for efficient 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)

After Burst Duration: The amount of time, in seconds, that AFTER BURST energy is delivered. (Also See: AFTER BURST & AFTER BURST DELAY)

Amplitude: Amplitude is the peak-to-peak displacement of mechanical motion as measured at the face of the horn tip. Amplitude is measured in thousandths of an inch or in microns. (i.e. A standard 40 kHz converter produces approximately .0004" or 10 microns of amplitude), Inches x 25,400 = microns. -- With 'Advanced Power Supply' 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.

Baud Rate: A communications measure describing the speed at which signals are transmitted serially (the number of signal events per second).

BBRAM: 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 BBR)

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 energy (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.

Clock: An electronic circuit that generates timing pulses to synchronize the operations of various other circuits in a device(s).

Communications: Transmission of information between points of origin and reception without alteration of the sequence and or structure of that information content.

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 Operation Manual to document the spare tooling for a specific metal welding application.

Continuous Sonics Mode: A system setting in which the power supply will deliver ultrasonic electrical energy until the start signal is terminated.

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

Converter: A device which utilizes a lead-zirconate-titanate electrorestrictive 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.

Hand Shaking: The procedure (signal exchange) when a connection is established between two electronic devices. A common example is the signal exchange between a terminal and a MODEM. These signals (hardware and software) are used to control the flow of data (start/stop) between devices.

Height: A display 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, (40 kHz = 2.2" ±, 20 kHz = 5.5" ±).

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 welded surfaces

Linear Height Encoder: (See: Height Encoder)

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

Maintenance Counter: A programmable device used to alert production personnel of the need to review / inspect application tooling and/or the ultrasonic system for preventive maintenance purposes. The device increments one (1) count for each system cycle. (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: A programmable device 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 40 kHz, (40,000) or 20 kHz, (20,000) 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.

Preheight: 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: System memory available for storage and retrieval of welding parameters.

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 condition will exist.

Setup Mode: The condition the control box must be in prior to adjusting parameters, quality windows, and/or any others settings except those contained within the Command Mode.

Squeeze Time: The amount of time after the ultrasonic tooling engages the component(s) and before delivery of ultrasonic energy. -- Adjustable from 0 - 0.5 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)

Weld Mode:

- **Weld In Energy:** System delivers ultrasonic energy until a predetermined amount of energy, in joules is dissipated. The system determines energy by calculating the area beneath the power curve -- Watts x Time = Joules (1 watt per second = 1 joule)
- **Weld In Height:** System delivers ultrasonic energy until the ultrasonic tooling reaches a predetermined position
- **Weld In Time:** System delivers ultrasonic energy for a predetermined amount of time
- **Welding Parameters:** (See: Parameters)

Chapter 3: Shipping and Handling

3.1 Unpacking, Handling & Installation

Unpack the Actuator and Touchscreen Controller. Remove the top cover of the power supply and check if any components became loose during shipment.

3.1.1 If damage has occurred

Notify the shipping company immediately. Retain packaging materials for inspection and possible re-use.

3.1.2 System Location

Locate the Touchscreen Controller in an area away from radiators or heating vents. Allow sufficient clearance in back of the controller to access the connectors. Observe the following:

- Do not block the exhaust or air intake areas. Proper air circulation is necessary to maintain a safe operating temperature
- Only operate the controller within an ambient temperature range of 41ºF to 122ºF (5ºC to 50ºC)
- Verify that neither dust nor dirt are allowed to restrict the flow of air exhaust or air intake. Clean the air ports as necessary

If the temperature of the power supply exceeds the recommended operating range, a thermal switch will stop ultrasonics and the power supply will display an Overload alarm. Ultrasonics will remain off until the power supply cools to a safe operating temperature and the RESET button is pressed.

If the environment is excessively dirty or oily, contact Branson for assistance. Special Touchscreen Controller enclosures, filters (i.e. filter/separator/regulator), and other equipment are available.

3.1.3 System Assembly

Connect the actuator system per the Hookup diagram contained in the Special Information Instruction Set. Verify that connections are complete and correct before proceeding. Plug the Controller into a proper power source. See the Touchscreen Controller Instruction Set for power specifications, plugs and receptacles used.

To prevent the possibility of an electrical shock, always plug the power supply into a grounded power source. Be sure the power switch is in the Off position before making any electrical connections.

Connect the system to a clean (5 micron air filter with 0.5 micron mist separator), dry, 80 psig (5.5 bar) minimum air supply. See the Actuator Instruction Set for information on the set up of application tooling and the use of this equipment for ultrasonic welding.

3.1.4 Crash Gap Adjustment

In most applications, adjustment of the gap between the ultrasonic Horn Tip and the Anvil is factory set to prevent these surfaces from contacting each other when no parts to be welded are present and the foot pedal is depressed. A poorly adjusted crash gap can cause serious damage to the tooling. See the Actuator Instruction Set for proper setup instructions.

3.1.5 Operating the System

With all proper connections made and with tooling properly set up, welding may be performed. In most instances it is likely that Branson has developed weld settings for your application and stored them as presets in the controller prior to shipping. See the Touchscreen Controller Instruction Set for information on retrieving presets. For other

weld parameter information pertaining to your system, see the parameter preset page included in the Special Information Instruction Set.

Chapter 4: Troubleshooting

4.1 Troubleshooting

This section shows how to fix some of the possible errors and problems which may occur in normal use of the MWX100/ Ultrasplice system.

4.2 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

4.3 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.

4.4 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 horn 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

4.5 Troubleshooting Guide

Table 4.1 Troubleshooting Guide

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.
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.
Horn 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. Press 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 thermo switch in power supply.

Table 4.1 Troubleshooting Guide

Problem	Solution
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. Cooling air is not directed at tooling.
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.

Table 4.1 Troubleshooting Guide

Problem	Solution
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.
Horn 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.
Unusual sound during weld cycle.	Check tooling gap. Check converter. Check stack assembly.
Squealing sound from power supply 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. **NOTE:** 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 horn 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.

Chapter 5: Maintenance

5.1 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.

Daily

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

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

After one million cycles

- Vacuum and clean inside of power supply
- Calibrate pressure regulator
- Clean and torque the stack interface
- Calibrate amplitude

5.1.1 FSR Assembly

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

- Disconnect the air supply
- Remove and clean out filter bowl with a clean rag
- Replace the white filter element and re-assemble
- Remove and clean out separator bowl with a clean rag
- Replace brass-colored filter element and reassemble
- Reconnect air supply

Do not use solvent to clean filter bowls.

CAUTION	
	Clean the air filter bowl with a mild household soap only. The bowl is made from a polycarbonate material, which can rupture if exposed to synthetic lubricating oils solvents or harsh chemicals. The bowl is rated for a maximum line pressure of 140 psig (1043 kPa) and a maximum temperature of 120ºF (49ºC).

Original Instructions
DCM00051 - REV. 10

EMERSON

Ultraseal 20
Actuator

Operating Manual

Branson Ultrasonics Corp.
120 Park Ridge Road
Brookfield, CT 06084
(203) 796-0400
http://www.bransonultrasonics.com

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.

Copyright and Trademark Notice

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.

Table of Contents

List of Figures

List of Tables

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.

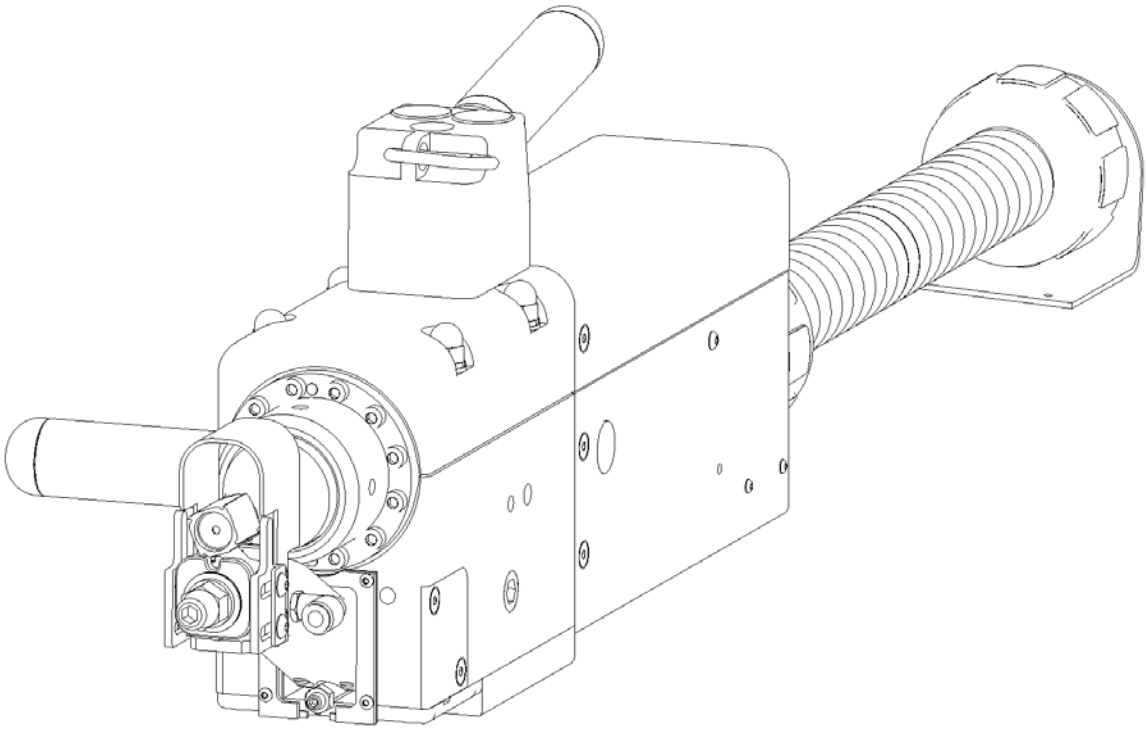
2.1.1 Controller Manual Set

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

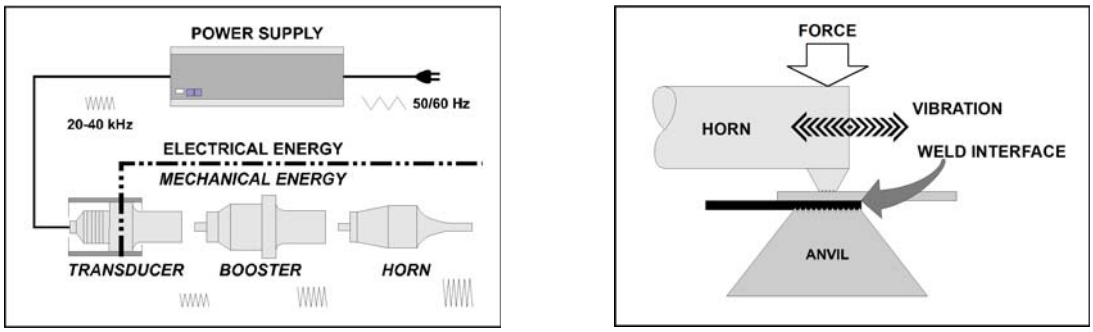
2.5.1 What Is an Ultrasonic Weld?

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.

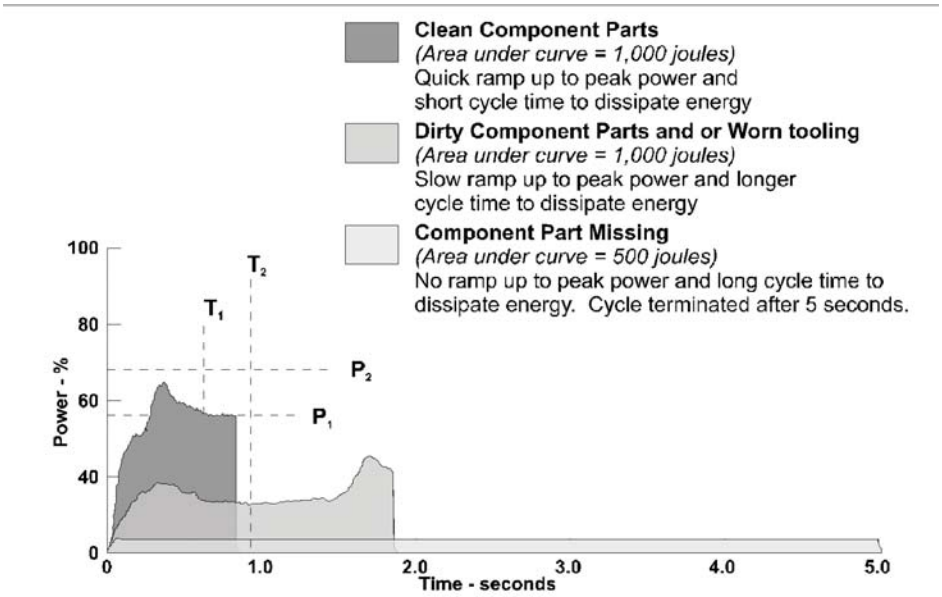
2.5.4 Welding to Energy - Why?

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

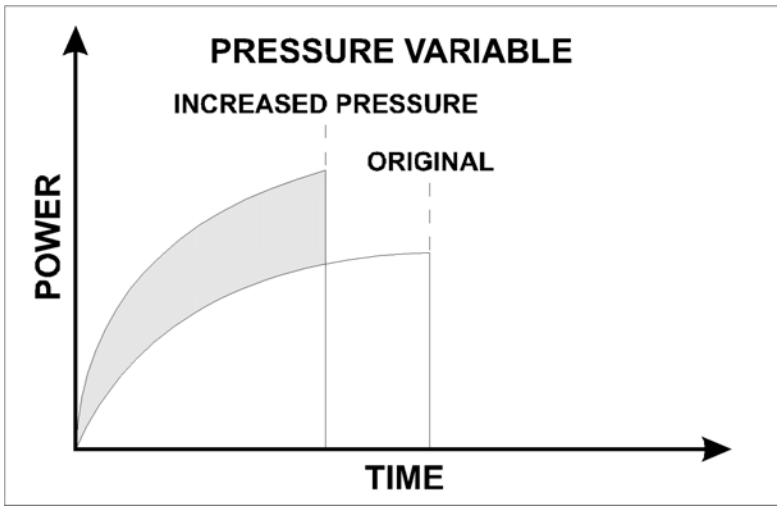


2.5.5 Power

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

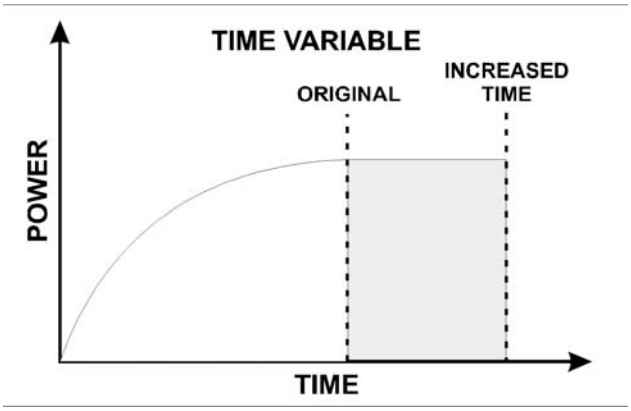


The difference in the appearance of each of the above weld graphs is the result of increased Power loading. Based upon an increase in Pressure, additional Power is required to maintain the motion of vibration. Thus, the same amount of energy is delivered in less time. This approach is typically used 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).

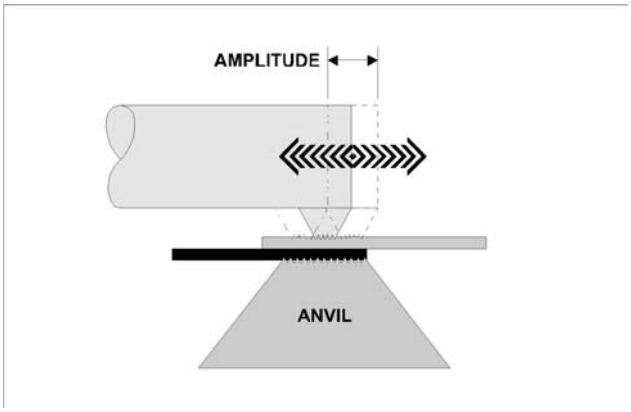
Figure 2.5 Pressure Variable with Increased Time



2.5.7 Amplitude

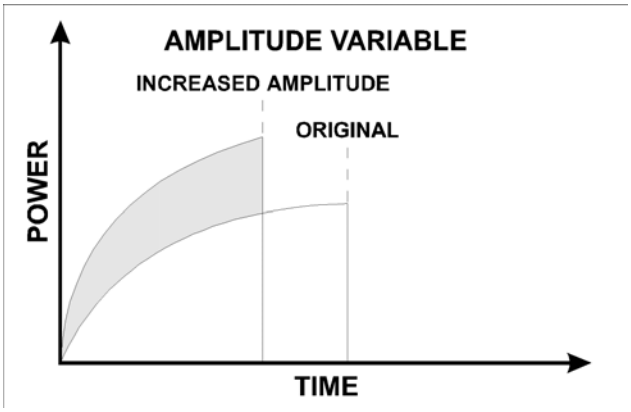
An ultrasonic tool is a resonant acoustical device. The term Amplitude is used to describe the amount of longitudinal expansion and contraction that the tooling endures as it vibrates (Figure 2.6). The amplitude correlates to the scrubbing action at the weld interface. This scrubbing action combined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

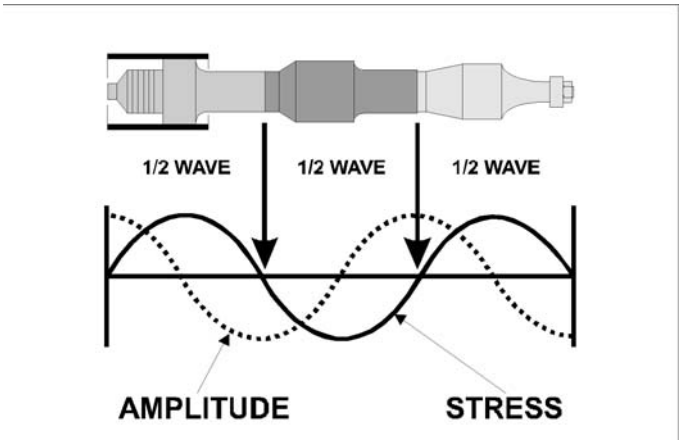


2.5.8 Resonant Frequency

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)

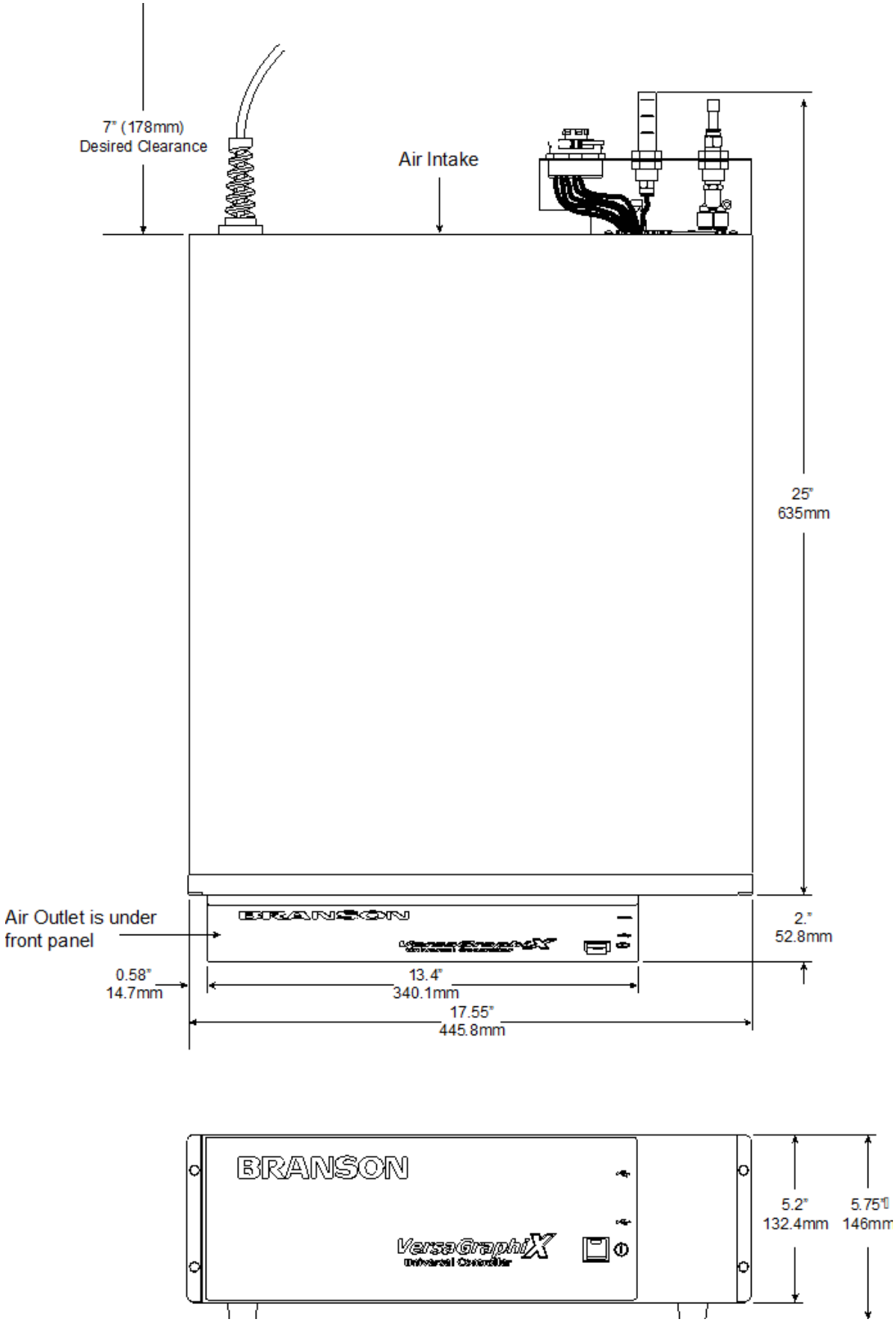


Figure 4.2 Controller Dimensional Drawing (Touch Screen)

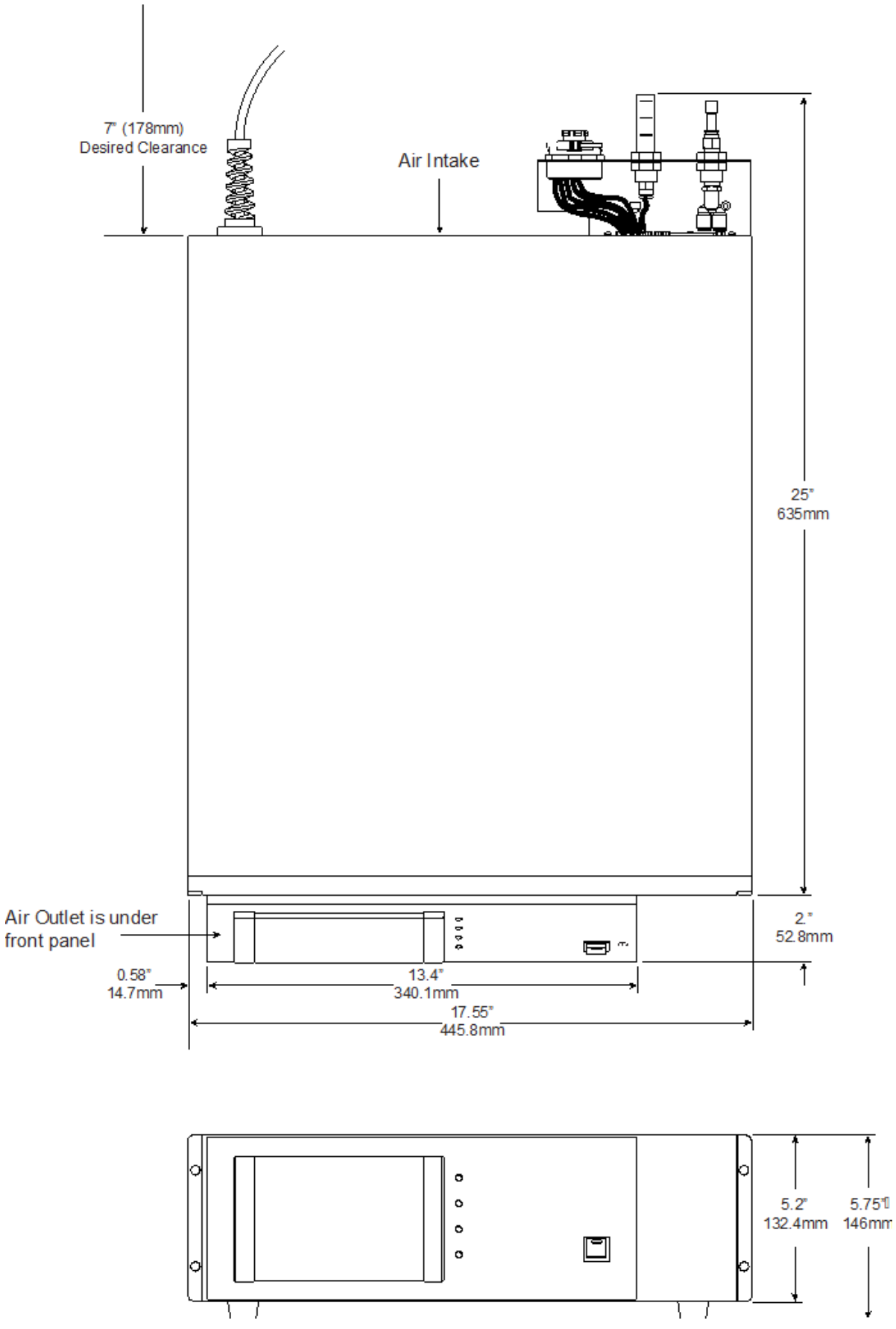
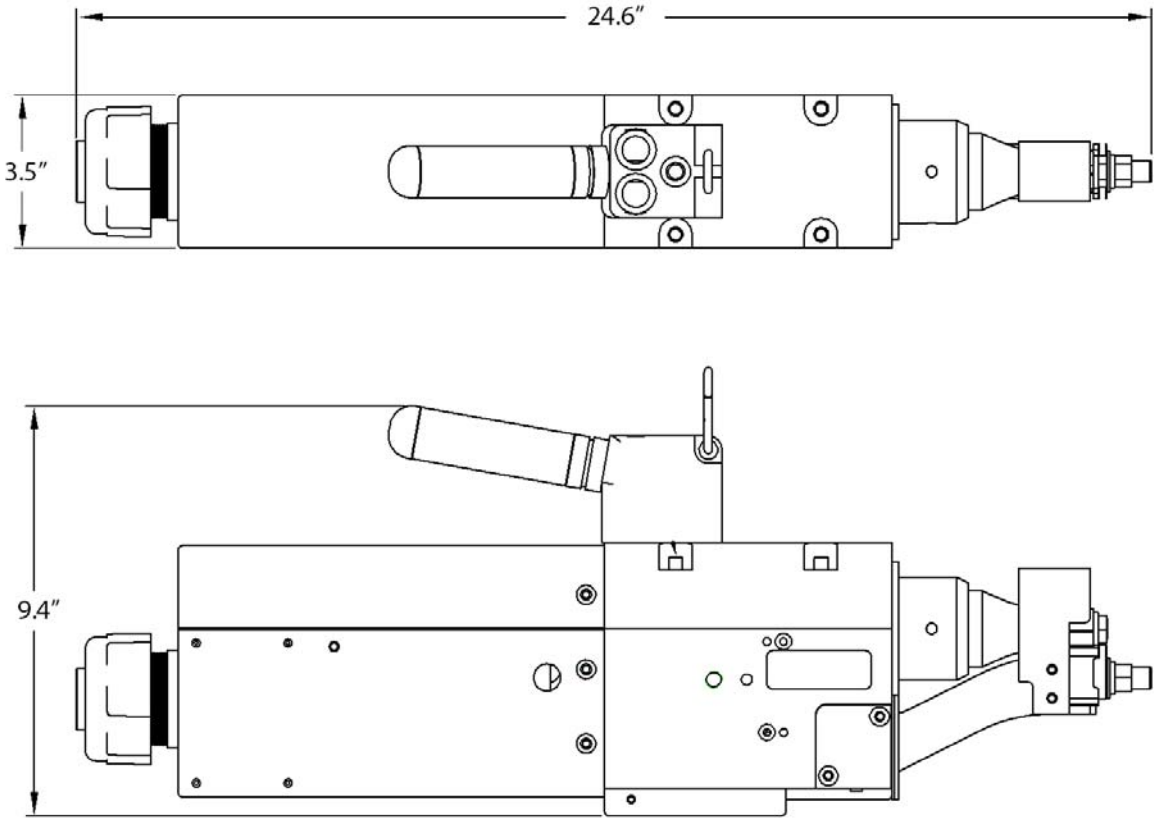


Figure 4.3 Ultraseal 20 Actuator Dimensional Drawing



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

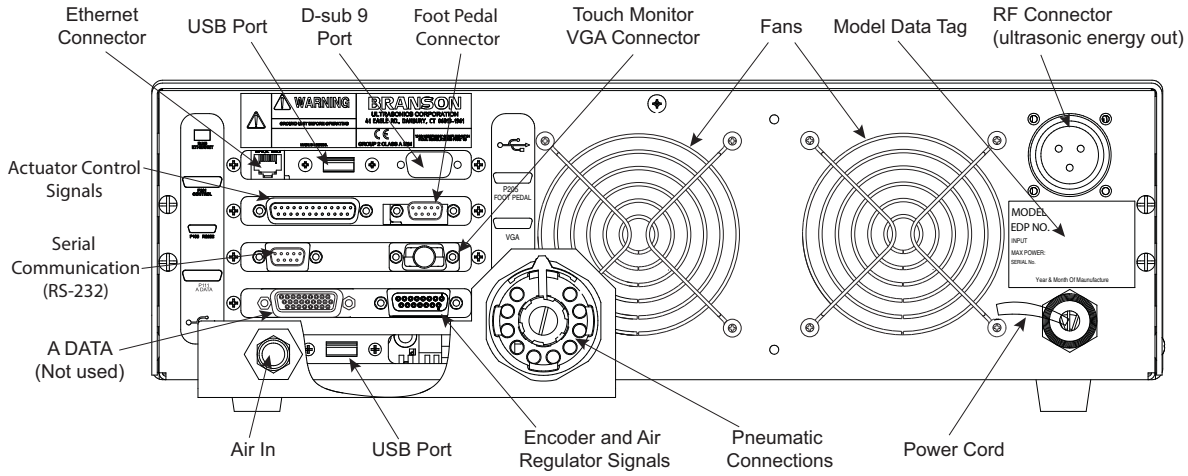
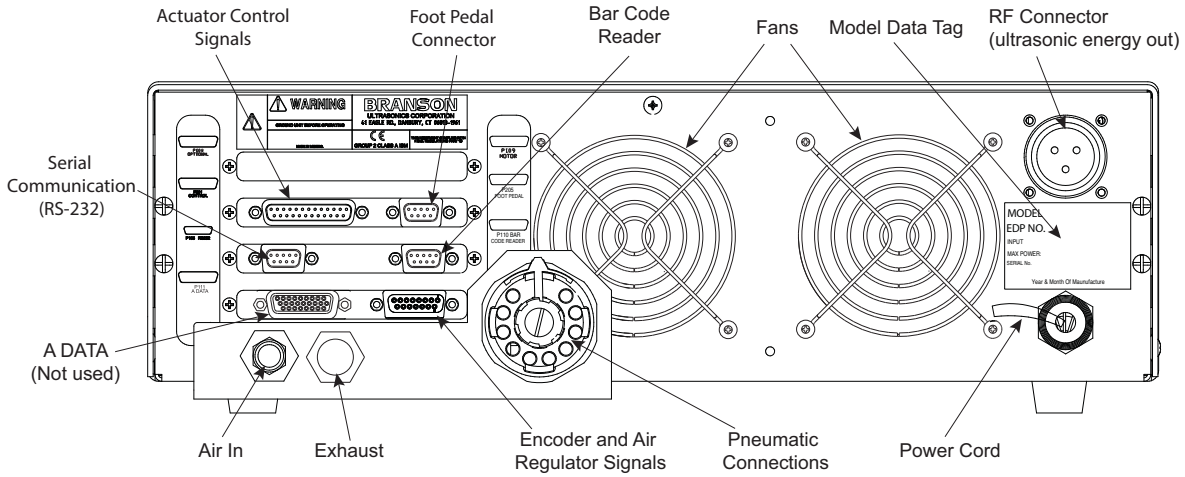


Figure 4.5 Connections on Rear of a Touch Screen Controller



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.

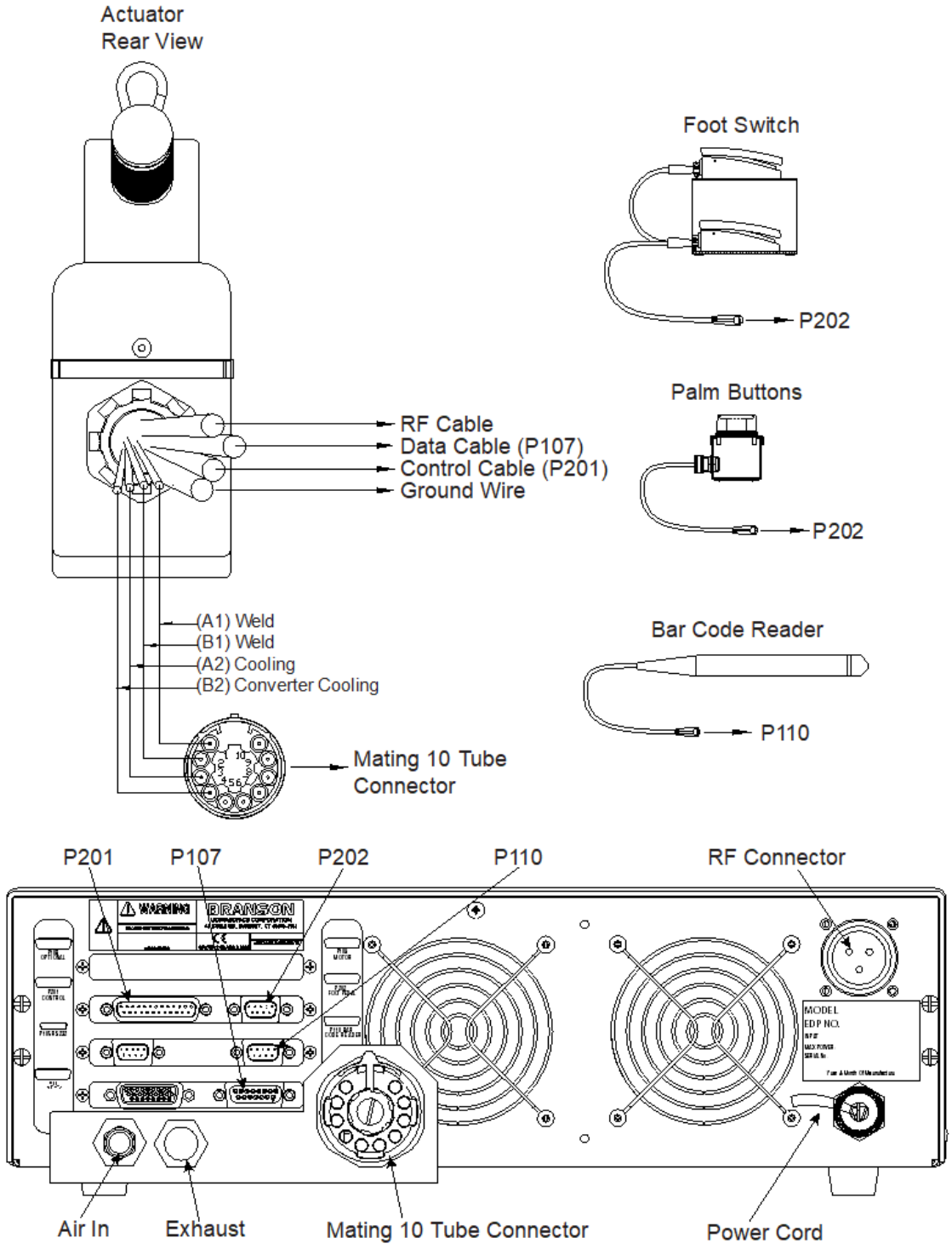
WARNING	
	Never operate the System with the RF Cable disconnected or if the RF Cable is damaged.

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



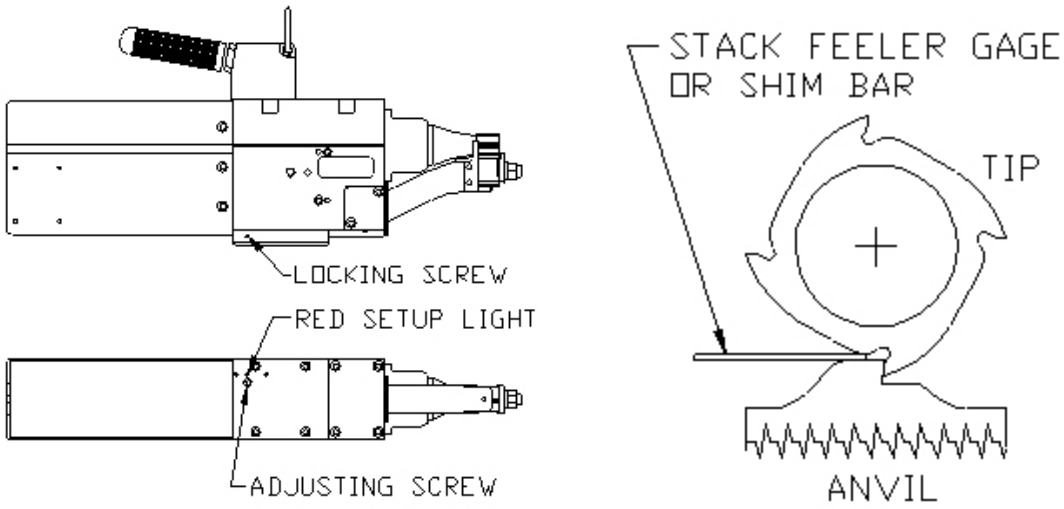
4.5.5 Setting Weld Height Proximity Switch

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

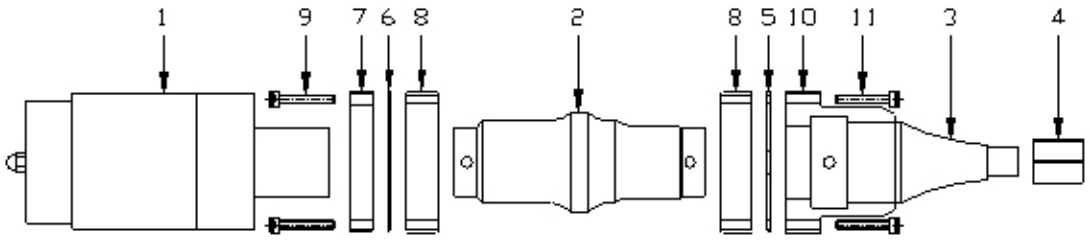


Table 4.4 Ultrasonic Stack Assembly Parts

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

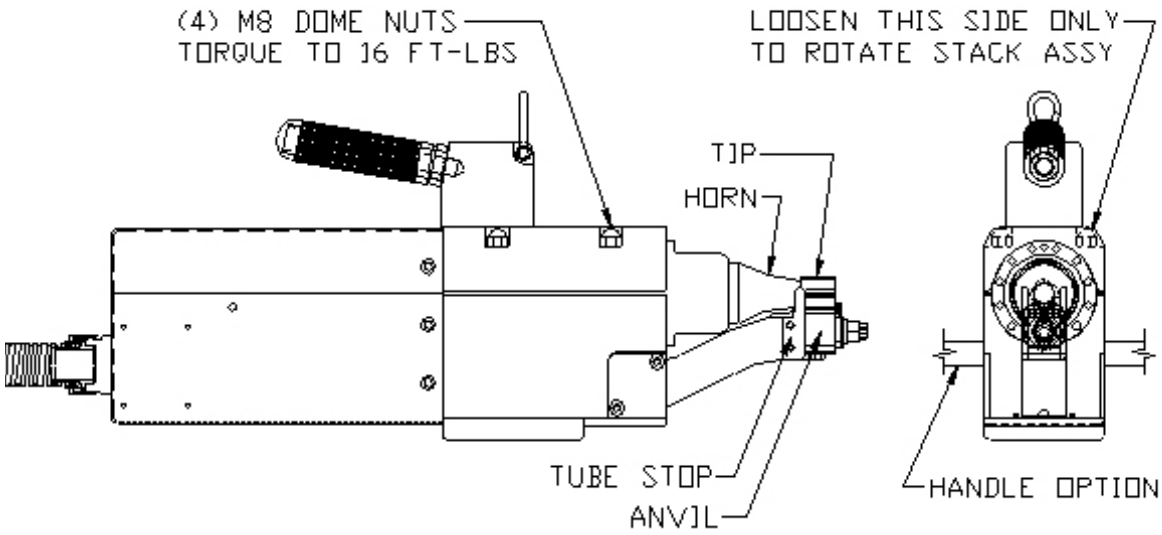
WARNING	
	Do not operate ultrasonics while the tip is loose.

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.

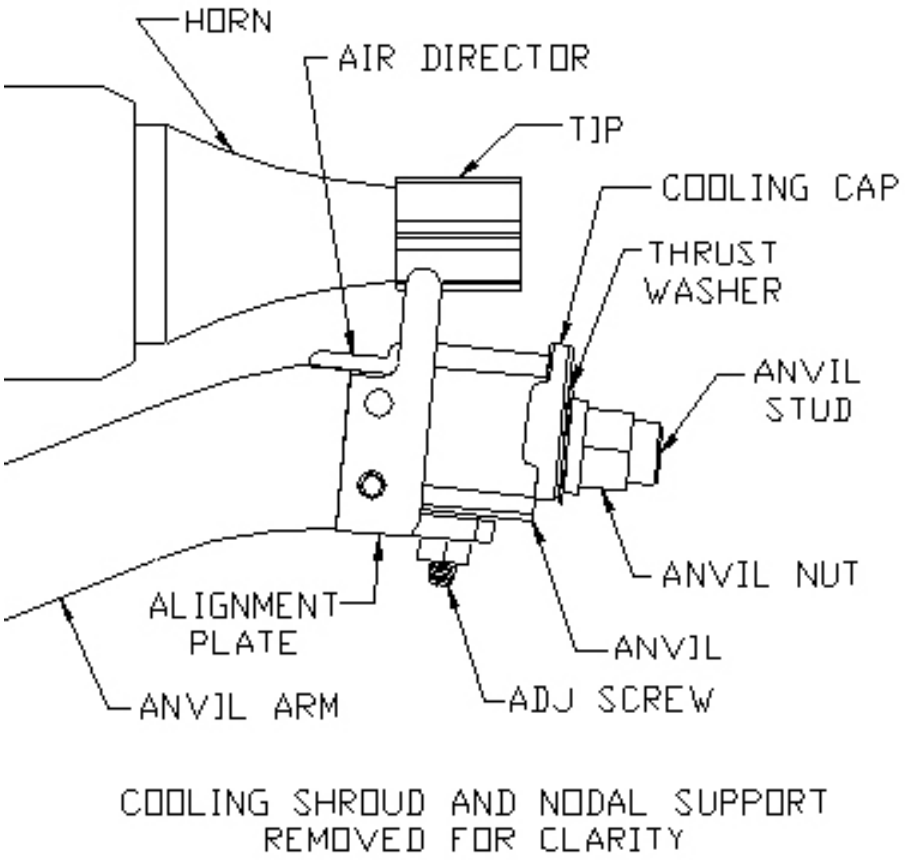
6.2.5 Tool Gap Requirements

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

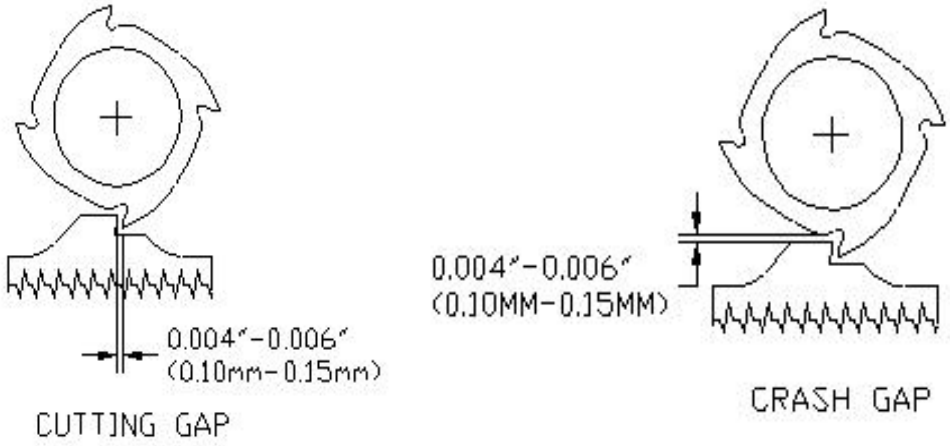
Horn Tip Replacement

- 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

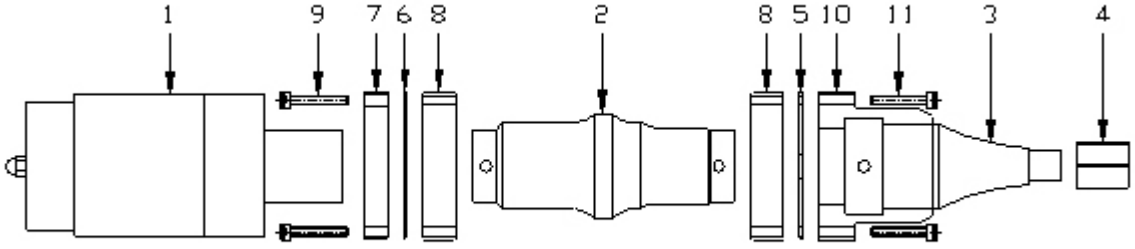


Table 7.1 Ultrasonic Stack Assembly items

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

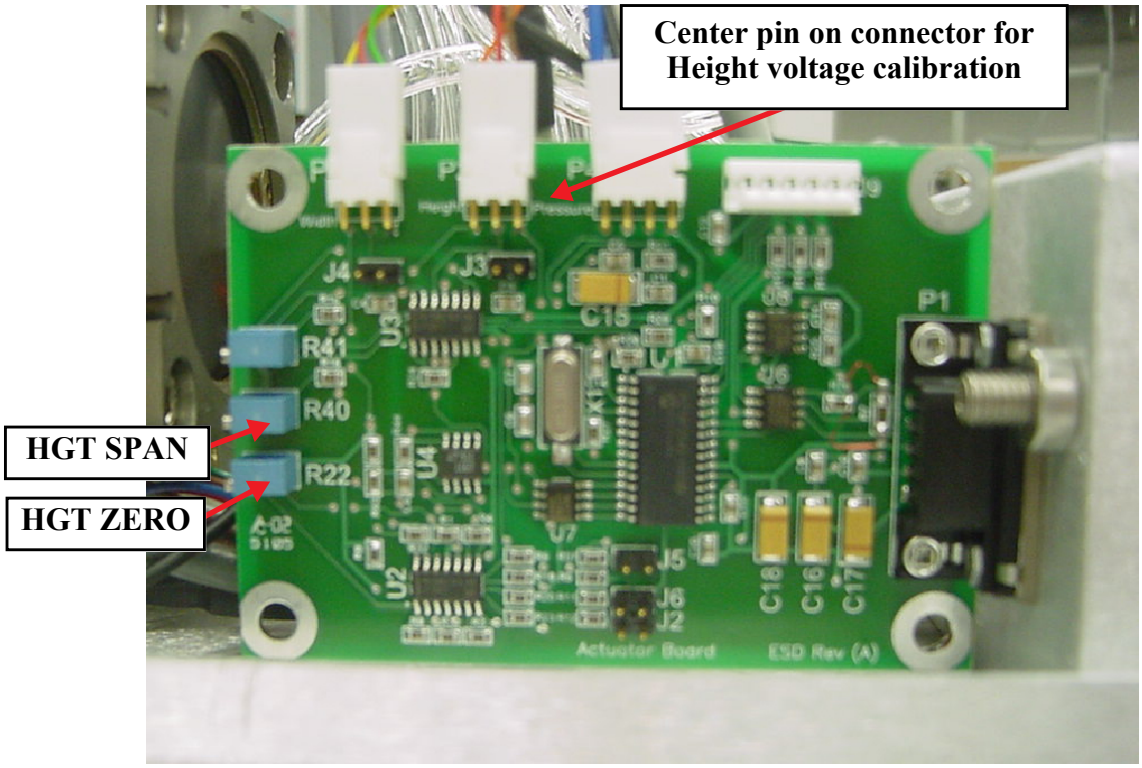
This product does not require scheduled calibration. However, if you are operating under requirements that mandate periodic calibration, for example, the FDA's Good Manufacturing Practices, contact your Branson Metal Welding representative for additional information.

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).

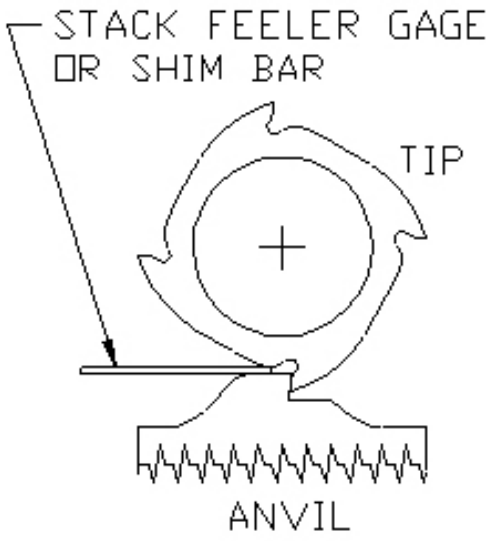
7.2.1.2 Height Calibration

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.

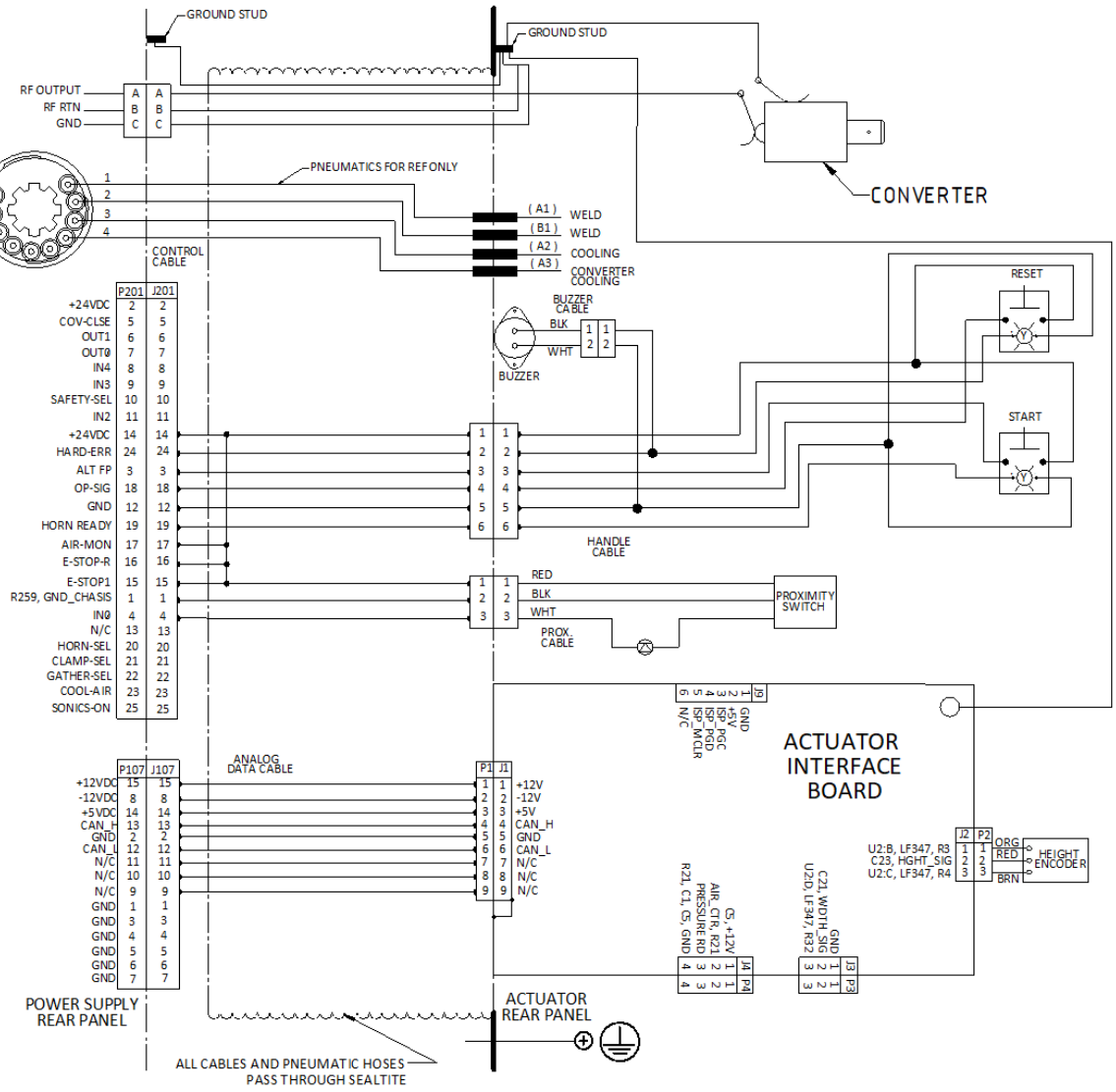
Table 7.4 Primary Spare Items

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

DocuSign Envelope ID: 55AF710C-8203-4C1E-8FD4-02E98293C063

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

Person authorised to compile the technical file:
BRANSON ULTRASONICS, a.s.
Piestanska 1202
91501 Nove Mesto nad Vahom
Slovak Republic

Original Instructions
DCM00062 - REV. 13

EMERSON

VersaGraphix
Controller
Ultraseal 20

Operating Manual

Branson Ultrasonics Corp.
120 Park Ridge Road
Brookfield, CT 06804
(203) 796-0400
http://www.bransonultrasonics.com

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.

Copyright and Trademark Notice

Foreword

Congratulations on your choice of a Branson Metal Welding system!

The Branson VersaGraphix 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 for assistance.

1.1.1 Symbols found in this Manual

These symbols used throughout the manual warrant special attention:

WARNING	Indicates a possible danger
	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 VersaGraphix Controller has several warning labels on it to indicate the presence of hazardous voltages inside the unit.

1.2 General Precautions

Take the following precautions before servicing the VersaGraphix:

- 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 VersaGraphix into a grounded power source
- Power supplies produce high voltage. Before working on the VersaGraphix module, do the following:
  - Turn off the VersaGraphix;
  - Unplug main power; and
  - Allow at least 2 minutes for capacitors to discharge
- High voltage is present in the VersaGraphix Controller. Do not operate with the cover removed
- High line voltages exist in the ultrasonic VersaGraphix 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 VersaGraphix before setting a DIP switch
- Keep hands from under the horn. Down force (pressure) and ultrasonic vibrations can cause injury
- Do not cycle the welding system if either the RF cable or converter is disconnected

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.

NOTICE	
	Because the Branson SBC Controller runs on a Windows XP®[a] based PC Platform, it is susceptible to computer viruses. Reasonable steps have been taken to protect our software but all customers are advised to take all necessary steps to ensure that no virus contamination occurs. Do not attempt to run any applications other than the Branson SBC Controller application. If you chose to connect the SBC controller to a computer network, added precautions must be taken in the form of firewalls, etc. No liability will be accepted for any loss or damage sustained as a consequence of any virus transmission.

a. Windows XP is a registered trademark of Microsoft Corporation.

1.2.1 Intended Use of the System

The Branson VersaGraphix Controller and Actuator are components of an ultrasonic welding system. These are designed for a wide variety of welding or processing applications.

1.2.2 Regulatory Compliance

The Branson products (VersaGraphix Controllers, Welders and Splicers) are 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, and other collateral materials
- NFPA 70 National Electric Code Article 670 Industrial Machinery
- UL 61010-1
- CSA 22.2 No. 61010-1
- NFPA 79 Electrical Standard for Industrial Machinery
- 29 CFR 1910.212 OSHA General Requirements for all machines
- 47 CFR Part 18 Federal Communications Commission

Branson products (VersaGraphix Controllers, Welders and Splicers) are designed to be in compliance with the following listed 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 13849-1 Safety of Machinery - Safety of related parts of control systems
- EN ISO 12100 - Safety of machinery — General principles for design — Risk assessment and risk reduction
- 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 61000-6-1 Electromagnetic Compatibility - Generic standards - Immunity for residential, commercial and light-industrial environments (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 products with CE Mark require: Same as above plus

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 6: 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

NOTICE	
	To return equipment to Branson, you must first obtain an **RGA number** from a Branson Metal Welding 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 Metal Welding Repair Department

120 Park Ridge Road

Brookfield, Connecticut 06804 U.S.A.

direct telephone number: (203) 796-0807

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 Metal Welding 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 the 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 6: 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 Branson VersaGraphix Controller

2.1 Model Covered

This manual provides detailed instructions for the setup, operation, and maintenance of the Branson VersaGraphix Controller. For detailed information on operation and maintenance of other components connected to the Controller, refer to appropriate Actuator instruction manual.

The VersaGraphix Controller contains a microprocessor-based controller that provides for control and monitoring of welding operations.

This document is intended for use with a Ultraseal 20 actuator. This document is intended for use in conjunction with others to form a complete manual for your Branson Metal Welding system. Please refer to the Table Of Contents of this Operating Manual to find specific information.

2.2 Overview of this Model

The Branson welder generates ultrasonic electrical energy through an ultrasonic converter for welding metals. Several models are available, depending on the desired frequency (for example, 20 kHz) or the desired power range (for example, 2.2 kW). The VersaGraphix also contains a microprocessor-based controller module that provides for control and monitoring of welding operations.

2.3 Compatibility with Branson Products

The Branson VersaGraphix Controller is designed to be used with:

- Branson Metal Welding Actuators: Ultraseal 20, Ultrasplice 40, Ultrasplice XL, Auto Terminator, Ultraweld L20, MWX100, and Ultraseal 20
- Branson Metal Welding converters: see Table 2.1 VersaGraphix Controller compatibility with Branson Metal Welding Converters below

Table 2.1 VersaGraphix Controller compatibility with Branson Metal Welding Converters

Branson Model	Converter
20 kHz/1250 W 20 kHz/2500 W 20 kHz/3300 W 20 kHz/4000 W	503, 105
20 kHz/5000 W	High Power
40 kHz/400 W 40 kHz/800 W	4TJ, 4TR, 4TH

2.4 Ultrasonic Theory

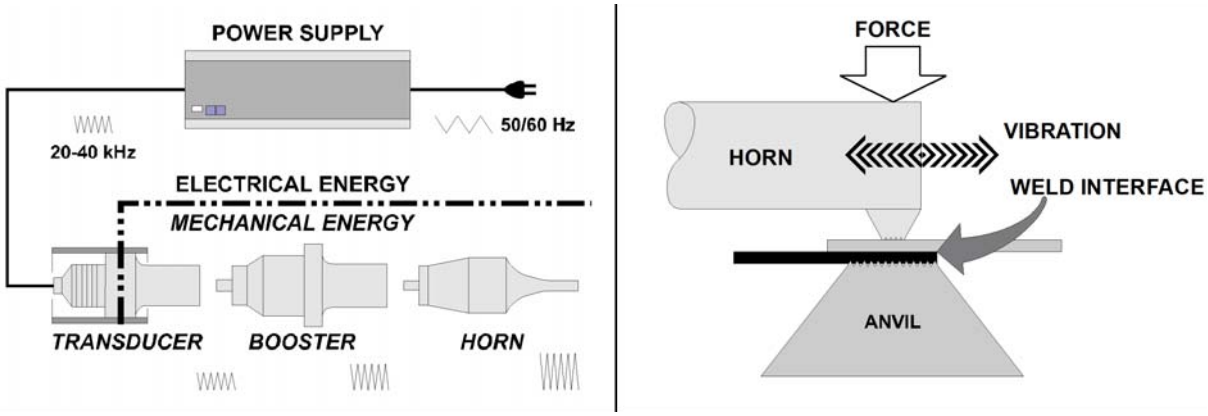
2.4.1 What Is An Ultrasonic Weld?

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

2.4.1.1 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 or 40,000 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 2.1 How does Ultrasonic Welding Work?



2.4.2 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

2.4.3 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 2.2 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 2.3 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:

$$E = (F \times A \times f) \times T$$

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.

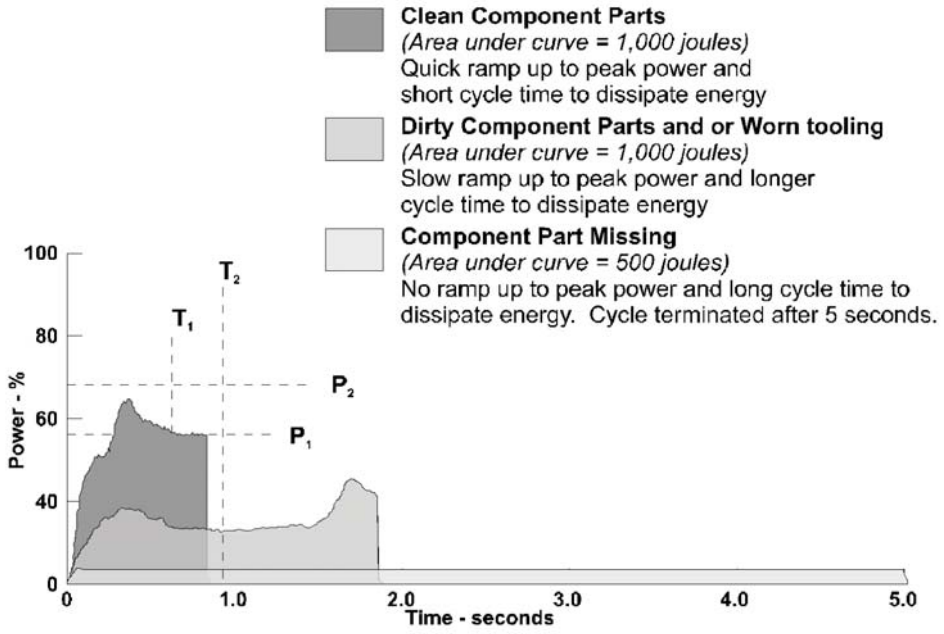
2.4.4 Welding To Energy - Why?

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 2.2 Weld Power Graph for clean components, dirty components, and when part is missing) illustrates a weld produced. The weld 'power graph' is sometimes referred to as 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 2.2 Weld Power Graph for clean components, dirty components, and when part is missing

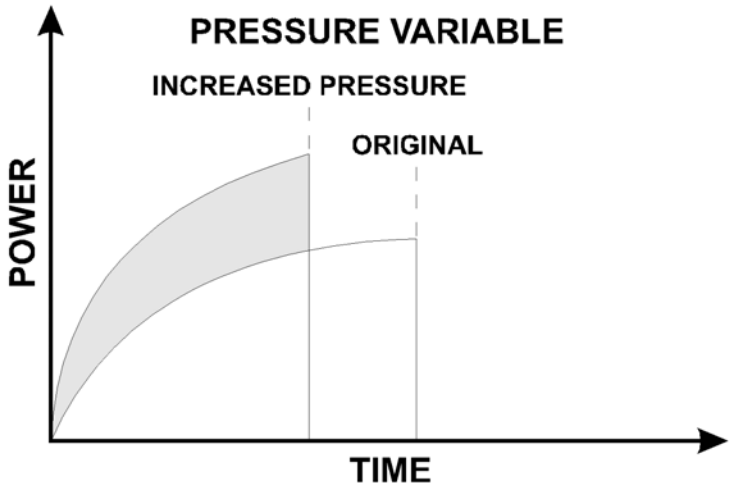


2.4.5 Power

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 2.3.

Figure 2.3 Pressure Variable with Increased Power

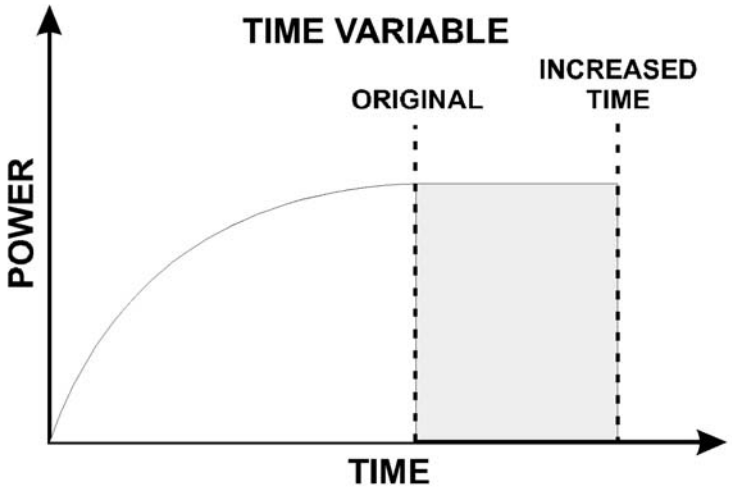


The difference in the appearance of each of the above weld graphs is the result of increased Power loading. Based upon an increase in Pressure, additional Power is required to maintain the motion of vibration. Thus, the same amount of energy is delivered in less time. This approach is typically used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

2.4.6 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 2.4 Pressure Variable with Increased Time).

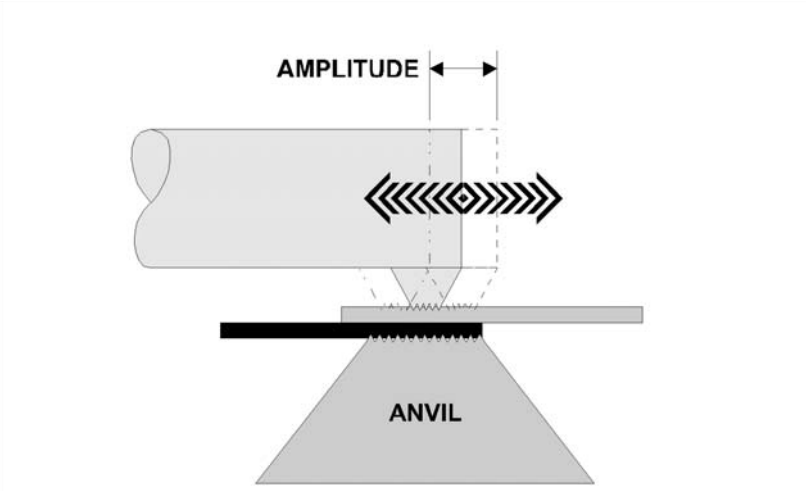
Figure 2.4 Pressure Variable with Increased Time



2.4.7 Amplitude

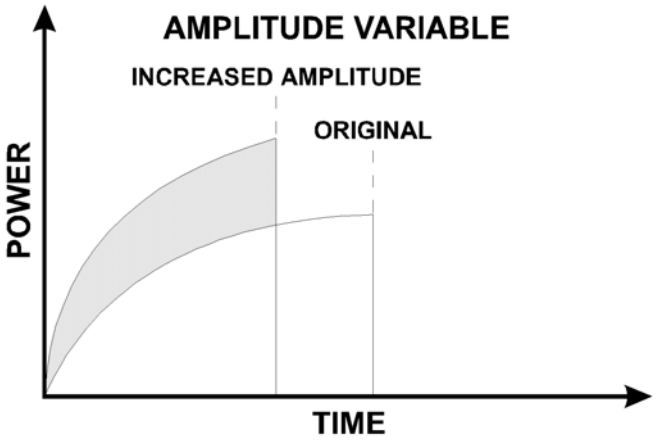
An ultrasonic tool is a resonant acoustical device. The term Amplitude is used to describe the amount of longitudinal expansion and contraction that the tooling endures as it vibrates (Figure 2.5 Scrubbing Action on Weld Interface). The amplitude correlates to the scrubbing action at the weld interface. This scrubbing action combined with pressure is what advances the weld by a diffusing or mixing of the base materials.

Figure 2.5 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 2.6 Amplitude's Influence on Weld Power and Time).

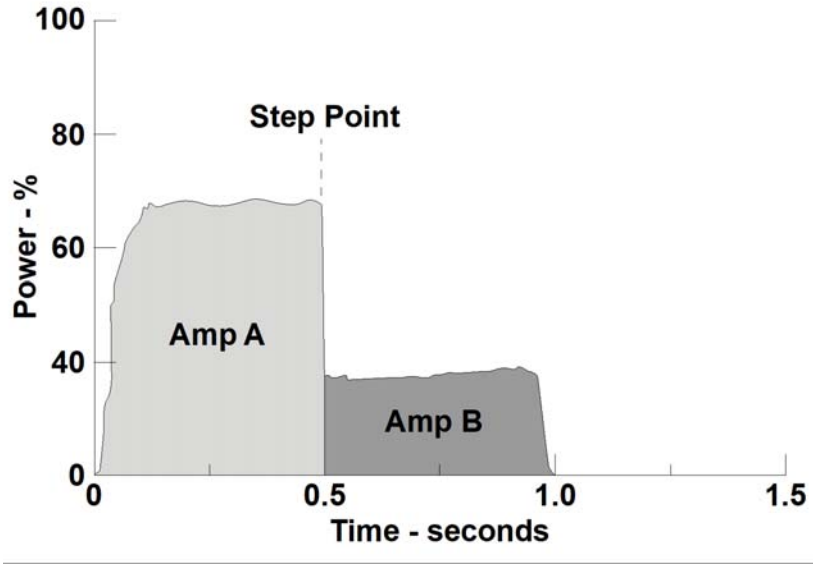
Figure 2.6 Amplitude's Influence on Weld Power and Time



2.4.8 Amplitude Stepping

In standard practice, the scrubbing amplitude at the weld interface is maintained constant during a weld cycle. Recent advances in technology have made it possible to change the amplitude of the horn face during the weld cycle. This is known as Amplitude Profiling. Figure 2.7 Amplitude Stepping Profile illustrates a typical profile where the amplitude is reduced during the cycle. This type of profile is used mostly with welding aluminum to increase weld strength and to help prevent sticking to the tooling.

Figure 2.7 Amplitude Stepping Profile

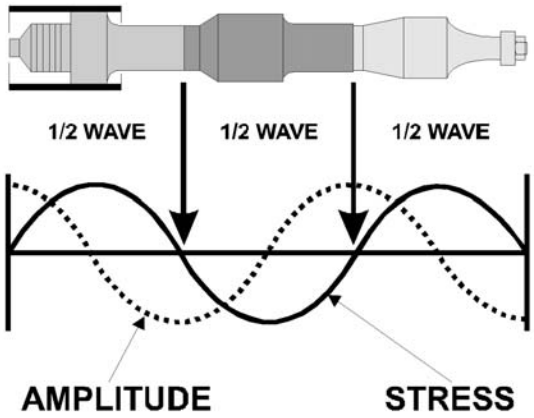


2.4.9 Resonant Frequency

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 Harmonic Resonance on Ultrasonic Tooling). 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



2.4.10 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. Electronic circuits in the system will protect the power supply if this condition exists.

2.4.11 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

2.4.12 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.

2.5 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 the weld is complete and at 1mm from the final height reading. Used when the splice nugget is sticking to the tooling.

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 .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.

Gathering Block: A specially designed mechanical device used to sweep across the face of the Tip to collect the wire strands, and to form the width of the compression chamber.

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 40 kHz, (40,000) or 20 kHz, (20,000) 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-Burst: A short duration (burst) of ultrasonic energy that begins after the Squeeze Time and before capturing the Pre-Height. Used when welding magnet wire. It helps to break up the insulation around the copper, and provide a small cooling period before the weld takes place.

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.

Quick After Burst: Once this option is enabled, the after burst needs to be implemented immediately after each weld cycle finished without any time delay or condition judgment.

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.

Width Encoder: A device utilized to monitor the position of the Gathering Block.

Chapter 3: Shipping and Handling

3.1 Shipping and Handling

CAUTION	
	The VersaGraphix Controller's internal components are sensitive to static discharge. Many components can be harmed if the unit is dropped, shipped under improper conditions or otherwise mishandled.

3.1.1 Environmental Specifications

The VersaGraphix Controller is an electronic unit that converts line voltage to ultrasonic energy and controls user input for regulating the weld process. Its internal components are sensitive to static discharge, and many of its components can be harmed if the unit is dropped, shipped under improper conditions, or otherwise mishandled.

The following environmental guidelines should be respected when shipping the VersaGraphix Controller and Touchscreen Monitor:

Table 3.1 Environmental Requirements

Environment	Range
Storage / Shipping Temperature	-13º F to +131º F (-25º C to +55º C)
Shock / Vibration (Transit)	40 g shock / 0.5 g and (3-100 Hz) vibration per ASTM 3332-88 and 3580-90
Humidity	30% to 95%* non condensing

*Above 40° C the humidity drops to 90%

3.2 Receiving

The VersaGraphix Controller is a sensitive electronic device. Many of its components can be harmed if the unit is dropped or otherwise mishandled.

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

Scope of Delivery

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

To inspect the VersaGraphix Controller when it is delivered, take the following steps:

Table 3.2 Inspect the VersaGraphix Controller upon delivery

Step	Action
1	Verify that all parts are complete according to the packing slip.
2	Check the packing and the unit for damage (visual inspection).
3	Report any damage claims to your carrier immediately.
4	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 Actuator and the VersaGraphix Controller are heavy. Handling, unpacking, and installation might require assistance or the use of a lifting device.

3.3 Unpacking

The VersaGraphix is fully assembled. It is shipped in a sturdy cardboard box. Some additional items are shipped in the box with the Controller.

Table 3.3 When unpacking the Controller, take the following steps

Step	Action
1	Unpack the VersaGraphix Controller as soon as it arrives. Save the packing material.
2	Inspect the unit for signs of damage.
3	Remove the cover of the VersaGraphix Controller (see 6.3 Parts Replacement) to check if any components became loose during shipping.
4	Store or ship the VersaGraphix Controller only within a temperature range of -13º F to +131º F (-25º C to +55º C).

NOTICE	
	If damage has occurred, notify the shipping company immediately. Retain packing materials for inspection.

3.4 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 appropriate procedure.

Chapter 4: Technical Specifications

4.1 Environmental Requirements

The VersaGraphix Controller and Touchscreen Monitor have the following Environmental Requirements:

Table 4.1 Environmental Requirements

Environmental Concern	Controller/Controller	Touchscreen
Ambient Operating Temperature	+41º F to +122º F (+5º C to +50º C)	+32º F to +104º F (0º C to +40º C)
Storage/Shipping Temperature	-13º F to +131º F (-25º C to +55º C*)	-4º F to +131º F (-20º C to +55º C)
Humidity	30% to 95%**non condensing	30% to 80%
Operating Altitude	1000 m (3280 ft)	3658 m (12000 ft)
IP Rating	2X	

*70° C for 24 hours

**Above 40° C the humidity drops to 90%

4.2 Electrical Requirements

The following tables list input voltages, current requirements, and fuse requirements for the VersaGraphix Welding System, and includes power required when it is used with Branson Metal Welding Actuators.

Table 4.2 Electrical Input Operating Voltage

Power Supply Rating	Nominal Input Operating Voltage, +/-10%
20 kHz / 3300 W	200-230 V, 50/60 Hz, Single Phase
20 kHz / 4000 W	200-230 V, 50/60 Hz, Single Phase

Table 4.3 Input Current and Fuse Requirements

Model	Input Current	Fuse Requirements
For 20 kHz Models	3300 W 200V - 230V	21 Amp Max. @ 200V / 20 Amp fuse
	4000 W 200V - 230V	25 Amp Max. @ 200V / 25 Amp fuse

4.3 Pneumatic Requirements

The factory compressed air supply must be “clean (to a 5 micron level), dry and unlubricated” air with a regulated maximum pressure of 80 psig (5.5 bar).

4.4 Operating System

The VersaGraphix Controller uses an embedded Single Board Computer (SBC) to offer advanced user interface functions. It uses Windows XP Embedded (Windows XPE) as its operating system.

4.4.1 About Microsoft Windows XP Embedded

While Windows XPE is similar to the standard desktop version of Windows XP there are some differences that the advanced user should be aware of.

The VersaGraphix Controller's SBC uses a solid state hard disk in the form of a Compact Flash card. While this Compact Flash card appears to be the same type used in digital cameras, it is a special industrial version which allows the Windows XPE operating system to boot.

To protect the application and the operating system, Windows XPE employs a File Based Write Filter (FBWF). This filter uses a RAM overlay to record changes to the Compact Flash Hard Drive. Any changes made to the C: drive are lost during a power cycle. Only the C:\AmtData folder remains unprotected allowing the VersaGraphix application to write directly to the Compact Flash card in order to save presets, sequences, setup parameters and log files.

The FBWF must be disabled before modifying the Windows XPE configuration. Changes made to Windows XPE configuration such as printer driver installation or Local Area Network configuration will be lost if the FBWF has not been previously disabled. Once all changes have been saved, the FBWF must be re-enabled before resuming controller operations. Enabling and disabling the FBWF goes beyond the scope of this application user manual. Contact customer support if this becomes necessary (see 1.5.3 Contact Information).

NOTICE	
	Operating the system while the FBWF is disabled will not allow the application to save presets, sequences, setup parameters and log file information.

Chapter 5: Operation

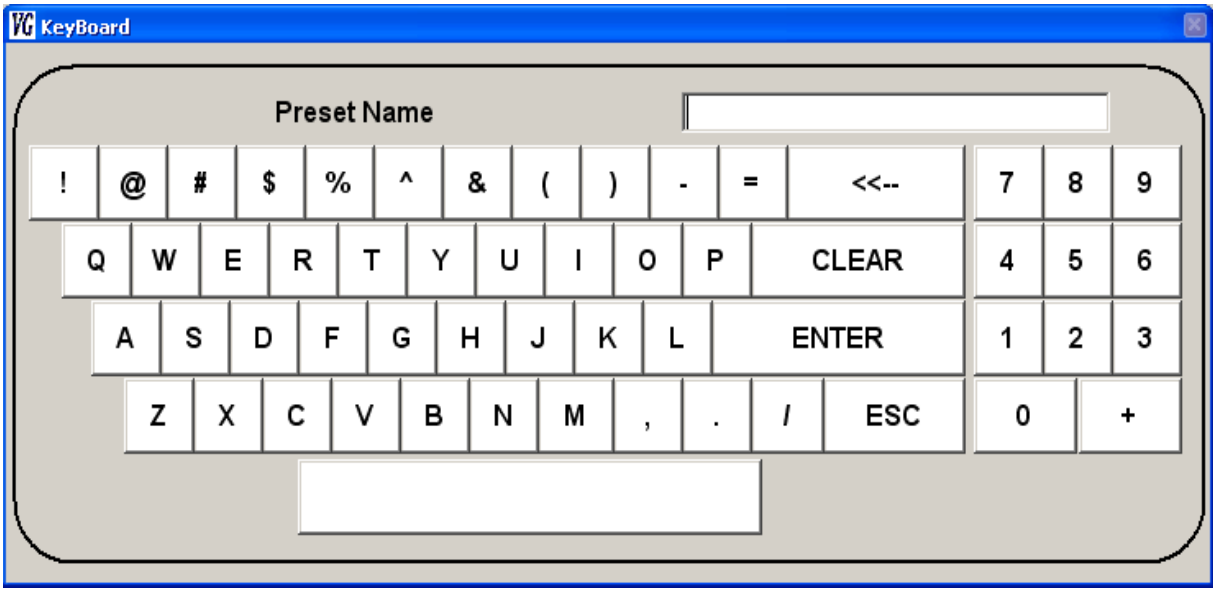
5.1 Before You Begin

High voltage might be present in the Branson VersaGraphix Controller (VersaGraphix). When setting up and operating the welding system, observe the potential hazards listed below.

- Do not operate the VersaGraphix with the cover removed
- To prevent the possibility of electric shock, always plug the VersaGraphix Controller into a grounded power source
- Do not cycle the welding system if either the RF cable or the converter is disconnected. High voltage could be present at open power connections
- Assure power switch is in the OFF position before making or breaking any electrical or pneumatic connections to the VersaGraphix and/or Welder
- Do not touch Ultrasonic Horn during or immediately following the welding cycle. Vibrations and heat can burn skin

5.2 Pop Up Alphanumeric Keypad

Figure 5.1 Alphanumeric Keypad

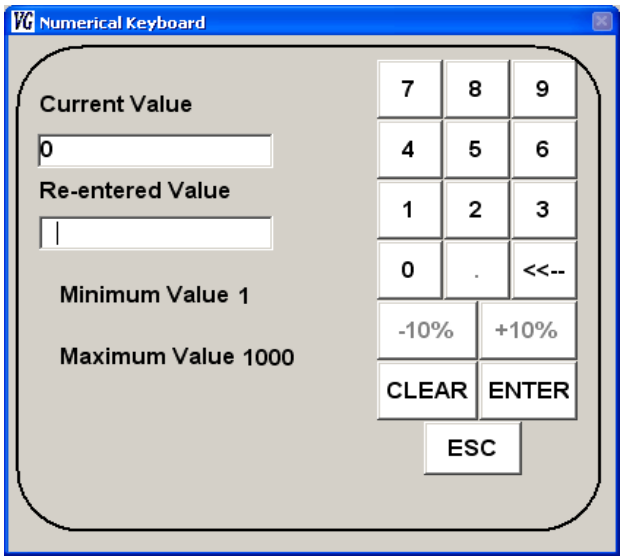


A pop up keypad will be displayed on the touchscreen when it is necessary to enter alphanumeric data using the touchscreen. This keyboard includes upper case letters A through Z, numbers 0 through 9, space, backspace, enter, clear and cancel. It also includes the following symbols: ! @ # $% ^ & () - = / + and ,.

Using non permitted characters when naming a preset or a sequence may happen if you use an external keyboard. To avoid system errors due to invalid name, please refer to the alphanumeric characters in the image above when naming a preset or a sequence with an external keyboard.

5.3 Pop Up Numeric Keypad

Figure 5.2 Pop Up Numeric Keypad



A numeric keypad will pop up on the touchscreen when it is necessary to input numeric data. This Keypad includes buttons for the numbers 0 through 9, decimal point, Backspace (<<--), ENTER, CLEAR, and ESC. It also has a +10% button and a -10% button, which are used to enter values +/- 10% of the currently set value, allowing quicker setups.

5.4 Editing Buttons

Edit

When the “Edit” is highlighted, it allows you to edit sequences.

Delete

When the “Delete” button is highlighted, you may remove unwanted sequence steps. On the file manager screen the “Delete” buttons allows you to eliminate unwanted files in the Browse and Application folders.

Enter

Touching the “Enter” button saves changes.

Copy

When highlighted, the “Copy” button allows you to create a copy of a sequence step.

Escape

Touching the “Escape” button undoes the previous change.

Copy To

“Copy To” buttons are available on the File Manager screen. You may use them to copy files between the Browse and Application folders.

Move To

“Move To” buttons are available on the File Manager screen. You may use them to move files between the Browse and Application folders.

Select All

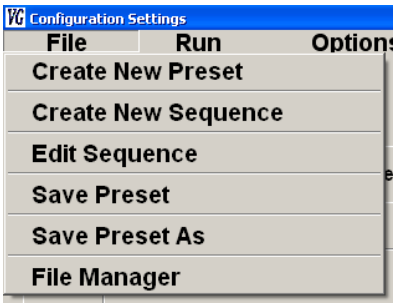
“Select All” buttons are available on the File Manager screen. You may use them to **Move**, **Copy,** or **Delete** at once all files in the user’s or Branson’s Application folders.

5.5 Pull Down Menus

Use the pull down menus at the top of each screen to navigate between different screens. The title of each screen appears in the screen's title bar.

5.5.1 File Menu

Figure 5.3 File Menu



5.5.1.1 Create New Preset

Select Create New Preset to input new weld Preset names into the controller. The Presets will be saved into the controller's library with default preset values. You may then proceed to the Setup screen to enter the preset's weld parameters. See 5.10.3 Setup Screen (When Running a Preset) for more information on entering weld parameters.

5.5.1.2 Create New Sequence

Select Create New Sequence to input weld sequences. A sequence is a series of grouped weld presets which are to be executed in a particular quantity and order. Sequences are constructed using existing weld presets stored in the Controller's library.

5.5.1.3 Edit Sequence

Touching this option will take you to the Edit Sequence screen where you can modify Sequences.

5.5.1.4 Save Preset

When a preset is modified on the Setup Screen, the preset is modified in running memory. An ' * ' symbol is appended to the preset name to indicate that the preset has not been saved. By selecting Save Preset, changes to the preset that is currently running on the Controller are made permanent. This also causes the ' * ' to disappear from the preset name.

NOTICE	
	Unless the preset is saved by selecting Save Preset, all unsaved setup changes will be lost when loading a different preset, closing the VersaGraphix application, or powering off the VersaGraphix Controller.

5.5.1.5 Save Preset As

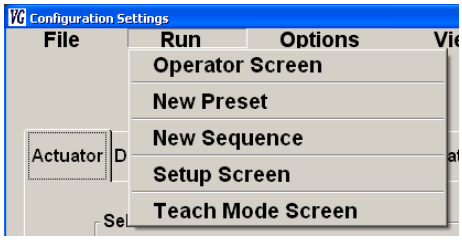
By selecting Save Preset as you can create a copy of the preset currently running on the Controller. You will be prompted to supply a new preset name. This new preset will be automatically loaded to memory.

5.5.1.6 File Manager

Selecting File Manager will take you to the Branson File Manager screen. From this screen files can be moved and copied between your directories and Branson's Application Directory. You can also delete files from either your own folders or from Branson's application folders.

5.5.2 Run Menu

Figure 5.4 Run Menu



5.5.2.1 Operator Screen

Touching this button will take you to the operator screen. You can choose the Operator Screen to be the start screen when you turn on your controller. For information see 5.11.1.4 System Configuration.

5.5.2.2 New Preset

Select New Preset to load a preset from the Controller's library. After selecting a preset the Operator Screen will be displayed.

5.5.2.3 New Sequence

Select New Sequence is used to load a Sequence from the Controller's library. After selecting a sequence the Operator Screen will be displayed.

5.5.2.4 Setup Screen

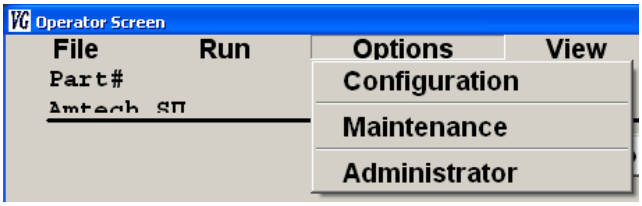
When running a preset, select Setup Screen to change individual weld parameters which are the basic elements required to make a weld. See 5.10.3 Setup Screen (When Running a Preset) for more details on entering weld parameters.

When running a Sequence, the Setup Screen can be used to monitor results for each weld. Weld parameters cannot be edited when running a sequence.

You can choose the Setup Screen to be the start screen when you turn on your controller. For information see 5.11.1.4 System Configuration.

5.5.3 Options Menu

Figure 5.5 Options Menu



5.5.3.1 Configuration

Select this option to access the Configuration screen where Controller features can be setup. These features include: Actuator model; default weld settings; Teach Mode settings; System Configuration; and COM settings.

5.5.3.2 Maintenance

Select this option to access the Maintenance screen. This screen allows adjustment and on-demand control of motion devices used in the actuator. This screen also allows access to the maintenance log, maintenance counters, and limit settings.

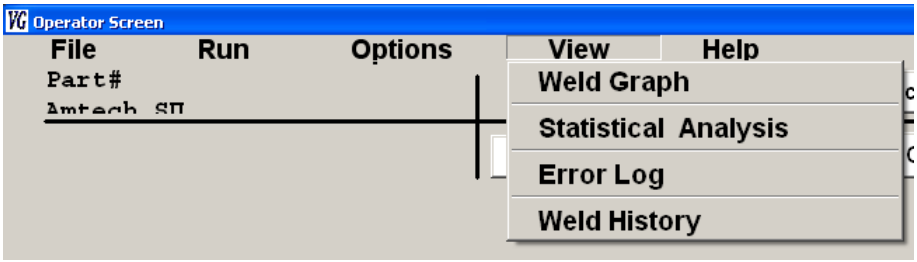
5.5.3.3 Administrator

Select this option to access the Administrator screen. From this screen you can exit the Controller program; determine if Windows should shut down at exit; rename auxiliary buttons; enable password requirement; edit the Administrator and Technician passwords; and set screen permissions.

NOTICE	
	The default password is **ADMIN**.

5.5.4 View Menu

Figure 5.6 View Menu



5.5.4.1 Weld Graph

Selecting this option will display a popup window with a graph showing how the last weld developed over time.

5.5.4.2 Statistical Analysis

Select this option to view weld result data for Time, Power, Pre-Height and Height in relation to their quality windows.

5.5.4.3 Error Log

Selecting this option will take you to the Error Log window. In this window the date/time, part name, error type and value for unsuccessful welds can be viewed and printed.

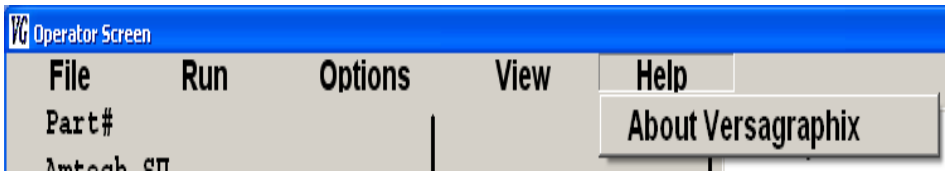
5.5.4.4 Part History

Select this option to view and/or print weld results.

5.5.5 Help Menu

5.5.5.1 About VersaGraphix

Figure 5.7 About VersaGraphix



Select About VersaGraphix to display the VersaGraphix's software version, and Controller version.

5.5.6 Branson Logo

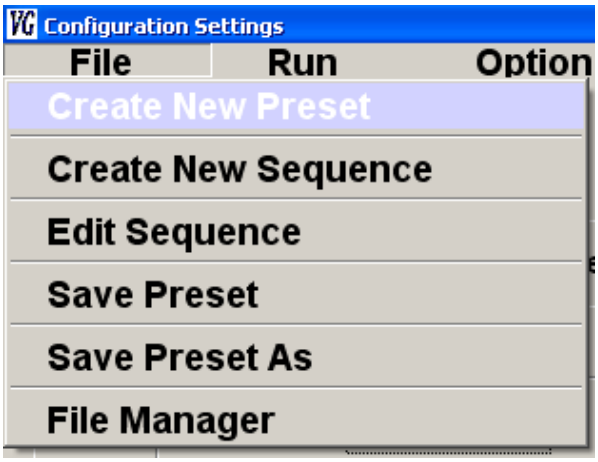
Figure 5.8 Branson Logo

Touching the Branson logo in any of the screens will cause the Language Settings window to pop up.

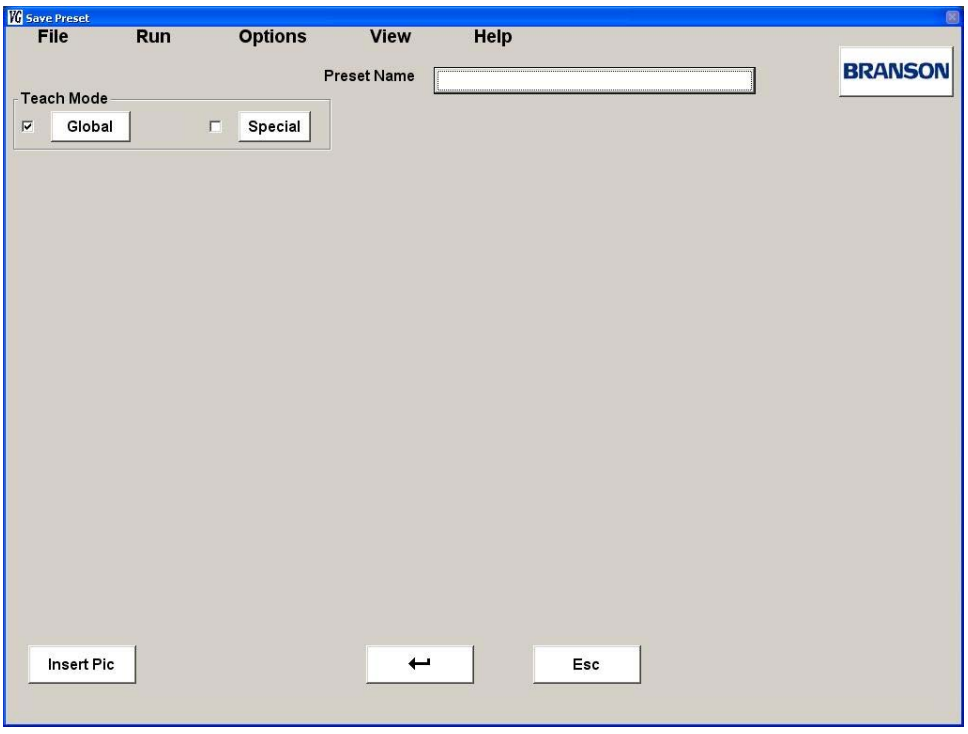
5.6 Create New Preset

Table 5.1 Create New Preset

Step	Action
1	Select Create New Preset from the File Menu



Step	Action
2	Touch the field next to Preset Name. (An alphanumeric keyboard will pop up). Input the preset name (20 characters max).



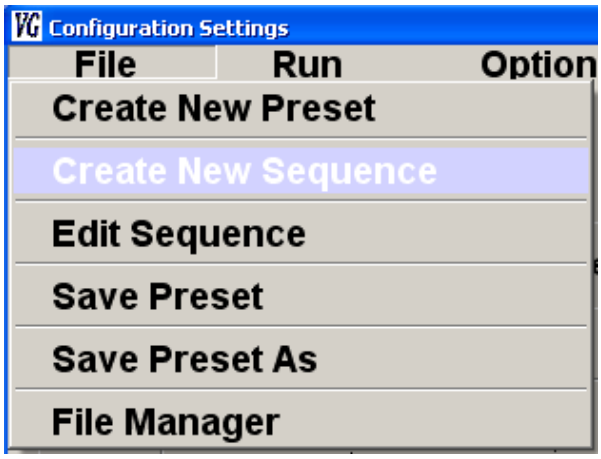
Step	Action
3	Select either Global or Special Teach Mode settings for your preset. Global Settings are set on the Teach tab in the Configuration Screen. For more information, see 5.11.1.3 Teach Mode Settings.
4	Touch the Insert Pic button to include an image to be displayed on the Operator screen as a visual aid for manufacturing.
5	Press the Enter button to save the preset.

Presets will be saved into the Controller's library with default preset values. You may then proceed to the Setup screen to enter the preset's weld parameters. See 5.10.3 Setup Screen (When Running a Preset) for more information on entering weld parameters.

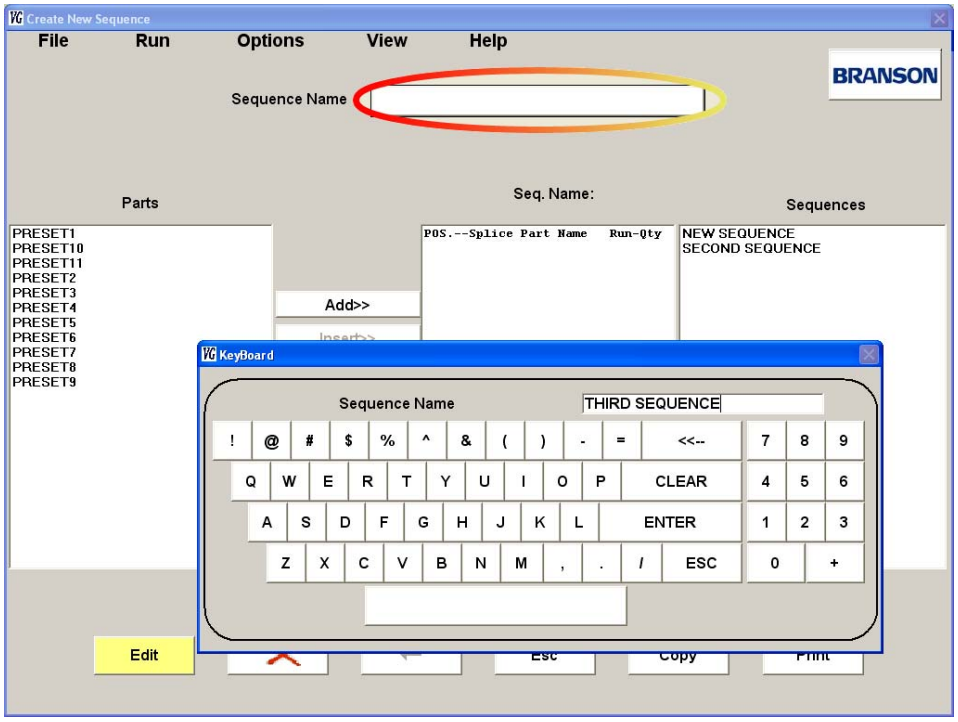
5.7 Create New Sequence

Table 5.2 Create New Sequence

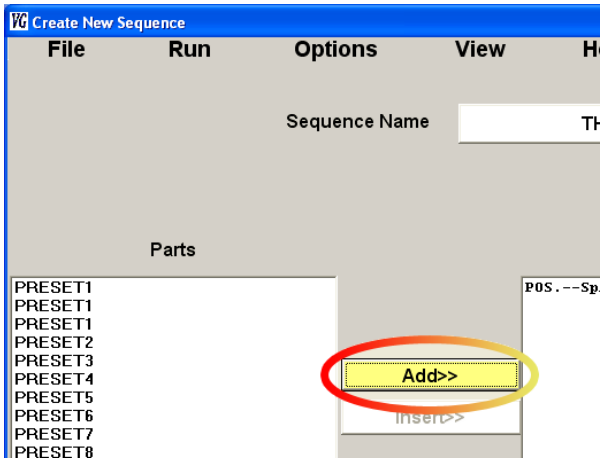
Step	Action
1	From the File menu select **Create New Sequence**

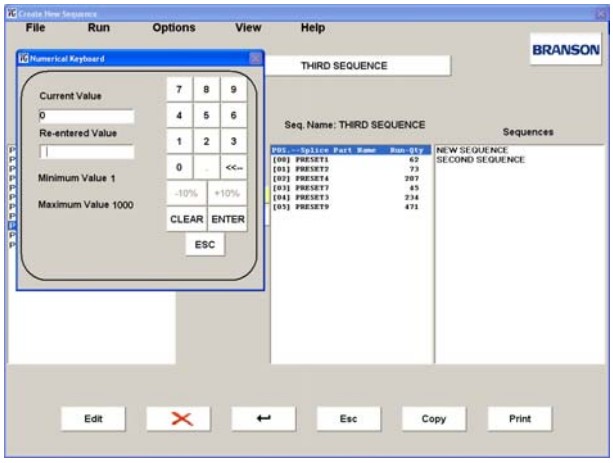


Step	Action
2	Touch the field next to **Sequence Name**. (An alphanumeric keyboard will pop up). Input the sequence name (20 characters max).

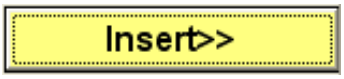


Step	Action
3	Touch the **ADD>>** button then choose a Preset from the Parts list to add a step. A numerical keyboard will pop up. Enter the number of welds for the step. Each step in a sequence can support multiple welds of a single weld preset.





NOTICE	
	Touching the **Insert** button allows user to insert steps. After touching the Insert button select a part from the Parts list. Then touch the position above which you wish to insert it. A numeric key pad will pop up. Enter the amount of welds you wish to make and press enter to insert the step.



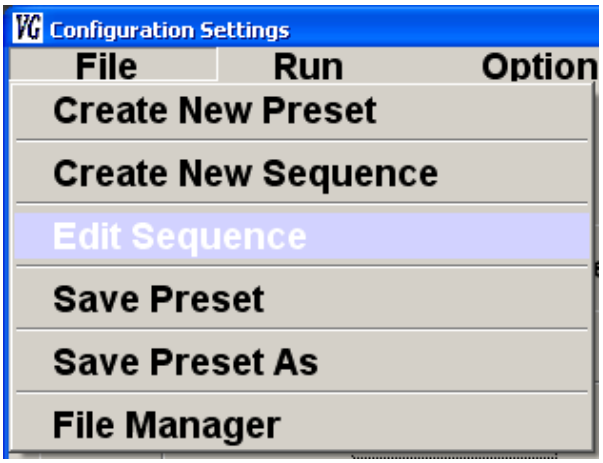
Step	Action
4	Once sequence has been completed touch the **Enter** button to save it. The VersaGraphix supports up to 250 presets per sequence.

5.8 Edit Sequence

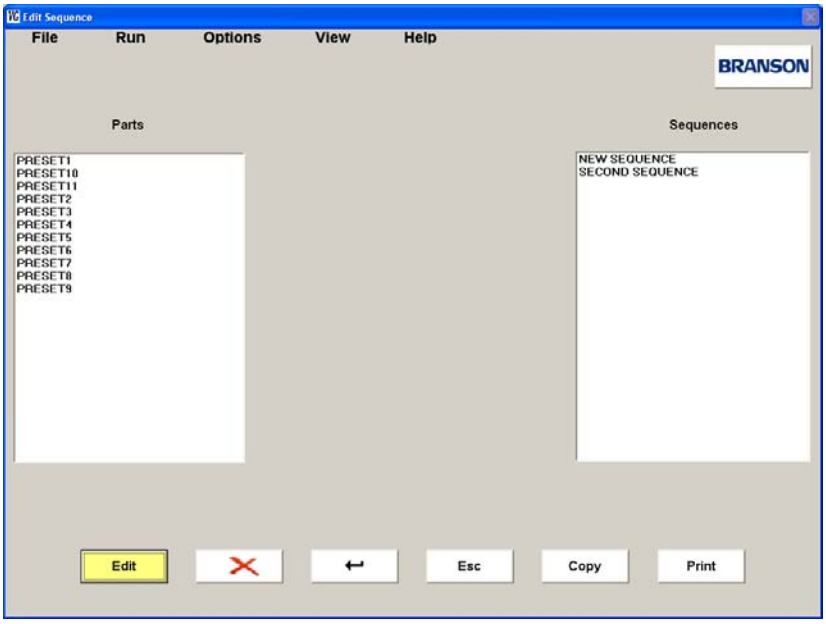
Existing Sequence presets may be edited from the Edit Sequence Screen.

Table 5.3 Edit Sequence

Step	Action
1	From the File menu touch the Edit Sequence.



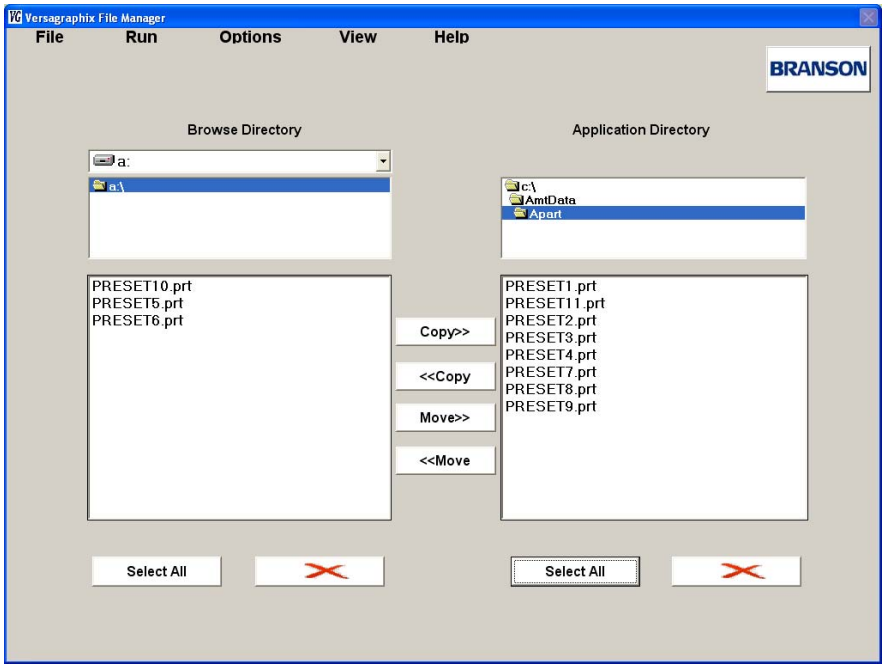
Step	Action
2	Touch the **Edit** button so that it is highlighted. Select the **Sequence** preset to be edited from the preset library.



Step	Action
3	A list box with the sequence's steps will appear in the middle of the window. The steps may now be edited (go to 5.7 Create New Sequence for more information on sequences).
4	Press the enter button to save the changes.

5.9 File Manager

Figure 5.9 File Manager



The File Manager screen is used to maintain data files used by the application. You may copy Presets, Sequences and History files to and from the VersaGraphix to other storage devices such as USB memory sticks, and external network drives. The Application Directory box shows the files that are available to the application. They are stored in a fixed directory structure as shown. The user's browsing on the controller files is limited to these three directories:

Presets: **C:\AmtData\Apart\Prstname.prt**

Sequences: **C:\AmtData\Aseq\Seqname.seq**

Log Files: **C:\AmtData\history\Wename.tsv**

5.9.1 Copying Files To The Application

Table 5.4 To copy files from the **Application Directory** to the **Browse Directory**

Step	Action
1	Touch the **<<Copy** button, so that it is highlighted.
2	Touch the file(s) on the **Application Directory** that you wish to copy into the **Browse Directory**.

Table 5.5 To copy files from the **Browse Directory** to the **Application Directory**

Step	Action
1	Touch the **Copy>>** button, so that it is highlighted.
2	Touch the file(s) on the **Browse Directory** that you wish to copy into the **Application Directory**.

NOTICE	
	Only files of types .prt, .seq, and .tsv can be copied using the file manager. They will automatically be put into the appropriate application library directory.

5.9.2 Moving Files

Table 5.6 To move files from the **Application Directory** to the **Browse Directory**

Step	Action
1	Touch the **<<Move** button, so that it is highlighted.
2	Touch the file(s) on the **Application Directory** that you wish to move into the **Browse Directory**.

Table 5.7 To move files from the **Browse Directory** to the **Application Directory**

Step	Action
1	Touch the **Move>>** button, so that it is highlighted.
2	Touch the file(s) on the **Browse Directory** that you wish to move into the **Application Directory**.

NOTICE	
	Moving files works the same as Copying with the exception that the source file is deleted after the transfer.

5.9.3 Deleting Files

Table 5.8 To delete files from the either the Application Directory or the Browse Directory

Step	Action
1	Touch the Delete button under the appropriate directory, so that it is highlighted.
2	Touch the files you wish to delete. (You will be prompted to confirm).
3	Select Yes to delete the file.
4	Repeat steps 2 and 3 for all the files you wish to delete.

NOTICE	
	If you Touch the Select All button when the Delete button is highlighted you will be prompted to confirm the deletion of all the files in the directory.

5.10 Run Menu

The Run pull down menu contains the following choices:

5.10.1 Operator Screen (When Running a Preset)

Figure 5.10 Operator Screen (When Running a Preset)

This is the Operator Screen when running a preset. You can choose this screen to be the start screen when you turn on your controller. For information see 5.11.1.4 System Configuration.

Displayed on the upper section of the screen are the Preset's name, the part counter (Part Count), cycle counter (Cycles), and the batch size (End Count). The cycle counter keeps track of the amount of welds performed. When the Part Counter equals the End Count the controller will ask if you want to reset the part counter to zero. Touch the **Part Count** or the **Cycles** button to reset the cycle or part counter. Touch the End Count button to enter a new batch size.

Touch the red arrow to switch between the Operator and Setup screens.

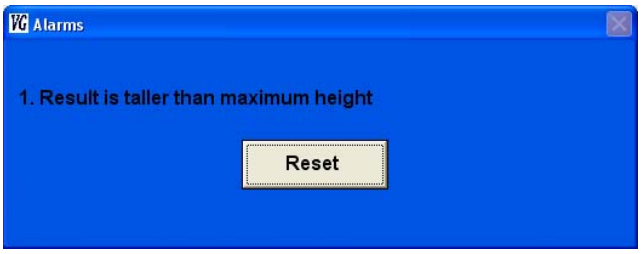
When running a preset on the Operator Screen, changes made to the End Count are kept in memory only. The preset name will display a ' * ' symbol to note that the preset has not been saved. If a different preset is loaded, the VersaGraphix application is closed, or the VersaGraphix Controller is powered off, unsaved changes will be lost. To save the End Count change to the preset file, select Save Preset from the File menu, or select Save Preset As to save the changes into a new preset file.

NOTICE	
	Unless the preset is saved by selecting Save Preset, all unsaved setup changes will be lost when loading a different preset, closing the VersaGraphix application, or powering off the VersaGraphix Controller.

NOTICE	
	If an image was selected for the preset, it will be displayed on the middle of the screen.

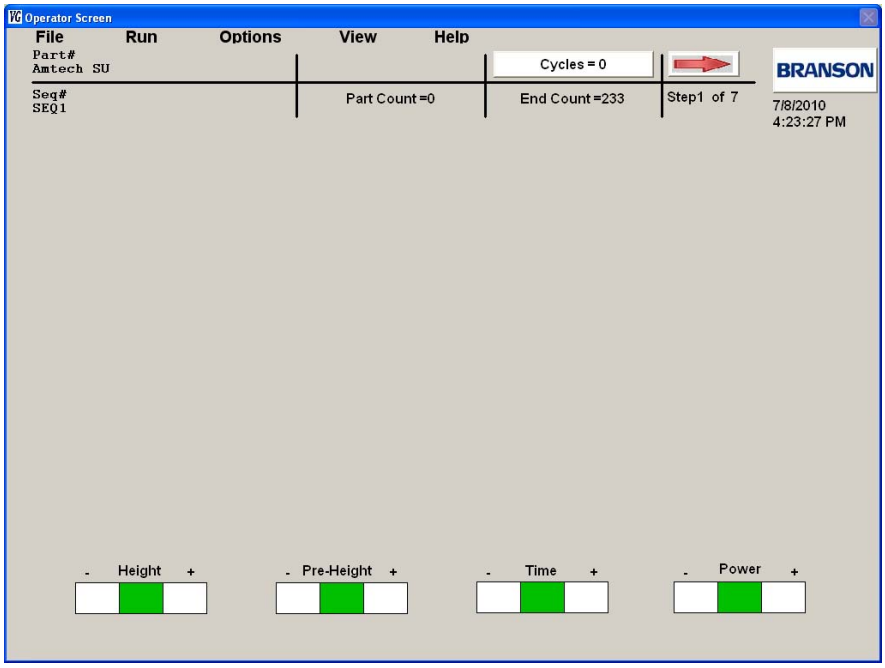
On the bottom of the screen you can see the quality indicators. These indicate visually if the **Height**, **Pre-Height**, **Time**, and **Power** readings fell within the acceptable range for the last weld. They each have three sections. The section in center is the pass section and it will light green when the parameter reading fell within the acceptable range. The left and right sections are, respectively, the fail low, and fail high sections. These sections will light red when the parameter reading fell outside the acceptable range. The controller will also display a pop up window with an alarm message for unsuccessful welds.

Figure 5.11 Result is taller than maximum height message



5.10.2 Operator Screen (When Running a Sequence)

Figure 5.12 Operator Screen (When Running a Sequence)



This is the Operator Screen when running a sequence. You can choose this screen to be the start screen when you turn on your controller. For information see 5.11.1.4 System Configuration.

Displayed on the upper section of the screen are the sequence's name, the current step's Preset name, the part counter (Part Count), cycle counter (Cycles), the step's batch size (End Count) and the current step number. The cycle counter keeps track of the total amount of welds performed while the part counter keeps track of the welds performed for the current step. Touch the **Cycles** button to reset the cycle counter. Touch the red arrow on the upper right side of the screen to go the next step on the sequence.

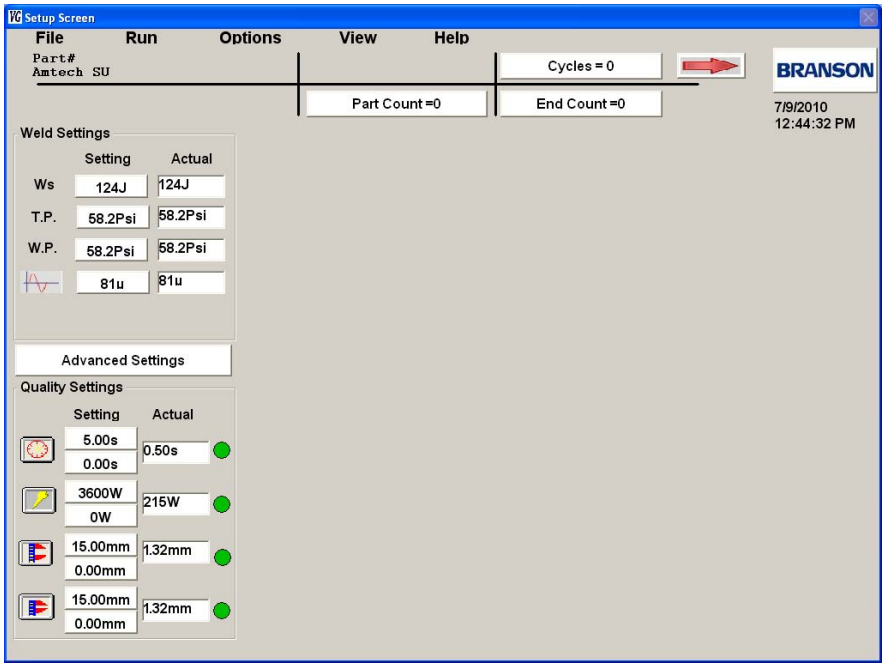
NOTICE	
	If an image was selected for the preset, it will be displayed on the middle of the screen.

On the bottom of the screen you can see the quality indicators. These indicate visually if the **Height**, **Pre-Height**, **Time**, and **Power** readings fell within the acceptable range for the last weld. They each have three sections. The section in center is the pass section and it will light green when the parameter reading fell within the acceptable range. The left and right sections are, respectively, the fail low, and fail high sections. These sections will light red when the parameter reading fell outside the acceptable range. The controller will also display a pop up window with an alarm message for unsuccessful welds.

Figure 5.13 Result is smaller than minimum height message

5.10.3 Setup Screen (When Running a Preset)

Figure 5.14 Setup Screen (When Running a Preset)



This screen can be used to setup and fine-tune your weld presets. On this screen you can run and edit Weld, Advanced, and Quality settings for your currently loaded preset. You can choose this screen to be the start screen when you turn on your controller. For information see 5.11.1.4 System Configuration.

Displayed on the upper section of the screen are the Preset's name, the part counter (Part Count), cycle counter (Cycles), and the batch size (End Count). The cycle counter keeps track of the amount of welds performed. When the Part Counter equals the End Count the controller will ask if you want to reset the part counter to zero. Touch the **Part Count** or the **Cycles** button to reset the cycle or part counter. Touch the End Count button to enter a new batch size.

Touch the red arrow to switch between the Operator and Setup screens.

In the middle of the screen on the left side are the Weld Settings Box, the Advanced Settings button, and the Quality Settings box. On the right side of each quality parameter a circle is displayed. The circle will light green for successful welds and red for unsuccessful welds. If an image was selected for the preset, it will be displayed on the screen. The controller will also display a pop up window with an alarm message for unsuccessful welds:

Figure 5.15 Result is taller than maximum height message

While on the Setup Screen, when running a preset, all changes made to a preset setup are kept in memory only. The preset name will display a ' * ' symbol to note that the preset

has not been saved and a Save Preset Button will appear in the lower-left section of the screen. If a different preset is loaded, the VersaGraphix application is closed, or the VersaGraphix Controller is powered off, unsaved changes will be lost. To save the setup changes to the preset file, touch the Save Preset button, select Save Preset from the File menu, or select Save Preset As to save the changes into a new preset file.

NOTICE	
	Unless the preset is saved by selecting Save Preset, all unsaved setup changes will be lost when loading a different preset, closing the VersaGraphix application, or powering off the VersaGraphix Controller.

5.10.3.1 Weld Settings

In the Weld Settings box you can see the actual readings for the last weld on the rightmost column. You may alter the parameter settings by touching the buttons on the center column. The parameters:

Watt/seconds (Ws): The amount of energy (in joules) delivered on each weld.

Trigger Pressure (T.P): The clamping pressure that needs to be exerted to the parts before applying ultrasonic energy.

Weld Pressure (W.P): The clamping pressure applied to the parts during a weld.

Amplitude ( **):** The amplitude (in microns) of the applied ultrasonic vibration. If an amplitude stepping mode has been selected on the Advanced Settings window, you will be able to enter Amplitude A, Amplitude B, and a Step Point.

5.10.3.2 Quality Settings

In the Quality Settings box you can see the actual readings for the Time, Energy, Pre-Height, and Height of the last weld. You may also adjust the acceptable range for the following quality parameters

Time( **) max/min:** The max/min time that the ultrasonic energy may be applied to a weld.

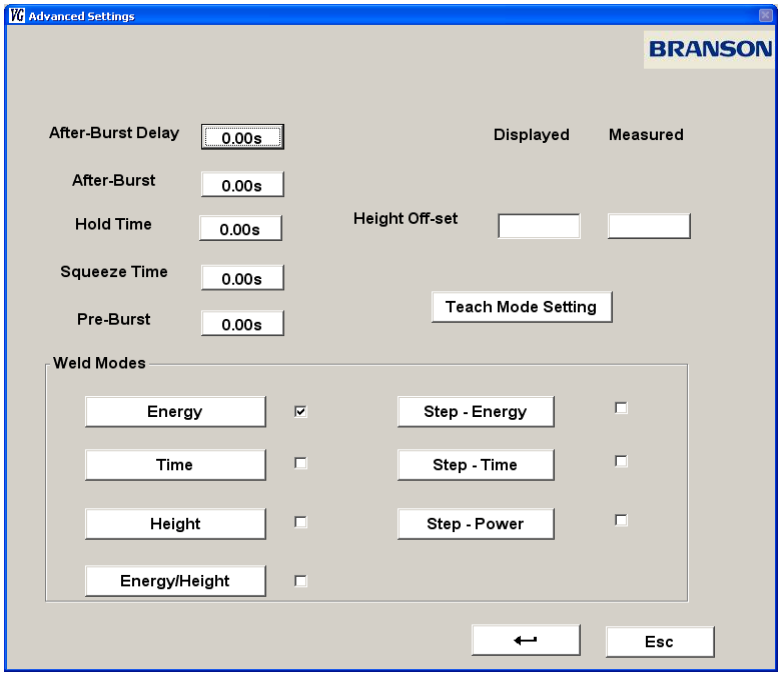
Energy( **) max/min:** The max/min power which may be applied to a weld.

Pre-Height( **) max/min:** The max/min height of the parts before welding. This is a pre-welding inspection reading from the height encoder.

Height ( **) max/min:** The max/min height of the resulting weld.

5.10.3.3 Advanced Settings Screen

Figure 5.16 Advanced Settings Screen



This window allows access to the advanced weld settings described below. These values will normally reflect the default settings made in the Configuration Settings screen on the Settings tab. Values set on this window will only affect the current preset's settings.

Parameters:

- **After Burst (s):** Used to fire sonics for a predetermined amount of time after the weld is complete and after After burst delay times out
- **After Burst Delay (s):** Used to delay after burst. Delay should be set so that no force is on the part
- **Hold time (s):** Delays the release of the weld. Used to remove discoloration from the weld
- **Squeeze Time (s):** Delay the weld for a predetermined amount of time. Allows the force of the cylinder to build up on the part before welding
- **Pre Burst (s):** Used to fire sonics for a predetermined amount of time after the Squeeze Time and before capturing the Pre-Height. Used when welding magnet wire. It helps to break up the insulation around the copper, and provide a small cooling period before the weld takes place

Weld Modes:

- **Energy:** Ultrasonics are activated until the specified amount of Energy (Watts integrate over time) has been applied
- **Time:** Ultrasonics fire for a predetermined amount of time
- **Height:** Ultrasonic energy is applied until a predetermined height is reached
- **Energy / Height Compensation:** Used for contaminated parts. The controller will first put in the predetermined amount of Energy, it will then look at the final height window. If the final height is not within the window, the controller will then put in up to 3 times more energy to get to the center of the window. Note quality window for time may need to be adjusted when using this mode. Controller will shut down when the upper time limit is exceeded
- **Amplitude stepping:** There are three stepping modes available: Step - Energy, Step - Time, and Step - Power. If a stepping mode is selected, you must also set the start amplitude, end amplitude, and a step point. After choosing a stepping mode, set the start amplitude, end amplitude and step point by editing the Amplitude setting located in the Weld Settings area of the Setup screen. See 2.4.8 Amplitude Stepping for more information

Off-set:

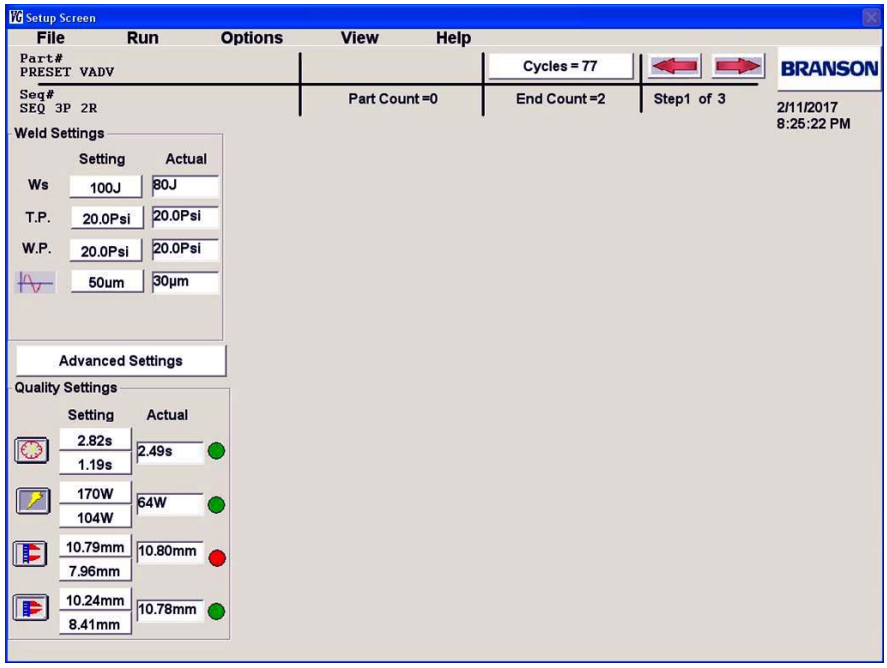
- **Height Off-set:** Displays the height measurement for the last weld. Touching the button under the Measured column allows the user to enter the height he measured on the last welded piece. The controller automatically adds a corrective offset to its measurements, so displayed values to match the user's measurements

Teach Mode Setting:

- **Global:** Select Global to use the Teach Mode settings set on the Teach tab on the configuration screen. For more information, see 5.11.1.3 Teach Mode Settings
- **Special:** Select Special to enter different Teach Mode settings for the current preset

5.10.4 Setup Screen (When Running a Sequence)

Figure 5.17 Setup Screen (When Running a Sequence)



This screen can be used to monitor actual weld and quality results for each weld. You can choose this screen to be the start screen when you turn on your controller. For information see 5.11.1.4 System Configuration.

NOTICE	
	While on the Setup Screen, no changes can be made to the preset settings.

Displayed on the upper section of the screen are the sequence's name, the current step's Preset name, the part counter (Part Count), cycle counter (Cycles), the step's batch size (End Count) and the current step number. The cycle counter keeps track of the total amount of welds performed while the part counter keeps track of the welds performed for

the current step. Touch the **Cycles** button to reset the cycle counter. Touch the red arrow on the upper right side of the screen to go the next step on the sequence.

In the middle of the screen on the left side are the Weld Settings Box, the Advanced Settings button, and the Quality Settings box. On the right side of each quality parameter a circle is displayed. The parameters shown are the same as the ones described in sections 5.10.3.1 Weld Settings, 5.10.3.2 Quality Settings, and 5.10.3.3 Advanced Settings Screen, but they cannot be modified within the within the sequence. The circle will light green for successful welds and red for unsuccessful welds. The controller will also display a pop up window with an alarm message for unsuccessful welds.

Figure 5.18 Result is smaller than minimum height message

5.10.5 Teach Mode Screen

In the Teach Mode screen, the controller automatically derives the quality window's limits based on calculations performed on results from a weld sample set. It is operational in three run screens: Setup Screen, Operator Screen and Statistical Analysis Screen. There are three available teach modes: Standard Teach Mode, Auto Teach Mode, and Sigma Teach Mode. To run Teach Mode click on: Run > Teach Mode Screen. The controller will run in the teach mode currently selected in the TEACH tab in the Configuration Settings window. See 5.11.1.3 Teach Mode Settings.

NOTICE	
	While in any of the Teach Modes, the screen background is orange and the Quality settings are not editable.

NOTICE	
	Exit the Teach Mode by closing the application, loading a Preset/ Sequence, Saving/Editing a Preset/Sequence, or by switching to following screens: Run New Preset/Sequence, File Manager, Maintenance, Configuration Settings, and Administrator.

NOTICE	
	You can switch between the Operator Screen, Statistical Analysis screen, Weld Graph screen, Weld History screen and Error Log screen without affecting the Teach process. While in teach mode, the Operator Screen and Statistical Analysis screen will also be shown in orange background.

NOTICE	
	To start a new Teach process click [Run -> Teach Mode Screen] and select the required preset to be loaded from the list.

NOTICE	
	If you change any Weld/Advanced settings at any time, the Teach mode restarts with wide open quality windows. The preset will be saved at this point.

5.10.5.1 Standard Teach Mode

In the Standard Teach Mode the default quality windows (wide open) are used, and you may accept or reject each weld as part of the sample set. Upon successful completion of the sample set, the average values for Time, Power, Pre-Height, and Height are computed; the allowable min./max deviation percentages are factored in; and the resultant is used to calculate the weld settings and the quality window settings. The quantity of samples to be run and the allowable deviation percentages for each weld parameter are set in the TEACH tab in the Options > Configuration window. See 5.11.1.3 Teach Mode Settings. After completing the Teach process, the Preset and the quality windows settings are saved; the gray Operator Screen is displayed; and you will no longer be in Teach Mode.

5.10.5.2 Auto Teach Mode

In the Auto Teach Mode you may not reject samples. If no changes are made to the Weld/Advanced settings, the previously saved quality windows are used for the first five welds, which form a basis. Their averaged values for Time, Power, Pre-Height and Height, plus or minus ten percent tolerance, are used to evaluate the acceptability of the remaining samples. If one of the remaining samples falls outside of this range, it is rejected and an alarm occurs. Up to three welds may be rejected in a teach session. If a fourth bad weld is encountered the Auto Teach process starts over with wide open quality windows. The run quantity for Auto Teach Mode can be set in the Teach tab in the Configuration settings window. When the Teach process is complete, the Preset and the quality window settings are saved; the gray Operator Screen is displayed; and the system will be in monitoring mode. While in monitoring mode you can weld normally. The system will restart a complete Auto Teach session automatically if you change any of the weld parameters, quality windows settings, recall a new preset, or go to the File Manager, Maintenance, Configuration or Administration screens.

NOTICE	
	In Auto Teach mode File > Create New Sequence, File > Edit Sequence, Run > New Preset, and Run > New Sequence menu options are always grayed out.

NOTICE	
	If you go to the Statistical Analysis or the Operator Screen just after selecting Auto Teach option in Configuration screen, the application will go directly into monitoring mode and you will be allowed to weld normally with the currently loaded preset.

NOTICE	
	If Auto Teach mode is left selected in the configuration screen before powering down, the system will display the operator screen; load the previously loaded preset or default preset; and go directly in to monitoring mode in Auto Teach mode on the next power up.

NOTICE	
	After Creating a New preset while in Auto Teach mode both Run > Operator Screen and Run > New Sequence menu options are grayed out. The only way to weld is to first go through the Auto Teach process for the newly created preset by clicking Run > Teach Mode Screen.

5.10.5.3 Sigma Teach Mode

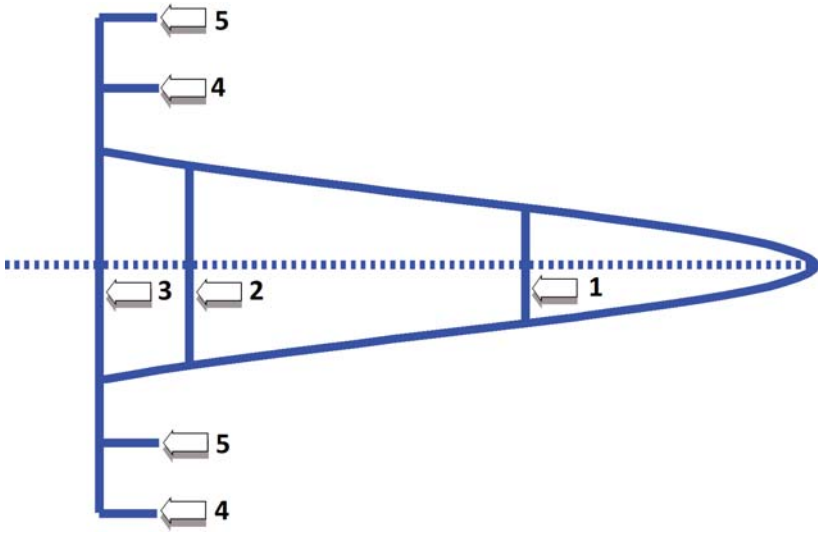
The Sigma Teach mode collects data for the last 128 samples taken for each weld. It limits itself to the last 128 samples to keep data and statistics that will be meaningful to the current sample. The Sigma Teach mode calculates the average and standard deviation for each or the monitored parameters (Time, Power, Preheight, and Height). The early samples are displayed starting on the left of the screen and, as they are added, continue from the left to right.

At 128 and later samples, the oldest data point on the left is removed and the latest data point is added at the right position. Average and standard deviation are always based on the latest data. Removed data has no influence on the calculations.

Standard deviation is calculated with an (n-1) weighting. This tends to make the smaller values of the n have wider standard deviations.

The collected data is displayed between the Upper Specification Limit (USL) and the Lower Specification Limit (LSL). These are the limits as shown on the Run screen. If there are more the 3 samples in the data a Gaussian curve is displayed. The Gaussian curve is positioned between the limits and as much of its data as possible is displayed. There are markers on the curve to show 1, 2, 3, 4, 5, standard deviations. The 1, 2, and 3 markers are vertical while the 4 and 5 are horizontal (see Figure 5.19 below). The most desirable situation is narrow limits with a tight curve.

Figure 5.19 Sigma markers.



After completing the Teach process, the Preset and the quality windows settings are saved; the gray Operator Screen is displayed; and you will no longer be in Teach Mode.

5.11 Options Menu

The Options pull down menu contains the following choices:

5.11.1 Configuration

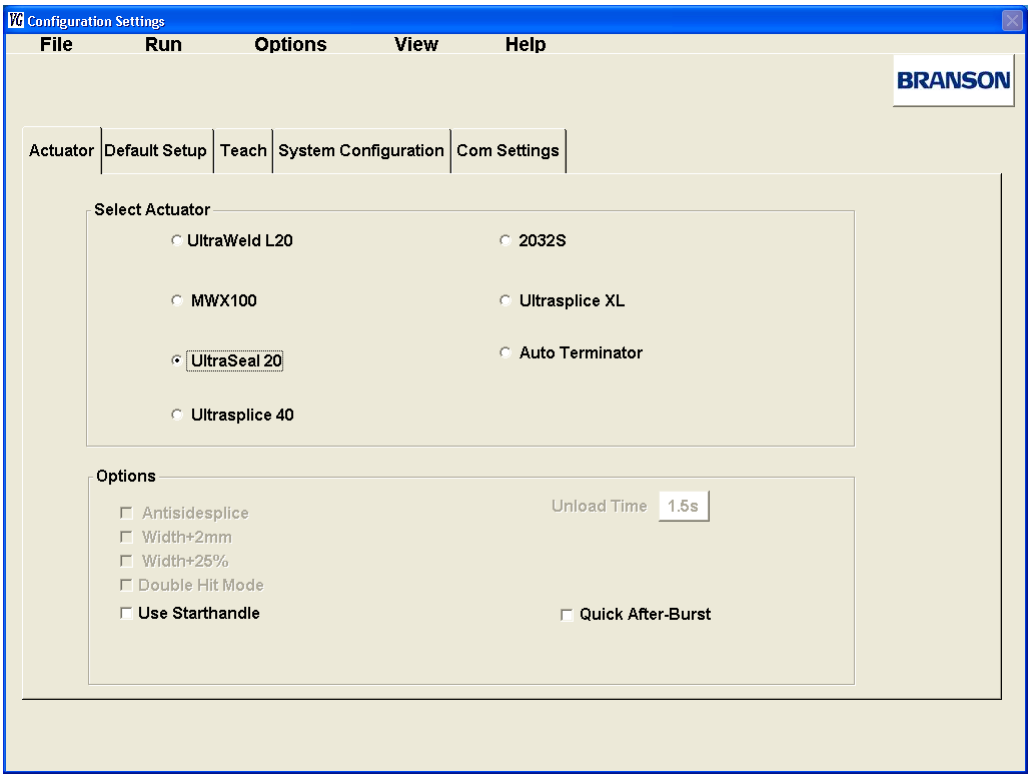
User is allowed to configure the following features of the application.

- Actuator
- Default Setup
- Teach
- System Configuration
- Com Settings

5.11.1.1 Actuator

The Actuator tab found in the Configuration screen allows you to setup the VersaGraphix to work with your Actuator model.

Figure 5.20 Actuator Tab



The VersaGraphix can be setup to work with any of the following actuators:

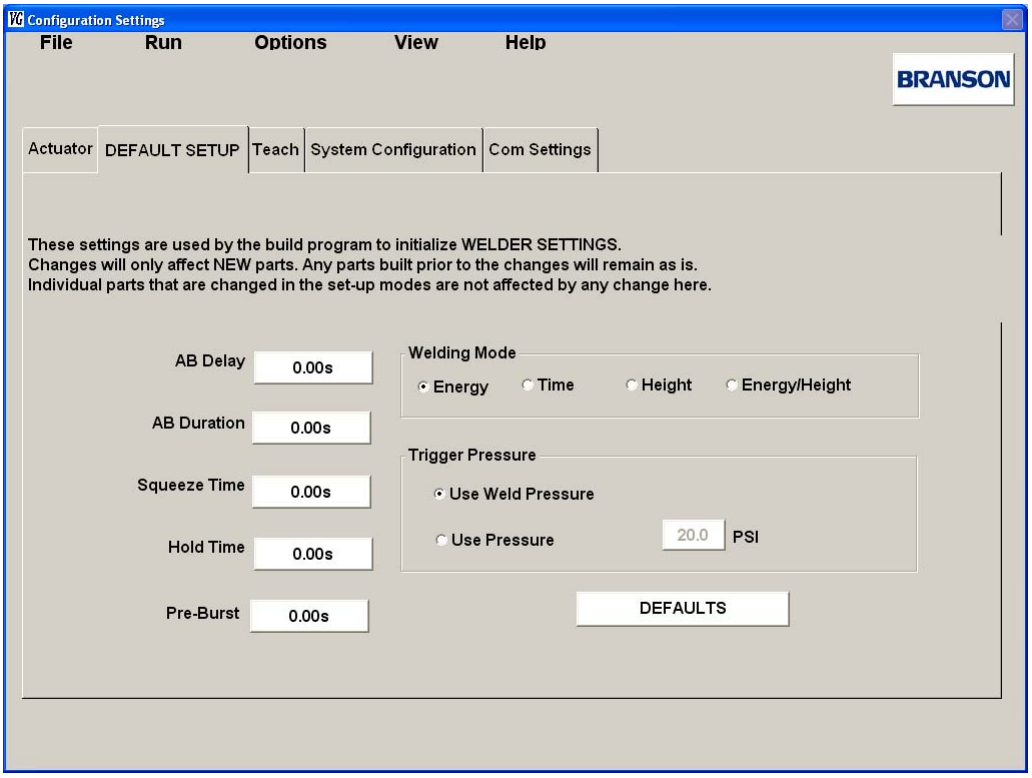
- UltraWeld L20
- MWX100
- Ultraseal 20
- Ultrasplice 40
- 2032S
- Ultrasplice XL
- Auto Terminator

On this tab you may also set the following:

- Use Start Handle: To toggle between using a foot-pedal or a start handle to initiate the weld cycle
- Quick After Burst: The after burst function is implemented immediately after each weld cycle finished without any time delay or condition judgment

5.11.1.2 Default Preset Settings

Figure 5.21 Default Setup Tab



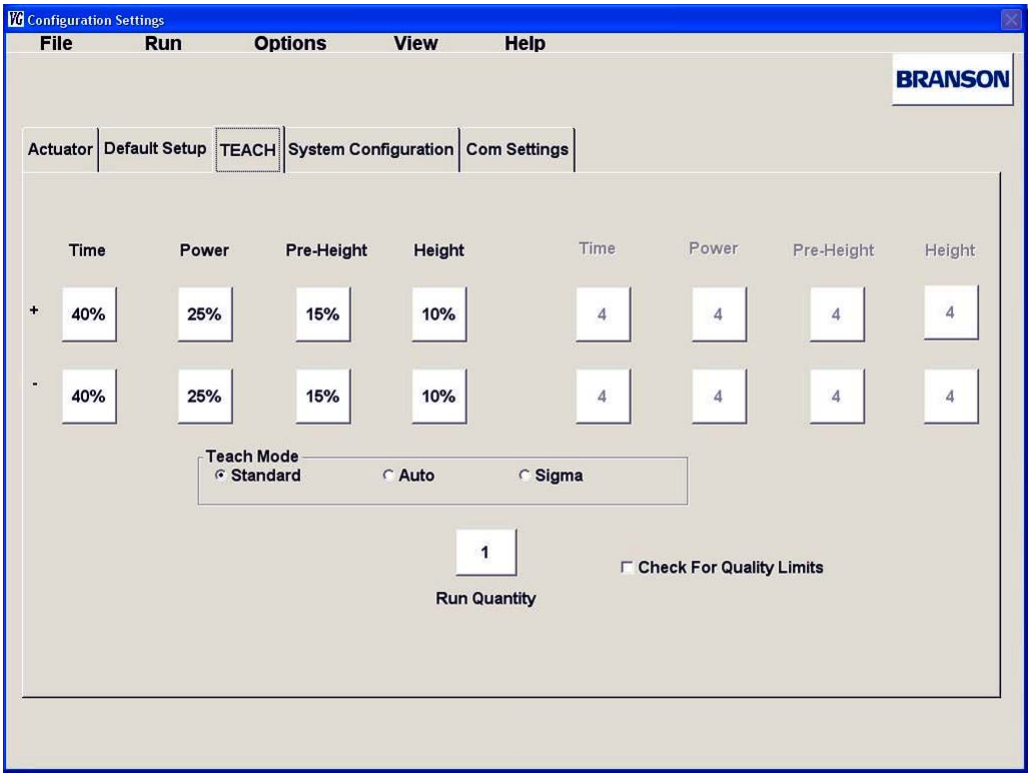
Set the default weld settings for all new presets on the Default Setup tab. These settings will only affect new presets. You may set the following parameters:

- AB Delay
- AB Duration
- Squeeze Time
- Hold Time
- Pre-Burst
- Welding Mode
- Trigger Pressure

See 5.10.3.1 Weld Settings and 5.10.3.3 Advanced Settings Screen for more information on these parameters.

5.11.1.3 Teach Mode Settings

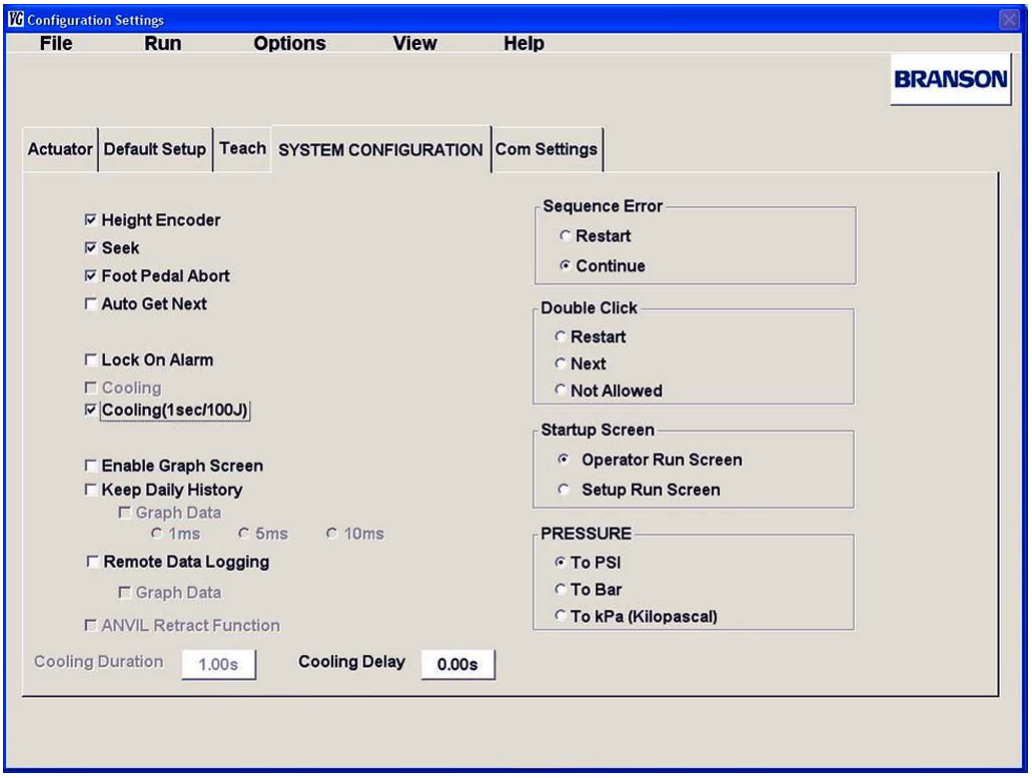
Figure 5.22 Teach Tab



On the Teach tab you may select the teach mode the VersaGraphix will use. There are three different teach modes available: Standard, Auto, and Sigma. On this tab you can set the run quantity and allowable deviation percentages for the Standard or Auto teach modes. See 5.10.5 Teach Mode Screen for more information on Teach modes.

5.11.1.4 System Configuration

Figure 5.23 System Configuration



Height Encoder: Toggles the height encoder on/off.

Seek: Toggles Seek function on/off. This pulses ultrasonic energy to the stack prior to each weld in order to allow the system to tune to stack frequency.

Foot Pedal Abort: When this box is checked, foot pedal must be maintained until sonic starts or the weld cycle will be aborted.

Pressure to Bar: Toggles pressure units between PSI (unchecked) and bar (checked).

Auto Get Next: When this box is checked the Controller automatically sequence to the next part. Used in sequencing.

Lock On Alarm: Toggles between locking or allowing a weld to continue when an alarm condition exists. When set to lock the actuator will not release the part until a password is entered.

Cooling: Enables the setting of a predetermined amount of time the cooling air will stay on after a weld.

Enable Graph Screen: Enable/disable Power Graph data.

Cooling (1sec/100J): Automatically sets cooling duration after a weld to 1 second per 100J of energy applied.

Keep Daily History: When this box is checked the Controller will create a daily folder on the hard drive to store all weld results. If the **Graph Data** box is checked the Controller will also store the weld power readings, sampled every 0.005 seconds into a text files.

Remote Data Logging: When this box is checked the Controller will send weld results out the Ethernet port at the end of each weld cycle. If the **Graph Data** box is checked the Controller will also send the weld power readings, sampled every 0.005.

Sequence Error: Sets what the Controller should do when a weld error occurs when running a sequence. It has two Options:

- Restart - to restart the sequence from step 1
- Continue - To reweld the same step in the sequence

Double Click: Sets double click action when running a sequence. The options are:

- Restart the sequence - to restart the sequence from step 1
- Next - to move to the next step of the weld sequence
- Not allowed - to disable double click inputs

Startup Screen: Sets the screen that will be displayed on powerup. The options are:

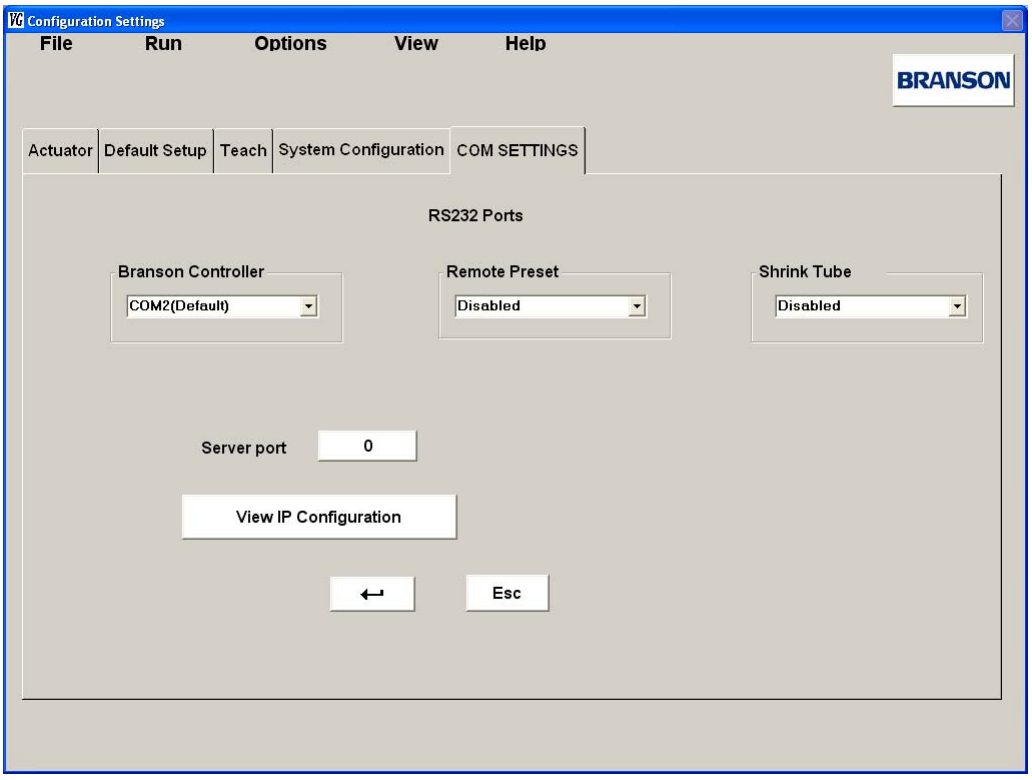
- Operator Run Screen
- Setup Run Screen

Cooling Duration: To change the amount of time the cooling air is on after each weld cycle.

Cooling Delay: To change the delay period after a weld and before cooling is turned on.

5.11.1.5 COM Settings

Figure 5.24 COM Settings



On the COM SETTINGS tab you can configure serial port and Ethernet settings to communicate to its internal controller and an external devices.

Branson Controller:

The Branson Controller is connected to port COM2 by default.

Remote Preset:

Presets and sequences can be recalled by an external user application connected to one of the available RS-232 serial ports. Use this drop-down selection list to set the serial port to

which the application will be connected. The ports available for Remote Preset recall are COM1, through COM4. Baud rate is fixed at 115000 baud.

To recall a Sequence or Preset, a string containing the 'Preset Name' or a 'Sequence Name' followed by a carriage return must be sent by the user application:

NAME<CR>

NOTICE	
	The application will search sequences first, then search presets.

Sequence or Preset to the VersaGraphix application.

The VersaGraphix application returns one of three responses:

sNAME<CR><LF> Application found sequence.

pNAME<CR><LF> Application found preset.

nNAME<CR><LF> Application found neither a sequence or a preset or it found a sequence with a missing preset.

The VersaGraphix application will timeout after 5 seconds if characters are sent without a carriage return **<CR>**. A response "Timeout" will be sent and the receive buffer will be reset.

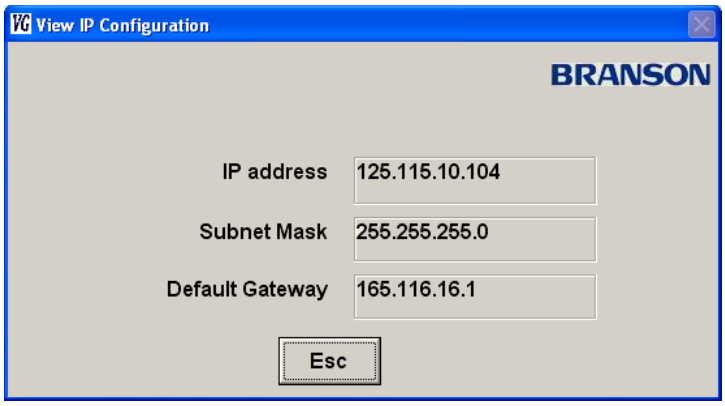
Shrink tube:

The VersaGraphix Controller can be connected to an external Raychem® RBK-ILSProcessor shrink tube machine. Use this drop-down selection list to set the serial port to which the shrink tube machine will be connected.

View IP Configuration:

Displays the current IP configuration.

Figure 5.25 IP Configuration



NOTICE	
	The Host IP Address must be set from the Microsoft XP Control panel.

Server Port:

Sets the server port that will be used to communicate between the VersaGraphix and user data logging application.

5.12 Remote Data Collection

At the end of each weld cycle the VersaGraphix writes a line to the daily history log file if “Keep Daily History” is enabled.

This special will echo this line to a remote user application through an Ethernet socket connection. For this special the data format will be hard coded.

A header will be sent every time the user connects to the socket.

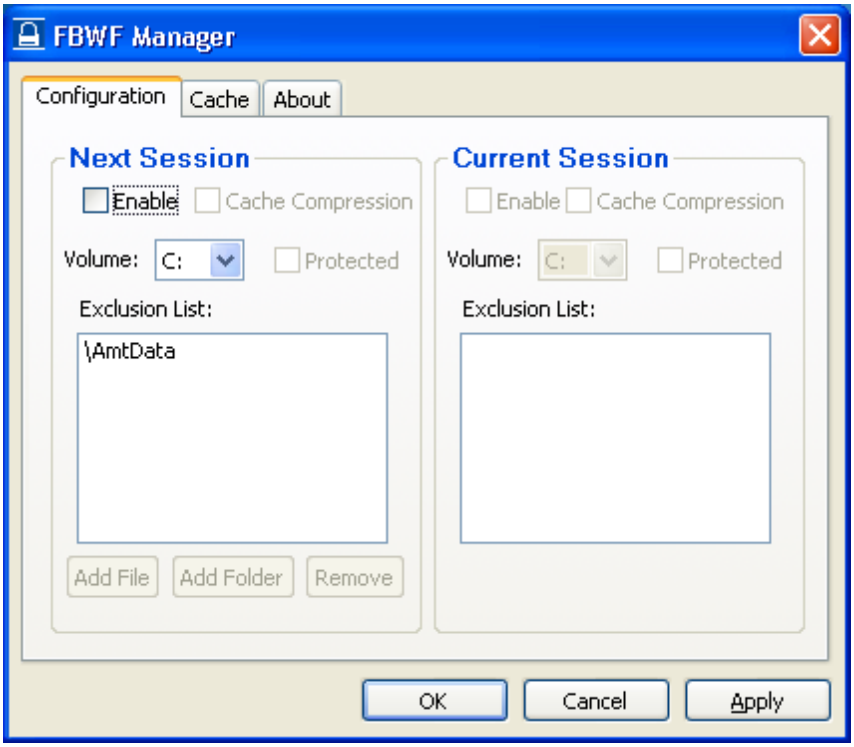
5.12.1 Connection to VersaGraphix SBC will be through a TCP / IP socket

NOTICE	
	The File Based Write Filter (FBWF) must be disabled when configuring the SBC's Network Connections.

The 'Host IP Address' will be set outside the application at the system level.

Exit the VGX application

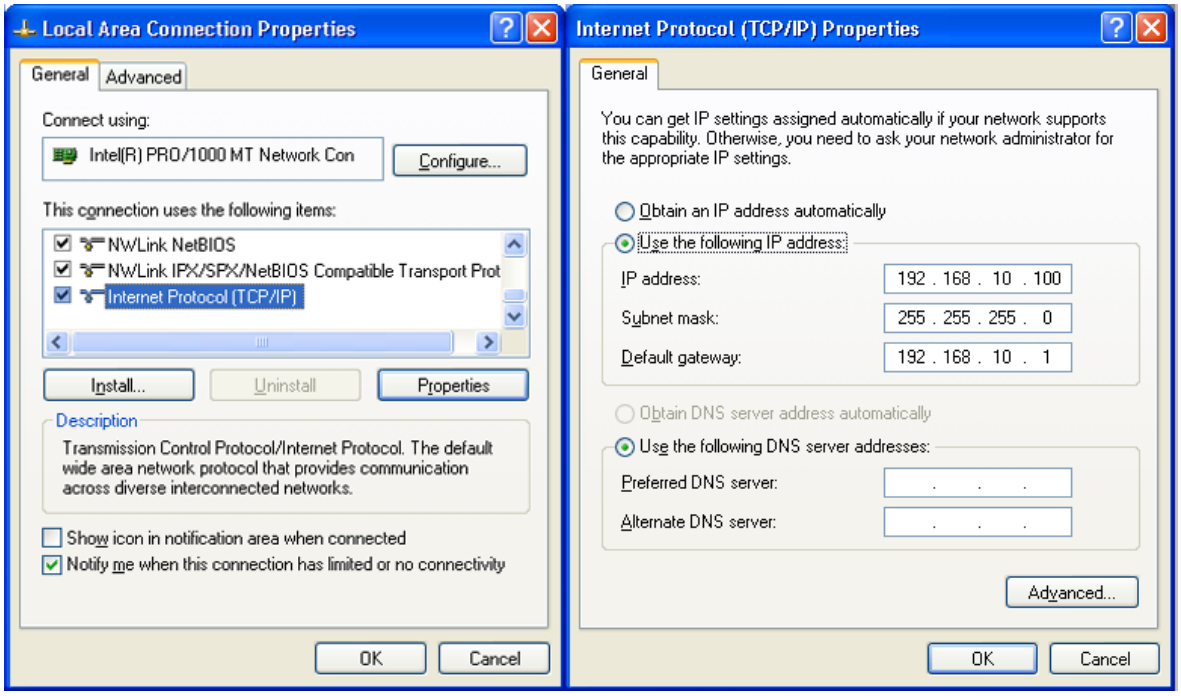
Disable the FBWF



Allow the unit to reboot

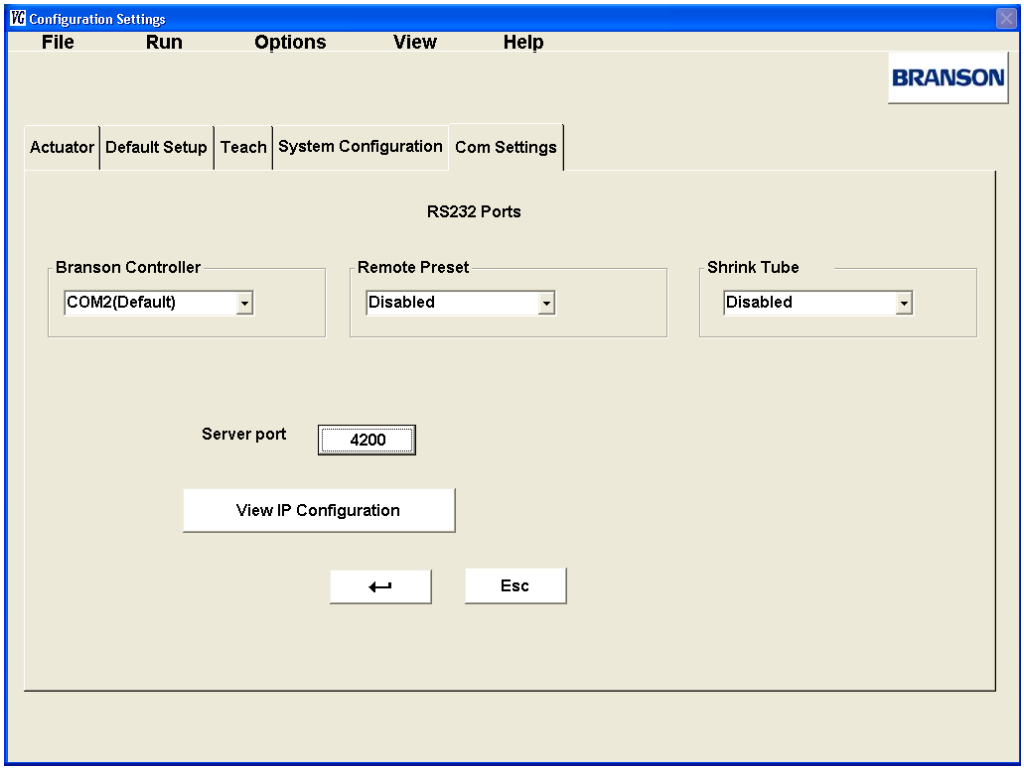
Exit the VGX application

Set the 'Host IP Address' in Windows



Open the VGX application

Set the 'Server Port Number' to 4200.



Options/Configuration/COM SETTINGS/Server Port'. Default= 4200.

5.12.2 Testing Remote Data Collection

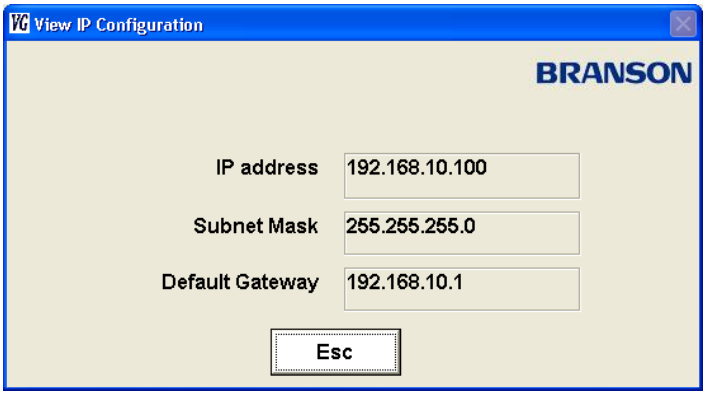
Testing and verification will be done using TeraTerm.

Connect to the VersaGraphix SBC using an Ethernet Cable.

Start TeraTerm Terminal on the remote PC.

Connect Using: TCP/IP

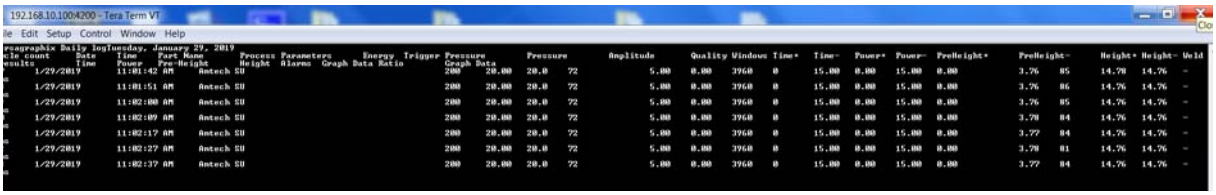
Host Address: (Use IP address of VersaGraphix SBC)



Port Number: 4200 (default)

Make a Weld Cycle

Weld results should be displayed as follows:

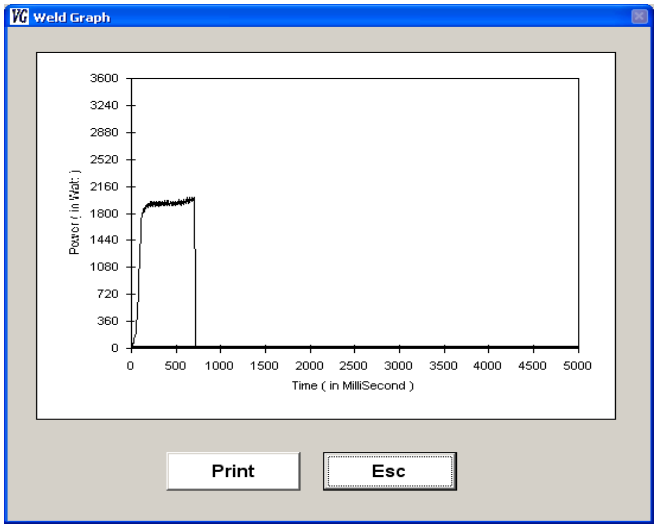


5.13 View Menu

The pull down View menu contains the following choices:

5.13.1 Weld Graph

Figure 5.26 Weld Graph



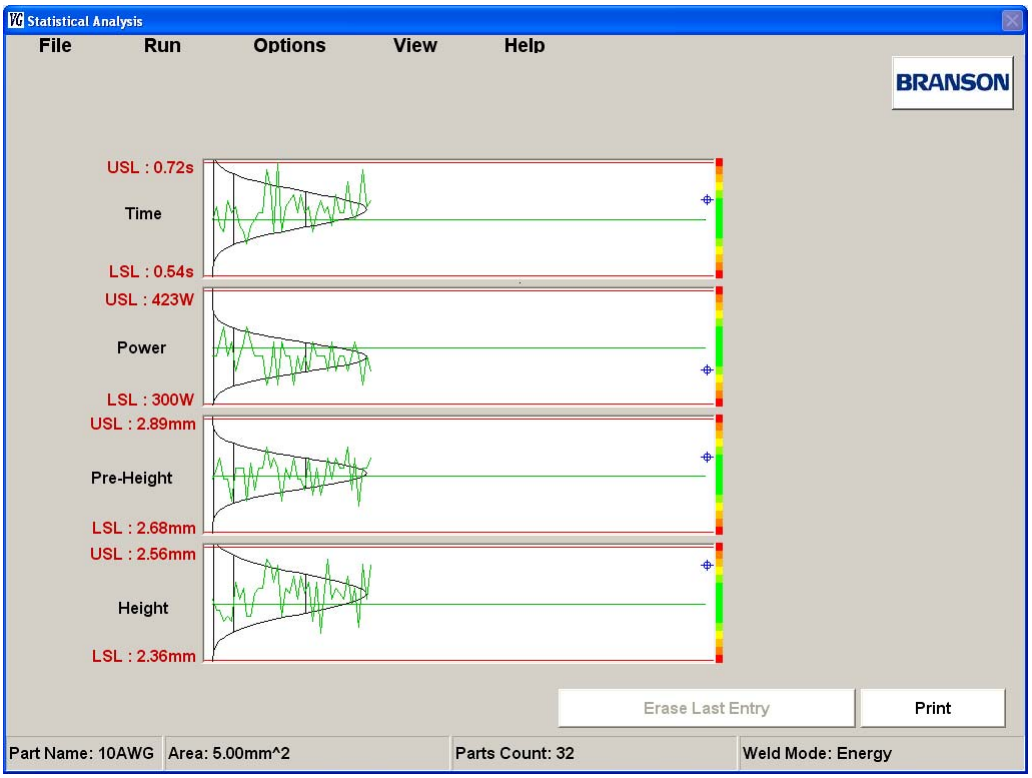
Touch View > Weld Graph to display a pop up window containing a graph of Power (Watts vs. Time) for the last weld performed.

Weld graphs are sometimes referred to as weld “foot print”. They 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. (See Figure 2.2 Weld Power Graph for clean components, dirty components, and when part is missing).

NOTICE	
	Weld Graph data can be saved into a text file or sent out the Ethernet port. See Section 5.11.1.4 System Configuration for more information.

5.13.2 Statistical Analysis Screen

Figure 5.27 Statistical Analysis Screen



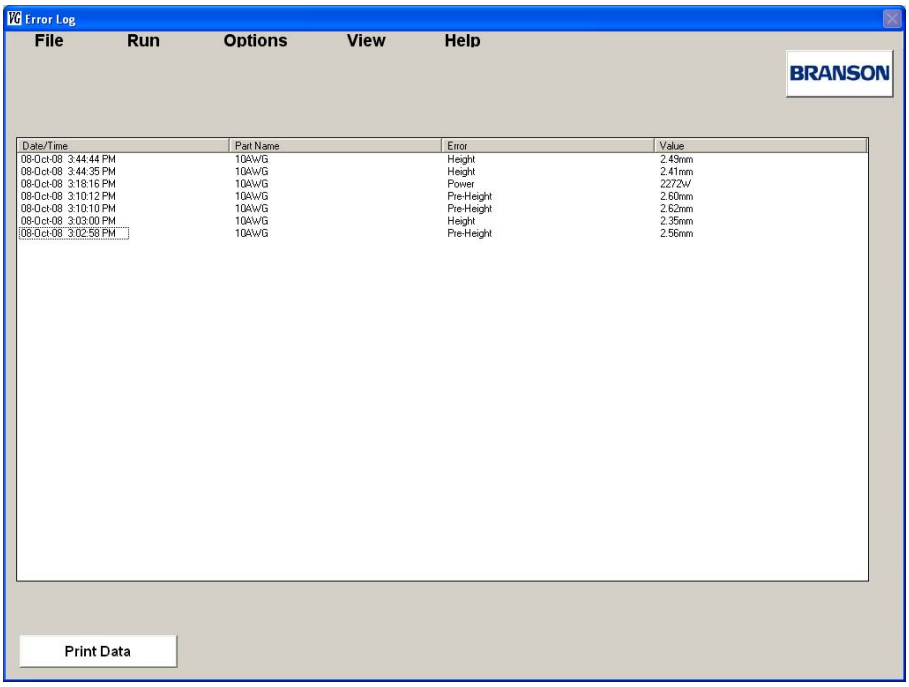
The Statistical Analysis screen displays a histogram and Gauss curves for an accumulation of up to 128 samples of the current part.

The program keeps a file on each part and records each sample as it is run. The file is updated at the end of each weld cycle that does not contain any faults. Weld cycles that contain faults are not included in the data nor is the parts counter increments. The file contains data for the last 128 weld cycles for the current part. If less than 128 cycles are available, only those available are displayed. If more than 128 parts are on the counter, the file is updated by discarding the oldest sample data and adding the latest sample data. The average, standard deviation, and Gauss curves are based on the latest data.

The labels USL and LSL are the upper and lower Specification Limits set on the Setup Screen. The Gauss curves are displayed proportional to the upper and lower specification limits and have markers for the 1, 2, 3, 4, 5 and 6 sigma deviations if they fall inside the limits. No Gauss curves are displayed if the parts counter is less than 3.

5.13.3 Error Log

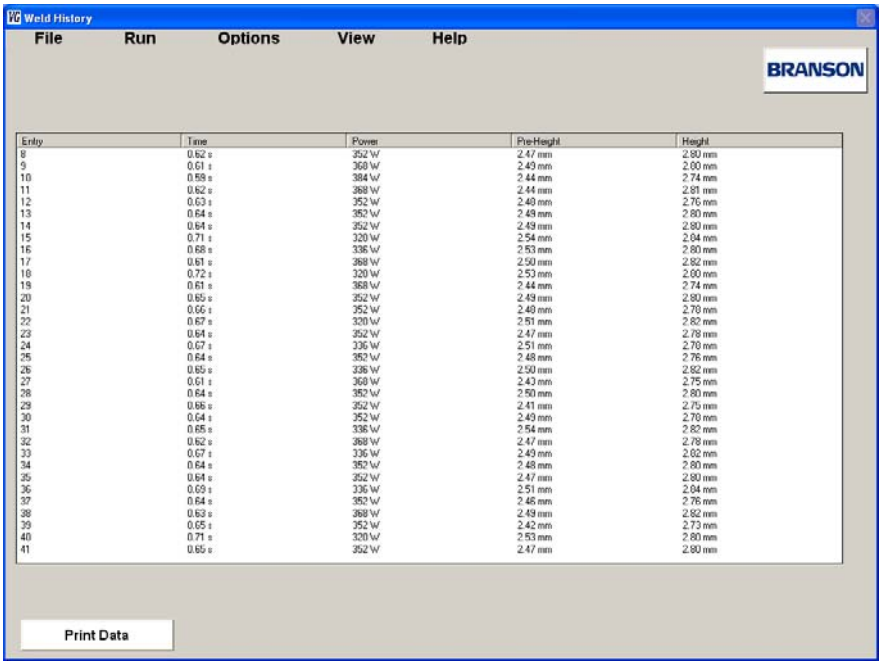
Figure 5.28 Error Log



The Error log keeps track of all unsuccessful welds and their fault cause. You can generate a printout of all errors by touching the Print Data button.

5.13.4 Weld History

Figure 5.29 Weld History



On the Weld History screen you can view all saved weld results. You can generate a printout of all errors by touching the Print Data button.

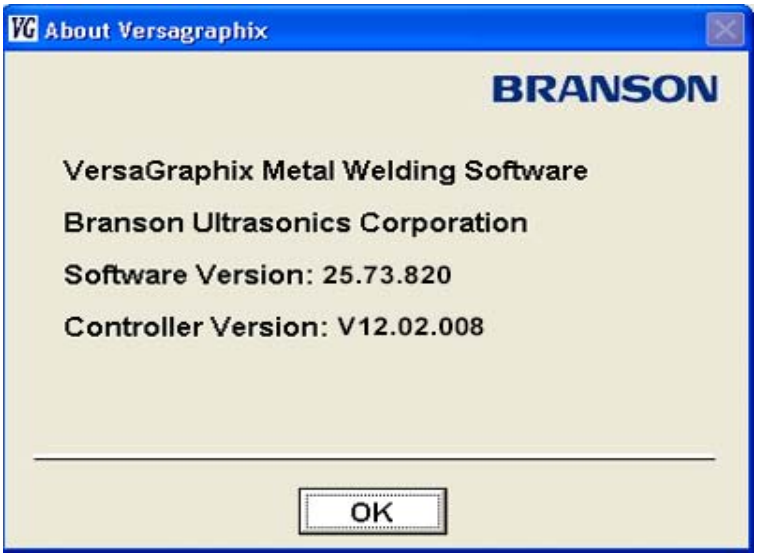
NOTICE	
	The Keep Daily History checkbox on the Settings tab on the Configuration screen must be checked for the controller to store weld results.

NOTICE	
	Weld results can also be sent out the Ethernet port at the end of each weld cycle. See 5.11.1.4 System Configuration for more information.

5.14 Help Menu

In the Help pull down menu you can select About VersaGraphix to view the VersaGraphix software version and Controller version.

Figure 5.30 About VersaGraphix



5.15 Language Support

Figure 5.31 Language Settings

The VersaGraphix software supports 18 user selectable languages. The supported languages are: English, French, German, Japanese, Russian, Romanian, Portuguese, Spanish, Hungarian, Korean, Polish, Czech, Turkish, Italian, Simplified Chinese, Traditional Chinese, Thai and Slovenian.

NOTICE	
	Touch the Branson logo on any of the screens to pop up the Language Settings window.

Chapter 6: Maintenance

6.1 Preventive Maintenance

WARNING	
	• Use LOTO (Lock Out Tag Out) lockable plug cover over line cord plug during any maintenance • All system components must be disconnected from the main electrical supply • All system components must be disconnected from the main air supply and system air pressure must be released via the pressure regulator • When performing maintenance on the welder, make sure that no other automated systems are active

The following preventive measures help assure long term operation of your Branson equipment.

6.1.1 Periodically Clean the Equipment

Air is continuously drawn into the Branson VersaGraphix Controller. Periodically disconnect the unit from power, remove the cover and vacuum out any accumulated dust and debris. Remove material adhering to the fan blades and motor, transistors, heat sinks, transformers, circuit boards, cooling intake vents, and exhaust ports. Filters can be added to the VersaGraphix cooling fans for dusty environments. External covers may be cleaned with a damp sponge or cloth using a solution of mild soap and water. Do not allow cleaning solution to enter the unit. To prevent rust in areas of high humidity, exposed steel surfaces, such as handles, hardware, and the main column may require a very light film of oil, such as WD-40®[1].

NOTICE	
	When it is necessary to clean the touch screen, wipe gently with a soft cloth dampened with a mild window glass commercial cleaner or 50/50 mixture of water and isopropyl alcohol. Use a soft cloth moistened with mild detergent to clean the display housing. Do not use abrasive cleaners, waxes or solvents to clean the touch screen monitor.

6.1.2 Routine Component Replacement

The lifetime of certain parts is based on the number of cycles the unit has completed, or on hours of operation, e.g., at 20,000 hours, cooling fans should be replaced.

1. WD-40 is a registered trademark of WD-40 Manufacturing Company Corporation.

6.2 Parts List

This section provides the list of replacement parts.

Figure 6.1 VersaGraphix Controller

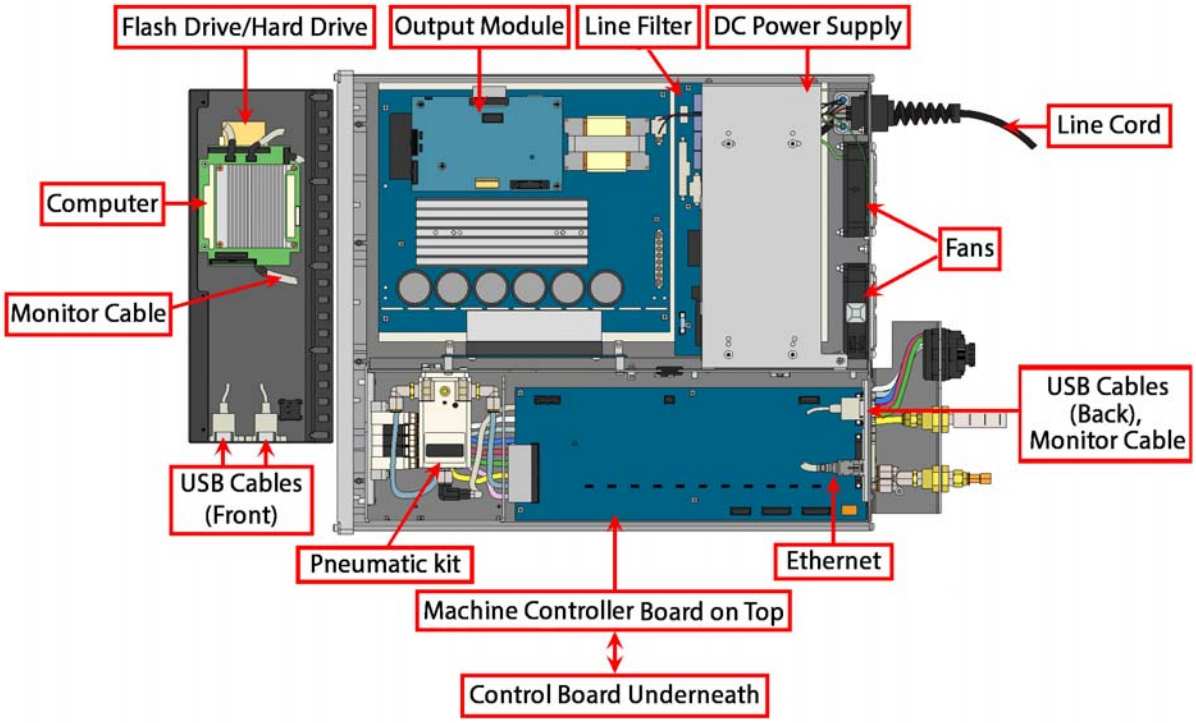


Table 6.1 Suggested Spares

Description	Part Number
Control Board[1]	102-242-1272R
Machine Controller Board	102-242-968
DC Power Supply	200-132-294R
Line Filter	100-242-1199R (100-242-1230R for 4KW units only)
Output Module[2]	Call Branson
Fan	100-126-015R
Line Cord	100-246-947
Touchscreen monitor	200-220-030
Monitor Cable	100-241-426
Computer	Call Branson
Flash Drive/Hard Drive[1]	Call Branson
Ethernet	Call Branson
USB Cables (Front)	100-241-423
USB Cables (Back)	100-241-422

Table 6.1 Suggested Spares

Description	Part Number
D-sub 9 Cable	J1A00226
Pneumatic Kit	Call Branson

[1]Please go to “About Branson” on the Help dropdown menu for software version and controller version.
[2]Have power supply wattage and frequency available for costumer service.

6.3 Parts Replacement

CAUTION	
	The Branson VersaGraphix Controller contains components that can be degraded or damaged by electrostatic discharge. Always use a Grounded Wriststrap and use a grounded work area when handling or servicing the VersaGraphix.

The VersaGraphix is designed for a long service life. In the event the system malfunctions, many of the internal components (Modules) are replaceable as a unit. If a particular module has failed, it should be replaced or repaired at an Branson Depot Facility.

6.4 Troubleshooting

When the Branson VersaGraphix Controller encounters a situation that is outside normal conditions, an alarm is generated. If there is any alarm condition, the Touchscreen displays an alarm message and generates an audible alarm (see Table 6.2 System Alarm, with probable cause and corrective actions). If you use the Emergency Stop button to terminate a weld, the welder will not operate until reset.

6.4.1 System Alarms

The following table details alarms that you can encounter on the VersaGraphix, listed alphabetically by the Display Message that is presented on the touchscreen. The message on the touchscreen of VersaGraphix is shown in the first column. The second and third columns indicate the condition that led to the alarm and the corrective action you should take.

Table 6.2 System Alarm, with probable cause and corrective actions

Alarm Messages	Cause	Corrective Action
COM port Error		
EMERGENCY STOP ON!	Emergency stop is active	Unlock emergency stop button
FILE ERROR		
Height System failure	Controller did not see the encoder move 1mm in 1 second	Check air pressure. Check flow controls.
Highest power is above power maximum	Power result above the maximum quality window	
Highest power is below power minimum	Power result below the minimum quality window	
Invalid PASSWORD Re-enter data	Wrong password entered	Enter correct password
Lock On Alarm	Quality windows exceeded. Part is locked down.	Enter password to release part.
Password Exists!	Enter different password.	
Power OVERLOAD	Power results above the maximum available power.	
Result is smaller than minimum height	Final height is below quality window.	
Result is taller than maximum height	Final height is above quality window	
Safety System Abort!	Safety system	
Weld longer than maximum time	Weld cycle too long	Check for parts contamination. Make sure correct preset is used. Check tooling for wear.

Table 6.2 System Alarm, with probable cause and corrective actions

Alarm Messages	Cause	Corrective Action
Weld shorter than minimum time	Weld cycle too quick	Check proper preset is used. Check air pressure. Check correct parts are being welded.
Insufficient Storage	Memory has reached 90% of capacity	Transfer the History files to an external drive.

6.4.2 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.

6.5 Service Events

Service events should be performed only by qualified individuals. The potential for injury or death exists, as well as that for damage to the equipment (which can include loss of product warranty) or loss of valuable setup information for your application.
When servicing the system, the service person(s) can have a need for certain conventional hand tools, and you might need to have the following information for testing or returning the system to service.

6.5.1 Required Tools

Special tools for the ultrasonic Converter, such as spanner wrenches, are provided with your system. You might also need the following hand tools or service tools:

- Six-inch or longer Phillips-head screwdriver with a magnetic tip or screw starter
- Good-quality multi-meter for continuity, AC and DC voltages, and resistance, with insulated test probes

6.5.2 Cold Start Procedure

The VersaGraphix's internal memory stores the system default settings and the parameters that you set. It also provides temporary storage to support the Controller's internal functions. A Cold Start clears Battery Backed RAM (BBR) values and restores them to their original factory defaults. It is not necessary to perform a cold start during normal operation and servicing, but you might find a cold start helpful when:

- You suspect the system is not operating properly
- You want to reset the system to its factory default setup

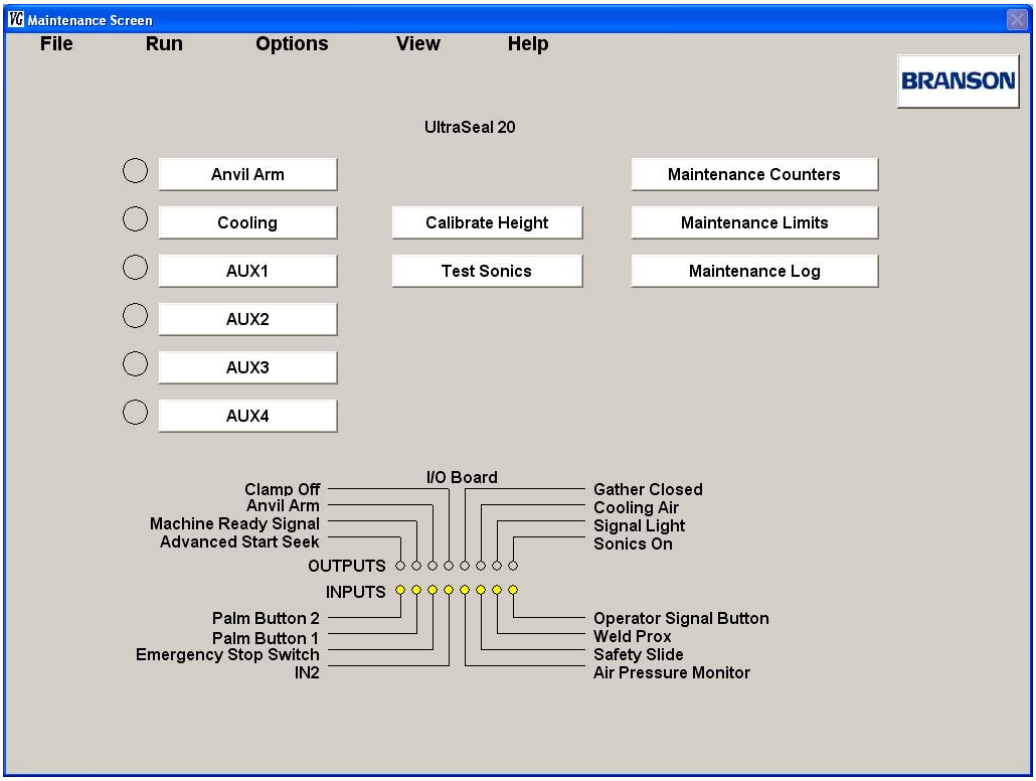
6.5.2.1 Performing a Cold Start

NOTICE	
	Before performing a cold start, the power supply power rating and maximum amplitude should be written down. This information will be needed for input after clearing the BBR. It can be found in the Maintenance Screen under Test Sonics.

To perform a Cold Start touch the Init BBR button on the Options tab in the Administrator screen (see 6.5.4.1 Administrator Options Tab). Once a cold start is performed the Height needs to be recalibrated, along with reinstating the calibrated amplitude and power rating.

6.5.3 Maintenance Screen

Figure 6.2 Maintenance Screen



The maintenance screen allows the adjustment and on-demand control of electromechanical devices in your actuator. This screen also allows you to clear maintenance counters, set maintenance limits and make entries to the maintenance log.

The left hand set of buttons have indicators associated with them. Touching each of these buttons allows you to:

Horn: Toggle the horn between the up and down positions.

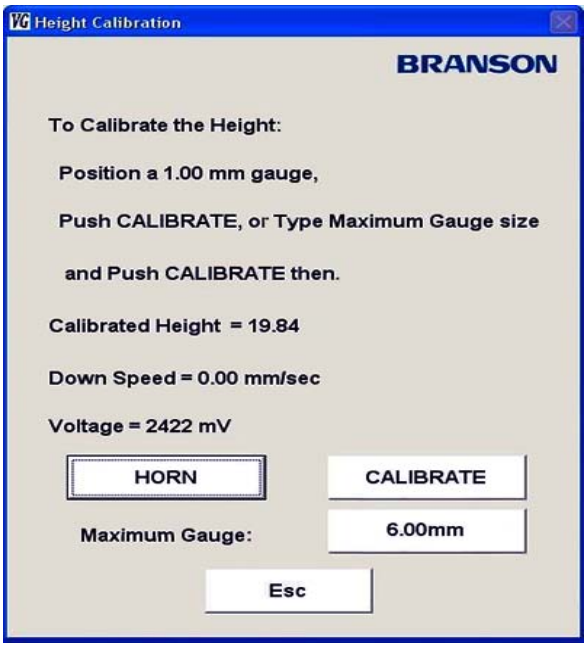
Cooling: Toggle the cooling air control solenoid on and off.

Aux 1-Aux 4: Toggle auxiliary actuators (used on special equipment). You may rename the auxiliary buttons in order to describe their given function (see 6.5.4 Administrator for more information on renaming auxiliary buttons).

The indicators under the ***I/O BOARD*** label show the current state of digital inputs and outputs.

6.5.3.1 Calibrate Height

Figure 6.3 Height Calibration



This window is used to perform a height (from horn to anvil) calibration. The instructions on screen explain the calibration procedure.

The following buttons are used to perform a height calibration:

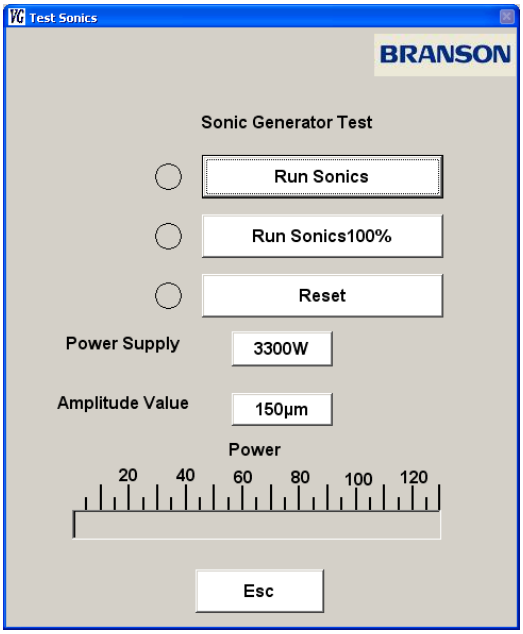
Horn: To move the horn up and down against the anvil.

Calibrate: To calibrate the height.

Press the **ESC** button to return to the Maintenance Screen.

6.5.3.2 Test Sonics

Figure 6.4 Test Summary



This screen allows the on-demand control of ultrasonic weld energy and the calibration of amplitude.

Amplitude calibration requires a dial indicator to be temporarily mounted in line with, and in front of, the horn, usually on a magnetic base. The Run Sonics 100% is held and the gage reading is viewed.

The gage reading x2 = total amplitude, this is the value to be entered as the amplitude value when calibrating.

The following buttons are used to test the Power supply and to calibrate the amplitude:

Run Sonics: Used to fire ultrasonic energy at the current amplitude setting.

Run Sonics 100%: Used to fire ultrasonic energy at 100% amplitude. Used when calibrating amplitude.

Power: Power rate is displayed in real-time.

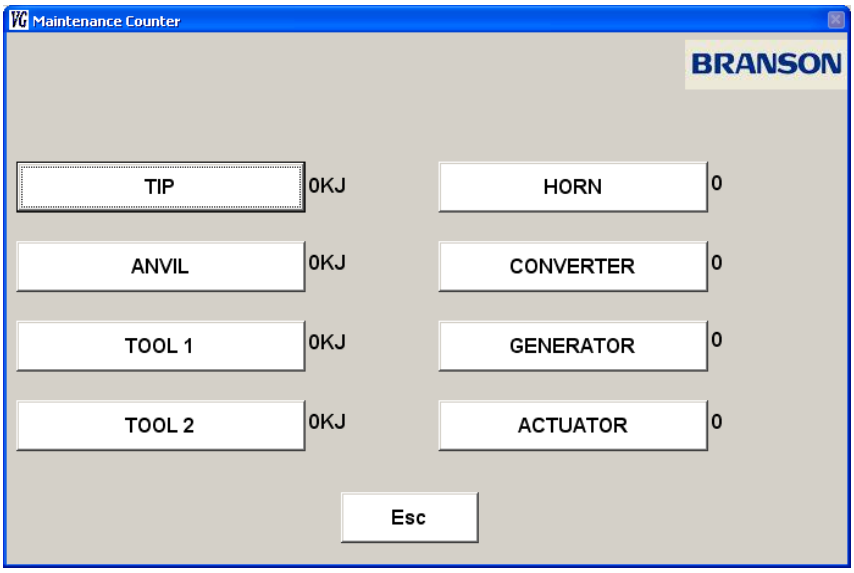
Power supply button: This value is set by Branson for a given actuator and should not be changed. Generally the setting for 20KHz actuators is 3300W and the setting for 40KHz actuators is 800W

Amplitude Value Button: Used to set the amplitude value based on the gage reading. See above.

Press the **ESC** button to return to the Maintenance Screen.

6.5.3.3 Maintenance Counters

Figure 6.5 Maintenance Counter



The lifetime of certain parts of your Branson system is based on the number of weld cycles performed, or the energy delivered for welding. Other parts require periodic maintenance depending on the number of cycles performed, or the energy delivered for welding. Maintenance Counters allow you to easily keep track of your system's maintenance requirements.

Maintenance counters and Maintenance limits are related. They are used in conjunction to schedule component maintenance or replacement. Maintenance counters increment after each weld cycle up to the limits set by the user on the Maintenance Limits screen. When a limit is exceeded the VersaGraphix will display warning on screen the next time it is turned on. Any maintenance counter whose value is less than its corresponding limit does not

produce an alarm. See 6.5.3.4 Maintenance Limits for more information on maintenance limits.

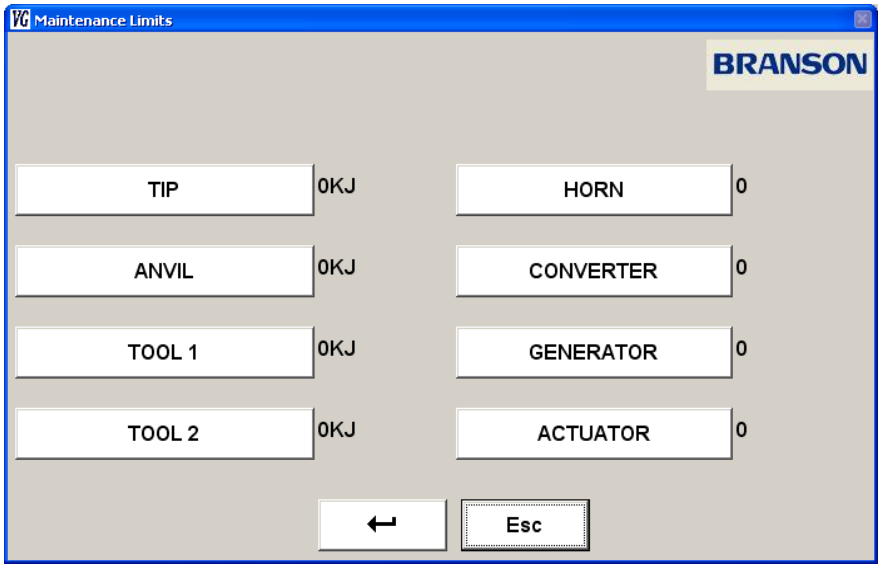
The maintenance counter window allows you to reset the counters to zero. Touch the name of the counter you want to reset (you will be prompted to confirm).

A maintenance counter should be reset after a maintenance is performed on the part it relates to.

Press **ESC** to return to the maintenance screen.

6.5.3.4 Maintenance Limits

Figure 6.6 Maintenance Limits



The lifetime of certain parts of your Branson system is based on the number of weld cycles performed, or the energy delivered for welding. Other parts require periodic maintenance depending on the number of cycles performed, or the energy delivered for welding. Maintenance Counters allow you to easily keep track of your system's maintenance requirements.

Maintenance counters and Maintenance limits are related. They are used in conjunction to schedule component maintenance or replacement. Maintenance counters increment after each weld cycle up to the limits set by the user on the Maintenance Limits screen. When a limit is exceeded the VersaGraphix will display warning on screen the next time it is turned on. Any maintenance counter whose value is less than its corresponding limit does not produce an alarm. See Section 6.5.3.3 Maintenance Counters for more information on maintenance counters.

The **Maintenance Limits** window allows you to set the maintenance limits for the listed items. Touch the name of the counter limit you want to set and a numeric keypad will pop up so you can set the counter limit. If a limit is set to 0 the controller will not yield an alarm for the counter regardless of its maintenance count.

The left side counter limits for the Tip, Anvil, Tool 1 and Tool 2 are set in kilo-joule units. For example, if the energy weld setting in use is 1500 joules, a limit setting of 7500 kilo joules will produce about 5000 cycles before reaching its limit. The Tool 1 and Tool 2 counters may be used to represent any special fixture tooling.

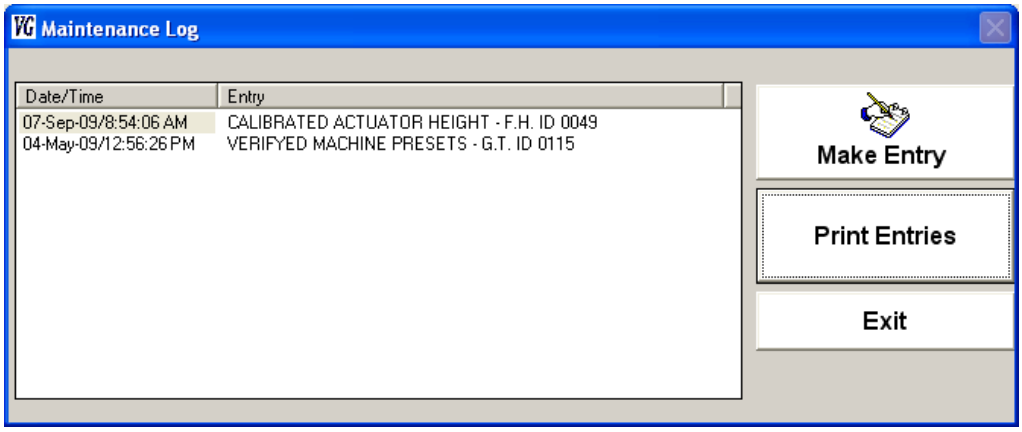
The right side counter limits on the window for the Horn, Converter, Generator (ultrasonic power supply), and Actuator are set in number of weld cycles.

Press the enter button to save the changes.

Press **ESC** to return to the maintenance screen without saving the changes.

6.5.3.5 Maintenance Log

Figure 6.7 Maintenance Log



The VersaGraphix has a built in Maintenance log that allows you to keep track of maintenance or testing done to your system.

On the Maintenance Log pop up window you can make entries to the controller maintenance log. Entries are limited to 100 characters per entry. You may also generate a printout of all currently stored entries.

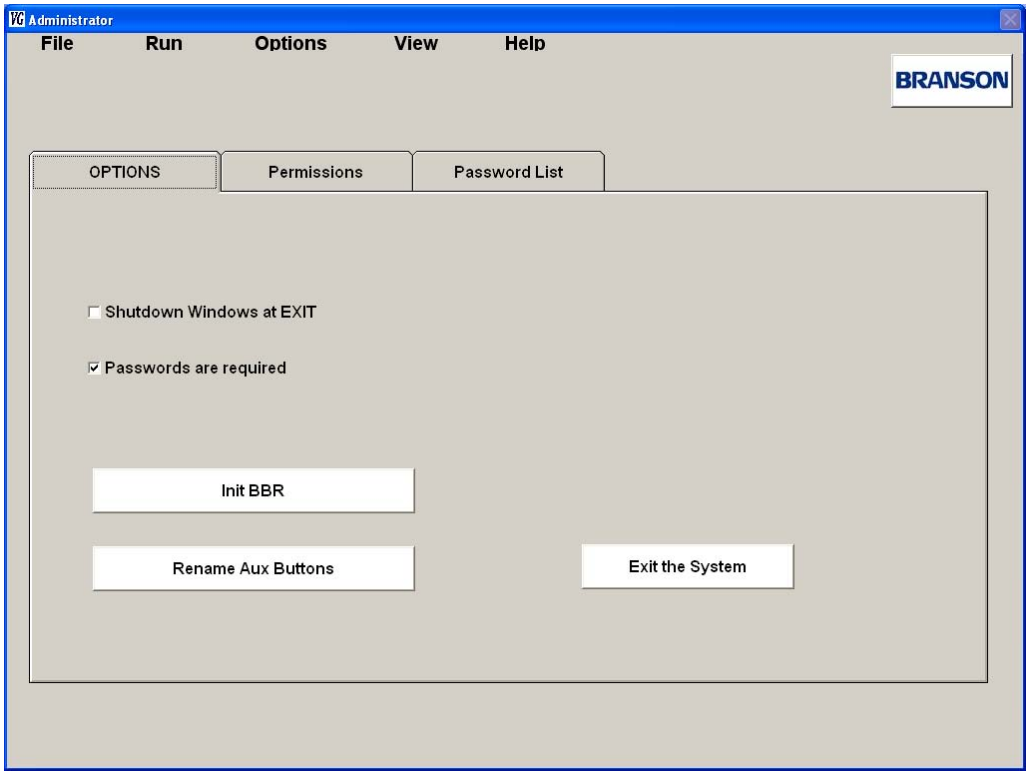
6.5.4 Administrator

On the Administrator screen you can perform a system Cold Start; exit the VersaGraphix software; shut down the system; and manage password requirements and screen access permissions.

NOTICE	
	The Administrator screen can only be accessed by entering the Administrator Password. The default Administrator password is **ADMIN**.

6.5.4.1 Administrator Options Tab

Figure 6.8 Administrator Options Tab



On this Tab you have the following check boxes and buttons:

Shutdown Windows at EXIT: Set this checkbox if you want the system to shut down when the Exit System button is pressed. If left unchecked the Software will give control to windows when the Exit System button is pressed.

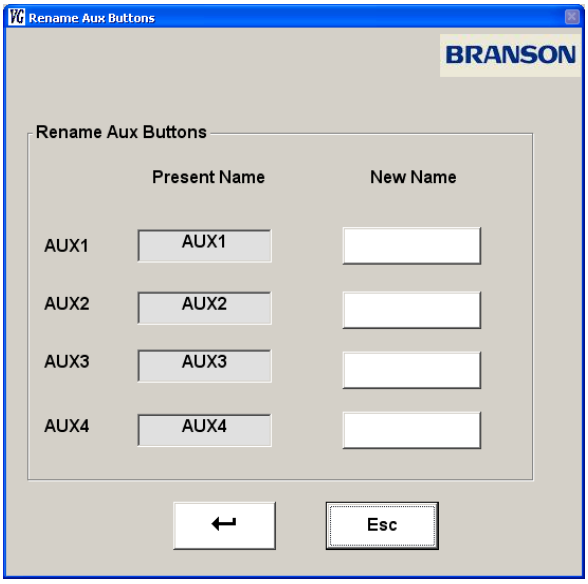
Passwords are required: Set this checkbox to make passwords required when accessing the Maintenance, Setup, Configuration, Create Preset/Sequence, Edit Preset/ Sequence, and Teach Mode screens, as set on the Permissions tab. See 6.5.4.2 Administrator Permissions Tab.

Init BBR: Touch the init BBR button to perform a Cold start. Touching this button resets the VersaGraphix's BBR (Battery Backed Ram) to its initial factory defaults. See Section 6.5.2 Cold Start Procedure for more information on performing a Cold Start.

NOTICE	
	Before performing a cold start, the power supply power rating and maximum amplitude should be written down. This information will be needed for input after clearing the BBR. It can be found in the Maintenance Screen under Test Sonics.

Rename Aux Buttons: Touching this button will cause the Rename Aux Buttons window to pop up. On this Window you may rename the four Auxiliary buttons shown on the maintenance screen. These buttons are used to control additional actuators on special

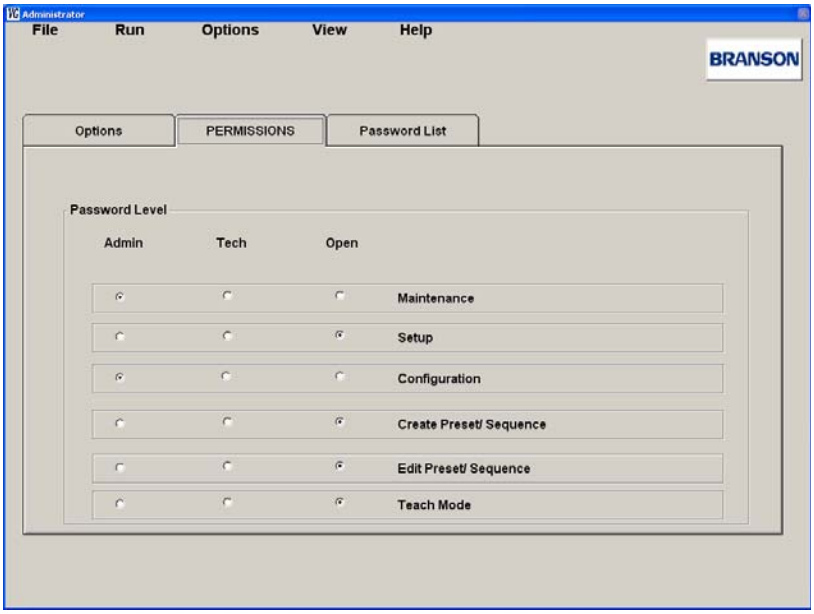
systems in order to perform maintenance activities. See Section 6.5.3 Maintenance Screen.



Exit the system: Touch this button to exit the VersaGraphix's software. If the Shutdown Windows at EXIT checkbox is checked, the system will shut down completely. If left unchecked, the software will exit and give control to the Windows OS.

6.5.4.2 Administrator Permissions Tab

Figure 6.9 Permissions Tab



On this tab you can assign password requirements for the Maintenance, Setup, Configuration, Create Preset/Sequence, Edit Preset/Sequence, and Teach Mode screens. There are three possible security levels you can assign to these screens:

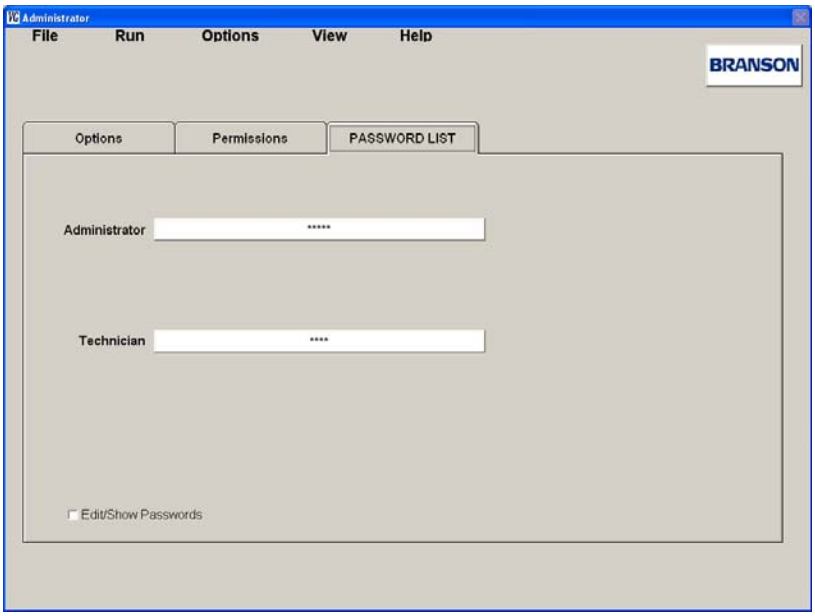
Open: Set the radio button to Open to make this screen accessible without a password.

Tech: Set the radio button to Tech to make this screen accessible using either the Technician or Administrator passwords.

Admin: Set the radio button to Admin to make this screen accessible only by using the Administrator password.

6.5.4.3 Administrator Password List Tab

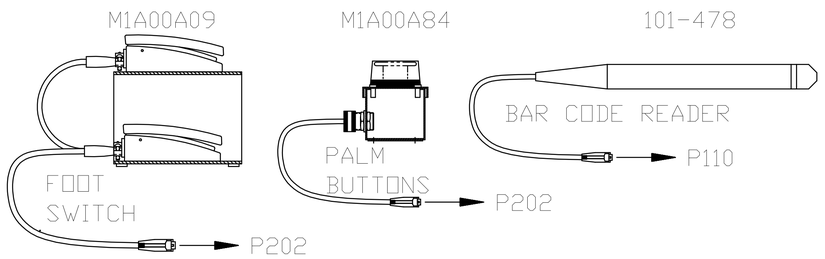
Figure 6.10 Password List Tab



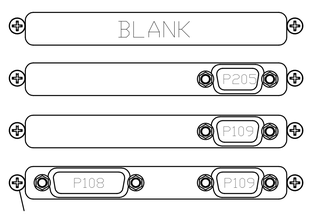
On this tab you may edit Both the Administrator and Technician passwords. First you must check the Edit/Show Passwords check box, to make the passwords visible and editable. Having this checkbox unchecked protects the passwords from being modified.

NOTICE	
	The default Administrator password is **ADMIN**.

REVISIONS						
ZONE	REV	DESCRIPTION	DATE	ECN/ECO	DRAWN	APPR.
-	1	INITAIL RELEASE	5/13/2002	-	DDL	-
-	02	CONVERTED TO SOLID EDGE	5/28/2015	-	SB	MGD



REF	TYPE	FUNCTION
P106	25 PIN MALE	PRINTER
P107	15 PIN FEMALE	ENCODERS & AIR REG
P105	9 PIN MALE	RS232 COMMUNICATION
P110	9 PIN MALE	BAR CODE READER
P201	25 PIN MALE	INPUT/OUTPUT
P202	9 PIN FEMALE	START
P108	MALE CINCH (15 PIN SIZE)	REMOTE START (XL)
P109	FEMALE CINCH (9 PIN SIZE)	MOTOR CONTROL
P205	9 PIN FEMALE	START ISOLATION (EX)

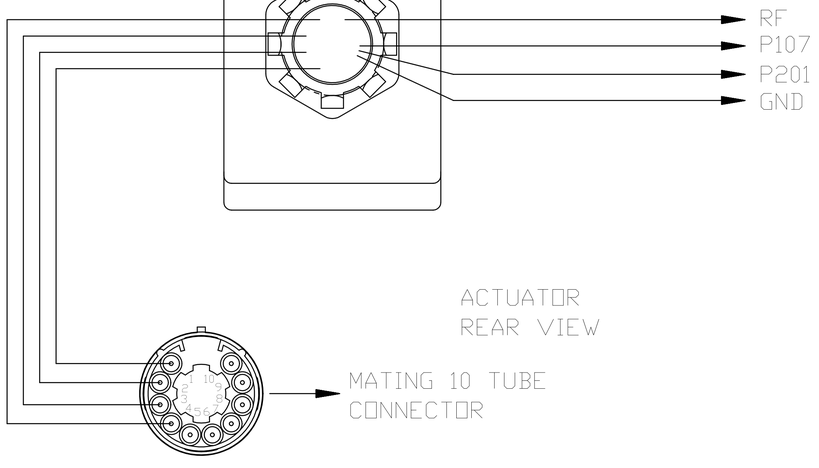


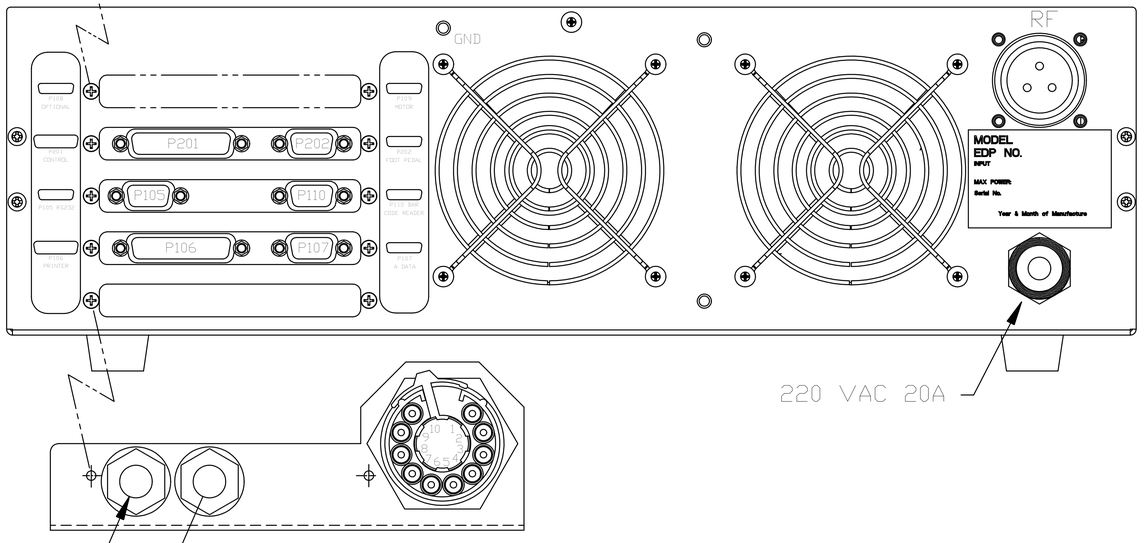
UW40, UW20, GUN 40, MOD 9 & TERMINATOR, ULTRASEAL 20

ULTRASEAL 20 EX

MOD 10 & 2020

XL





UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ±.015
3 PLACE DECIMALS ±.005
ANGLES ±1° FRACTIONS ±1/32
SURFACE FINISH 125

SECONDARY DIMENSIONS ARE PROVIDED FOR REFERENCE ONLY — INCHES (MM)

3RD ANGLE PROJECTION

MATERIAL:

Material Spec.

FINISH:

Finish Spec.

EMERSON Industrial Automation

	NAME	DATE
DRAWN	DDL	5/13/02
CHECKED	-	5/13/02
APPROVED	-	5/13/02
SCALE: 1:1	SHEET 1 OF 1	

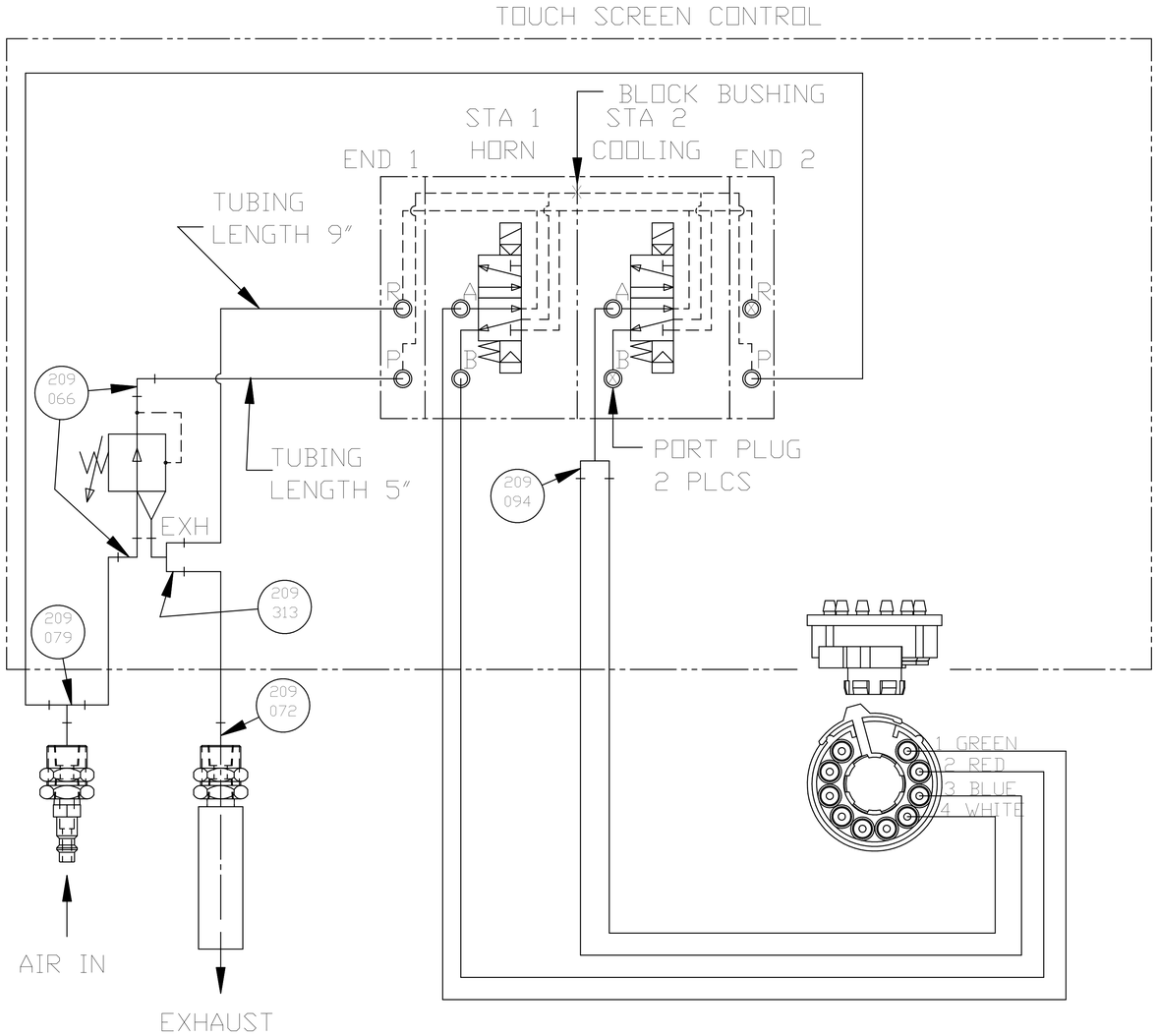
BRANSON

TITLE
UNIV TOUCHSCR HOOKUP DIAGRAM

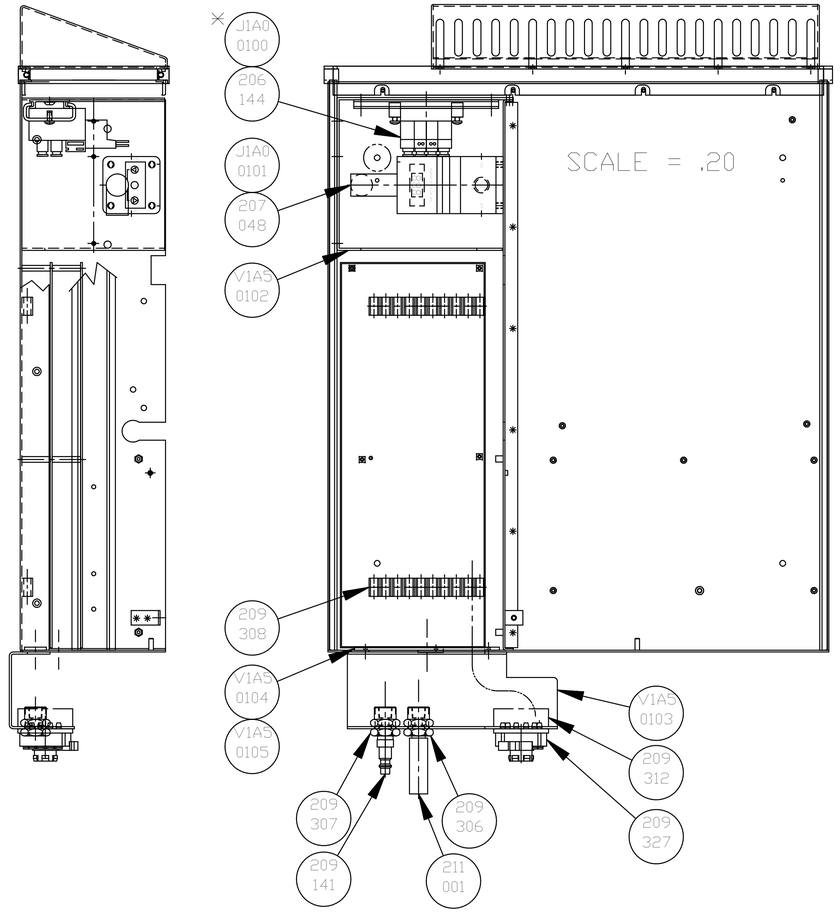
SIZE D | DWG NO J1A00111-03 | REV 02

SOLID EDGE

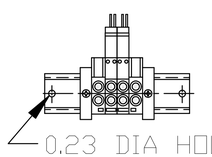
REVISIONS						
ZONE	REV	DESCRIPTION	DATE	ECN/ECO	DRAWN	APPR.
–	1	INITIAL RELEASE	11/5/01	–	DDL	–
–	2	REVISED 10TUBE COUPLING	12/17/02	1867	DDL	–
–	03	CONVERTED TO SOLID EDGE	05/28/15	–	SB	MGD



* HARNESS CONNECTIONS
P207-9 TO STA 1
P207-6 TO STA 2



VALVE STACK (206-144)
(1) VV5Q17-02C-D-00T MANIFOLD
(2) VQ1171-5LO-N7 VALVE (206-082)
(1) VVQ1000-87A-B-50 BLOCK BUSHING (206-084)
(2) VVQ0000-58A PORT PLUG (209-276)
(1) DIN RAIL PER DETAIL
(2) M5X6 SREWS (SHCS)
(2) #10 INTERNAL TOOTH LOCK WASHER



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERANCES ARE:
2 PLACE DECIMALS ±.015
3 PLACE DECIMALS ±.005
ANGLES ±1° FRACTIONS ±1/32
SURFACE FINISH 125
SECONDARY DIMENSIONS ARE PROVIDED FOR REFERENCE ONLY
INCHES (MM)
3RD ANGLE PROJECTION

MATERIAL:
Material Spec.
FINISH:
Finish Spec.

EMERSON Industrial Automation

	NAME	DATE
DRAWN	DDL	11/05/01
CHECKED		
APPROVED		
SCALE: 1:1	SHEET 1 OF 1	

BRANSON

TITLE
PNEU KIT ASSY (ULTRASEAL 20)

SIZE D | DWG NO V1A01A72-03 | REV 03

SOLID EDGE