Model
e-Press

SONICS®

Sonics & Materials, Inc.

WARRANTY

Sonics & Materials, Inc., hereinafter referred to as "Sonics", warrants its products for a period of one year from the date of original shipment against defects in materials and workmanship under normal installation, use and maintenance as described in the operating instructions which accompany such equipment. During the warranty period, Sonics will, at its option, as the exclusive remedy, either repair or replace without charge for material and labor, the part(s) which prove upon our examination to be defective, provided the defective unit is returned to us properly packed with all transportation charges F.O.B. Sonics dock, Newtown, CT. Warranty period on equipment rentals that are converted to purchase are deemed to have commenced on the date of original rental equipment shipment.

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

Ultrasonic plastics welding horns constructed of steel are guaranteed against defects for a period of ninety days from date of shipment. Sonics will repair or replace a cracked or defective steel horn once at a charge of 50% of the original purchase price, if failure occurs within the warranty period.
Ultrasonic metal welding horns constructed of titanium or steel are guaranteed against defects for a period of one year from date of shipment. Sonics will repair or replace a cracked or defective horn once without charge, if failure occurs within the warranty period.

Sonics warrants its ultrasonic converters for a period of one year from date of shipment with a one-time replacement if a converter proves to be non-repairable.

When customer site service is required, all travel, living and related expenses will be billed at cost. In-warranty service labor time (including travel time) at the customers facility is provided Monday through Friday (excluding holidays) from 8:00 am to 5:00 pm. Any in-warranty service time requested outside of these days and hours will be billed at 150% of Sonics current rate per hour for such site service work.

LIMITATION OF WARRANTY

This warranty does not apply to items subject to normal wear and tear or, to equipment or tooling which has been subject to unauthorized repair, misuse, abuse, negligence or accident. Misuse includes operation of equipment with tooling that is not qualified for the equipment or tooling not properly installed on the equipment. Equipment which, in our judgment, shows evidence of having been used in violation of operating instructions, or which has had the serial number altered or removed, will be ineligible for service under this warranty.

For components and parts not manufactured by Sonics but included in Sonics manufactured equipment, this warranty shall be limited to the warranty as given to Sonics by said original component or part manufacturer.

Ultrasonic horns supplied by Sonics are manufactured to exacting specifications and are tuned to vibrate at a specific frequency. Using an out-of-tune horn will cause damage to the equipment and may result in warranty nullification. Sonics assumes no responsibility for converters, horns or fixtures not supplied by Sonics or for consequential damages resulting from their usage.

Ultrasonic converters showing signs of excessive heat or contamination, such as but not limited to, oils and moisture, are not covered by this warranty.

Warranty does not apply to ultrasonic horns quoted as prototype, experimental or of unusual design which, in our judgment are more likely to fail in use.
Warranty does not apply to re-sharpening of ultrasonic blade type cutting or slitting horns.
Warranty does not apply to knurl pattern wear on ultrasonic plastics and metal welding horns and tips.
Warranty does not apply to ultrasonic horn or tip face wear when used with plastics that are molded with fillers, such as but not limited to, glass or talc.
This warranty does not apply to ultrasonic plastics welding equipment, horns or fixtures where metal-to-metal tooling contact time is in excess of 250 milliseconds.
This warranty does not apply to used or re-built equipment.
This warranty is non-transferable.

Data supplied in Sonics instruction manuals has been verified and validated and is believed adequate for the intended use of the equipment. If the equipment or procedures are used for purposes other than those specified herein, confirmation of their validity and suitability should be obtained in writing from Sonics. Otherwise Sonics does not guarantee results and assumes no obligation or liability.

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

WARNING
SAFETY PRECAUTIONS
READ BEFORE INSTALLING OR
USING THE EQUIPMENT

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

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

– Do not use with foot switch unless alternate means of pinch-point protection is provided.

– High voltage is present in the equipment. Disconnect plug before removing cover or servicing.

– Make sure equipment is properly grounded with a 3-prong plug. Before plugging in equipment, test outlet for proper earth grounding.

– High voltage potential may be present in the converter as a result of temperature changes. Do not touch the converter contact unless you first short both pins or the button to the converter case with an insulated tool.

– Never squeeze or grab a vibrating horn.

– Do not modify horn configurations.

– Ultrasonic welders operate above normal audibility for most people. Ear protection is recommended.

– Do not affix any device to any portion of the horn.

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INSPECTION

Prior to installing the equipment, perform a visual inspection to detect any evidence of damage which might have occurred during shipment. Before disposing of any packing material, check it carefully for small items.

The equipment was carefully packed and thoroughly inspected before leaving our factory. Responsibility for its safe delivery was assumed by the carrier upon acceptance of the shipment. Claims for loss of damage sustained in transit must therefore be made upon the carrier, as follows.

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

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

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

ELECTRICAL POWER

The E-Press motor controls require a fused, single phase, standard 3-terminal grounding type electrical receptacle capable of supplying 105-125 volts, 50/60 Hz, 15 amp service, or 200-240 volts, 50/60 Hz, 10 amp service, depending on the voltage option.

Fuse Slo-Blo	@ 115 VAC	@ 230 VAC
F1	15 amps	10 amps
F2	2 amps	1 amp

LOCATING THE EQUIPMENT

The system should be installed in proximity to the electrical source, and it is supplied with an 8 Ft power cord. The area should be free from excessive dust, dirt, corrosive fumes and extremes of temperature and humidity.

Allow at least 10 inches (25 cm) in back of each unit for cabling convenience.

All welding press models should be placed on a sturdy level bench capable of supporting a minimum of 500 pounds (227 kg).

The power supply and motor controller should be located so that the front panel controls are visible and accessible. Sufficient space should be allotted around the unit to ensure adequate ventilation. If the power supply and motor controller must be housed in a confined space, forced air-cooling may be necessary to keep the surrounding air within acceptable ambient temperature. Periodically check the ventilation grille and clean if necessary. The distance between the welding press and motor controls should not exceed 9 feet (3m).

PREPARATION FOR USE - CONNECTIONS

Connect the power supply and press in accordance with the following procedure. See section 4.0 starting on page 13 for additional information and a connection diagram.

1. Using cables provided, connect the power supply to the press. Do not strain or kink the cables. When going around corners, allow as wide a bend as possible. Do not run the cables parallel to any power line within a distance of less than 1 foot (30 cm).

2. Plug the power supply line cords into the electrical outlets. To prevent the possibility of an electrical shock, ensure that the line cords are properly grounded.

IMPORTANT SERVICE LITERATURE

Please read carefully before operating the equipment

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

MANUAL INFORMATION

We continually strive to keep up with latest electronic developments by adding circuit and component improvements to our equipment as soon as they are developed and tested.

In order to move around the manual quickly, hyperlinks are provided in the following Table of Contents (TOC) for each major section. Click the hyperlink to move directly to the selected section. At the top of each linked heading you will find a TOC link to return to the Table of Contents. This should help to minimize continuous page up/down key-strokes to find a section of interest.

For the purposes of this manual, references to the "GX controller" or to the "ultrasonic power supply" will mean the associated ultrasonic supply and microprocessor controller. References to the "motor controls" or "stepper system" will mean the transport controls for velocity and distance. Certain ultrasonic control parameters can affect the stepper control performance. The GX Ultrasonic Power Supply manual must be considered an integral part of understanding the Stepper Welding System.

Basic Windows™ familiarity is assumed. The user must be familiar with Windows™ based file selection and mouse operations. Consult a Windows tutorial if these operations are unfamiliar. Manual descriptions will not address these basic concepts.

Internet familiarity is also assumed. URL addresses have been included in a few sections to assist with downloads for viewing this manual. If Internet access is not available these references may be ignored.

Manuals for all new Sonics & Materials products are provided on CD.

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

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GENERAL

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System Operation

1.0 Introduction to Plastic Welding -

WHAT IS ULTRASONICS?

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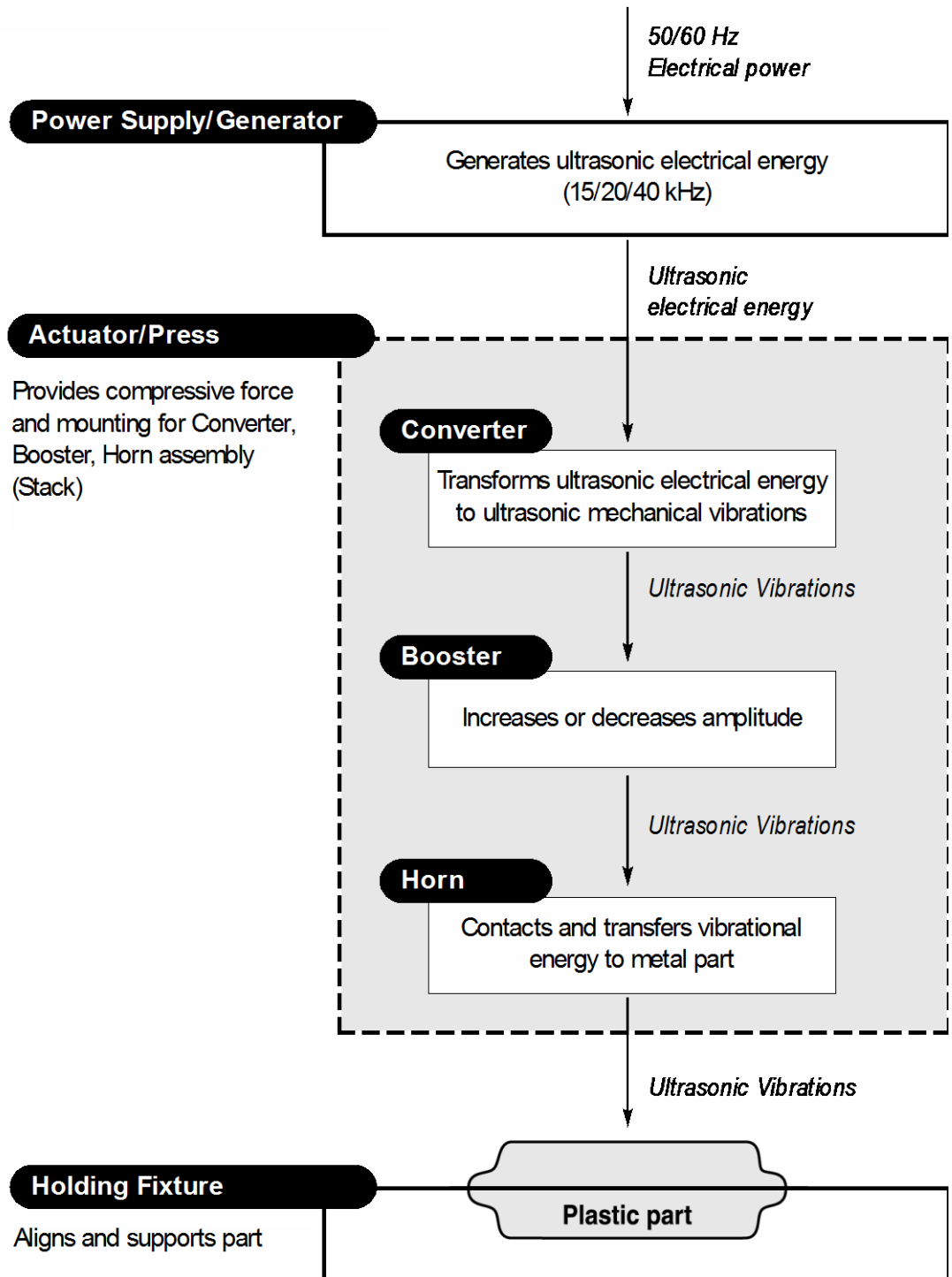
PRINCIPLE OF ULTRASONIC ASSEMBLY

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

ULTRASONIC ASSEMBLY SYSTEMS

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

50/60 Hz
Electrical power

Power Supply/Generator

Generates ultrasonic electrical energy
(15/20/40 kHz)

Ultrasonic
electrical energy

Actuator/Press

Provides compressive force
and mounting for Converter,
Booster, Horn assembly
(Stack)

Converter

Transforms ultrasonic electrical energy
to ultrasonic mechanical vibrations

Ultrasonic Vibrations

Booster

Increases or decreases amplitude

Ultrasonic Vibrations

Horn

Contacts and transfers vibrational
energy to metal part

Ultrasonic Vibrations

Holding Fixture

Aligns and supports part

Plastic part

ULTRASONIC TERMS

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

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

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

BOOSTER – Successful ultrasonic welding often depends on having the right amplitude at the horn face. Often it is not possible to design a horn which has both the necessary shape and required gain (ratios of input amplitude to output amplitude). To achieve the best desired assembly accuracy of the stepper system, a solid mount booster is located between the converter and the horn. In addition to changing/maintaining the amplitude, the booster provides support and alignment in the welding system.

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

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

2.0 The Stepper Welding System <u>TOC</u> **-** The Stepper Welder System (E-Press Model) is designed for precision plastic welding applications with dimensional requirements beyond the capabilities offered with a standard air actuated ultrasonic press. The system will control the final weld position with a tolerance of ±0.0003 inches. Finished assemblies are produced with a weld repeatability that is not possible with any other plastic welding process. The advancing speed of the ultrasonic horn is controlled with a stepper motor drive, which exactly repeats the defined profile for position and velocity every time. The results are repeatable welds with exact final dimensions of the bonded components when compared with air driven actuators (material dependent). The system is offered as a transport option with standard Sonics & Materials 20 kHz and 40 kHz ultrasonic power supplies.

The E-Press actuator assembly is a completely rigid system. Solid booster technology is used to mount the stack assembly into the actuator head. These boosters do not contain O-rings, which are found in conventional ultrasonic boosters. O-rings can move and distort as pressure is applied resulting in horn movement on the parts and weld quality problems. With this rigid system the horn will not move and full capability of the stepper motion controls can be achieved.

Welding with an E-Press driven actuator is very unique, compared to a conventional pneumatic welder. With a pneumatic welder the applied force on a part is adjusted by changing the air pressure regulation to the cylinder which drives the horn assembly. Continuous pressure is applied to the parts during the welding process. Attempts to modify the applied pressure are only marginally successful due to the volume of air that is present. Pressure cannot be changed instantaneously as long as the air system has pressure. A notable lag will occur between changing the regulator settings and any actual pressure change. In most cases, the weld will be completed long before the pressure change could affect the weld in any appreciable way. With the stepper system, force can be controlled precisely through a digital velocity profile.

The E-Press system uses the programmed weld velocity to control the applied force directly. This applied force is also dependent on ultrasonic amplitude, which controls the level of heat available, and therefore the amount of molten plastic that will be produced between the parts. The resultant force will be a function of heat (ultrasonics) to melt the plastic and velocity to drive the parts together. The faster the horn moves into the parts the greater the force. The greater the heat that's available to melt the plastic, the lower the force, because the plastic will flow out from under the horn. Best application results will be provided by careful balance of velocity, distance and ultrasonic amplitude. With the velocity and distance precisely controlled, the actual weld cycle time will also be exactly repeatable because the velocity profile will be the same every time.

The E-Press controls are packaged in the same size chassis as the Sonics & Materials ultrasonic power supply so that they can be stacked together. This provides a standard ultrasonic supply whether the customer application requires velocity controls with the stepper transport or a standard air actuated system. Both units should be located so that they are accessible to the operator for initial setup and programming.

3.0 System Specifications

Application Types:

– The E-Press Model is best applied to applications that require precise dimensional control, repeatability or improved bonding strength. Special materials and delicate components will also benefit from the velocity profile offered by the EP System.

– Clean room applications that cannot allow the pressurized air systems required by conventional ultrasonic welders.

– Marginal conventional ultrasonic applications may be stabilized to improve weld quality and reduce production reject rates.

Press (All):

Transport System: Stepper Motor positioning system w/ ball screw

Force Trigger Control: 5 – 150 lbs.; 1-lb. increments.
                                              (22 – 650 Newtons; 1 Newton increments).

Vertical Travel Velocity: 4 in/sec (102 mm/sec).

Weld Velocity 1 and 2:   0.001 –.500 in/sec
                                              (.025 – 12.7mm/sec)

Weld Distance (Ref Parts Contact Diagram Pg. 18):

    Absolute   0.0500 - 3.500 in.
                                              (1.27 - 89 mm)

    Incremental   0.0010 - 0.5000 in.
                                              (0.01 - 12.70 mm)

Motor Position (Digital) Accuracy: 0.00002 in. (0.0006 mm).

Parts search zone (Ref Parts Contact Diagram Pg. 18):

    Upper Tolerance   0.0020 - 0.1500 in.
                                              (0.050 - 4.000 mm).

    Lower Tolerance   0.0020 - 0.5000 in.
                                              (0.050 - 4.000 mm)

Fixture Mounting Thread: 3/8 - 16 (10 mm).

Maximum Stroke: 4.0" (101 mm).

Motor Stall Force: >500 Lbs. (2225 Newtons).

20 kHz e-Press Dimensions:

Press Height:	48" (1219.2 mm)
Weight:	210 Lbs. (95 Kgs)
Maximum opening for parts and fixture:	10" (254 mm)
Depth:	25" (635 mm)
Width:	14" (355.6 mm)

GXP Power Supply:

AC Power: 115 VAC F1 - 10 amps.
                                                        F2 - 2 amps
                                                230 VAC F1 - 10 amps.
                                                        F2 - 2 amps

Package size: 14.75" W x 7.5" H x 23.25" D
                                                (374.65 x 190.5 x 590.55 mm)

Weight: 21 Lbs. (9.5 Kgs).

Humidity: 20 – 90% non-condensing.
                                                Operating Temperature Range: 50°– 90° F
                                                (17° – 40° C)

Stepper Motor Resolution: 42666 counts/inch. (0.0000234 in./count).

Maximum Motor Case Temperature: 125° C

Display: Color Touch Panel HMI

4.0 Physical System and Connections

Cable Connections for Stepper Controller and Ultrasonic Power Supply

The drawings below and on the next page show the back connections of the Stepper and Ultrasonic controls. Match the cables from the press to the appropriate connections noted below. (The interconnecting cables will be supplied with your system.)

Back Panel Description, drawing 1
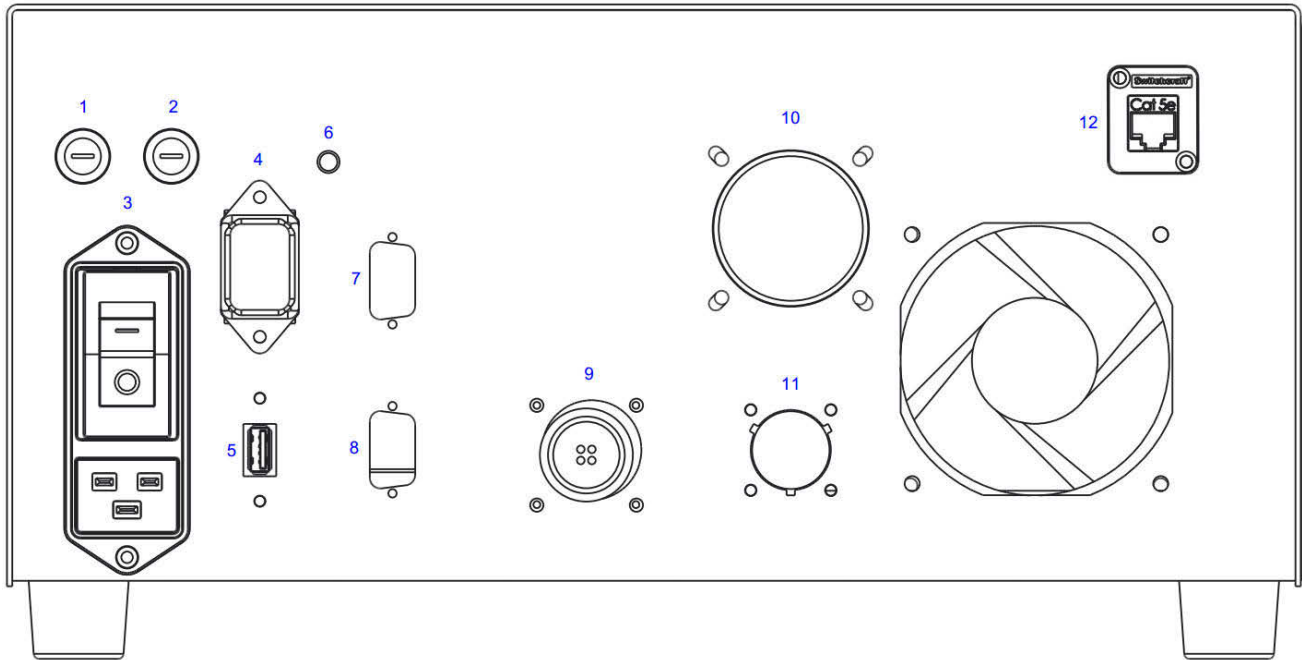
1. Fuse F1
2. Fuse F2
3. Power Entry/Power Switch (20A Breaker)
4. Power out to the motor in press
5. USB port for Data Log and Screen Shots
6. Reset button
7. Not in use
8. Not in use
9. Control cable to Press
10. Converter RF Connection to Press
11. J2 Base Palm buttons or Remote Actuation
12. RJ45 for Ethernet/IP and TCP/IP connection

Back Panel Connections, Drawing 2

Press Connections
Bottom side of press head
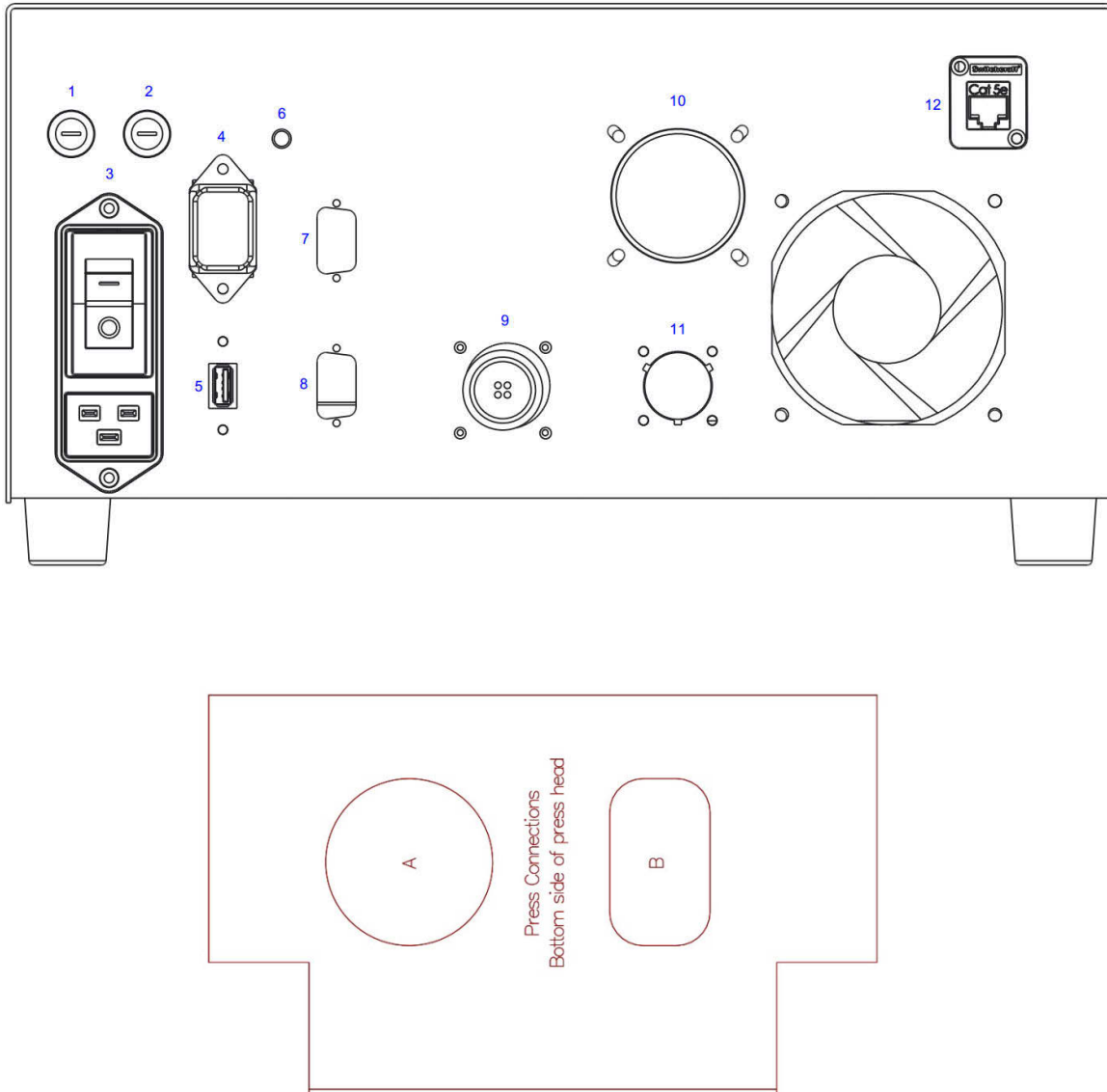
1. Connect the Coax cable from the press to the power supply (10).
2. Connect the signal cable 201-0290 from the press (A) to the power supply (9).
3. Connect the motor power cable 816-0120 from the Press (B) to the power supply (4).
4. Connect power supply (3) to main AC line power with supplied line cord 816-00162.
5. Connect the Base cable (Back of press base) for palm button actuation to the power supply (11).
6. *If used in impulse mode, connect the supplies actuation cable 201-0151 to power supply (11).*
7. *If used with EtherNet/IP connect the Ethernet cable to power supply (12).*

Security, Log In

5.0 System Operation <u>TOC</u> **–** The system cannot be operated unless one of 4 users has logged in. The default passwords can be changed by the supervisor login.
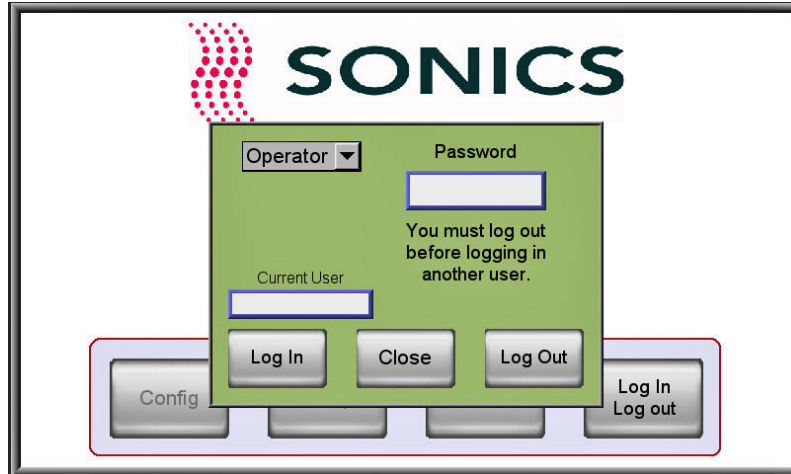
Users:

Operator, Password 1111
The operator login will only have access to the Run, Data Log and Graph screens. The operator will have no access to the setup screens and will not be able to change weld parameters.

Setup, password 2222
The Setup login will have access to the operator screens along with the Setup and Config screens. The Setup login will be able to modify the weld parameters and Teach the system for new part setup.

Supervisor, Password 3333
The Supervisor login will have access to the Operator and Setup screens along with the Supervisor screen. This added screen allows for the change of passwords, job screen setup and log functions. Panel system settings are also available.

Controls, Password 4444
The Controls login has access to an added screen which allows for the setup of actuation types and data collection functions. This screen is mainly used for use in automation.

Job setup

From the Setup or higher login, select the **Setup** screen. This screen has all the major weld parameters along with control values. Note: For quick information on a setting, tap the setting title for a pop up note.

Weld: Actual melt distance.

Velocity: Rate of travel for the Weld distance.

Hold: Time the horn will remain on the part after the completion of the Weld distance.

Amplitude: Ultrasonic displacement of the horn. 20% to 100%

Energy: Energy value to stop Sonics. There is an option to stop motion on Energy or continue to distance. See Additional Settings.

Pre-Trig: Option to turn ultrasonics on before the part is contacted.

Force: Trigger force on the part prior to welding.

Travel: The distance the horn will travel to the part. This value is used to Teach the system when setting up a new application. See Teach below for details.

Tolerance +: The position above a taught part where the horn slows to search for the part to be welded.

Tolerance -: The position limit that the horn will search for the part beyond the taught position before it aborts and returns home.

Upper Limit: Energy upper limit that will generate an over weld error.

Lower Limit: Energy lower limit that will generate an under weld error.

Additional Settings

These are less common settings that may be used to fine tune an application.

Inc: In incremental mode the weld distance is counted from the position that the force trigger is met.

Abs: In absolute mode the weld distance is counted from the horn Home position.

Pre Sonics: The Sonics will be active for this amount of time before the horn starts to move. The horn will travel to the part and apply force, sonics is turned on and the horn remains in position for the **Pre Sonics** time before the horn moves through the weld.

After Burst: A timed burst of Sonics as the horn is returning home to shake a part from the horn.

Stop on Peak Force: Stops a weld if a peak force has been achieved.

Stop on peak power: Stops the weld if a peak power is achieved.

Stop Motion on Energy: Allows the motion to be stopped if the energy is reached prior to distance.

Setup Helpers

Velocity Helper: Many applications are weld time critical. To help calculate the proper Weld Distance and Velocity for a specific Time, tap the Weld title for a Helper pop up.
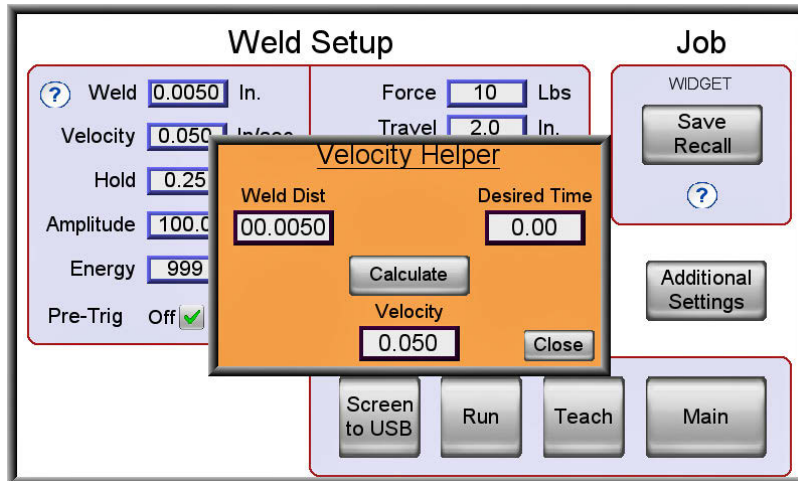
Enter the Weld Distance and *desired Time* and tap Calculate. Close the pop up and the values will be entered for welding.

Absolute Helper: Calculating an Absolute distance can be difficult since the travel distance and weld distance need to be known. This Helper takes the taught distance and the Weld distance to come up with an Absolute weld distance. Tap the Weld title in when in Abs mode for the pop up Helper.
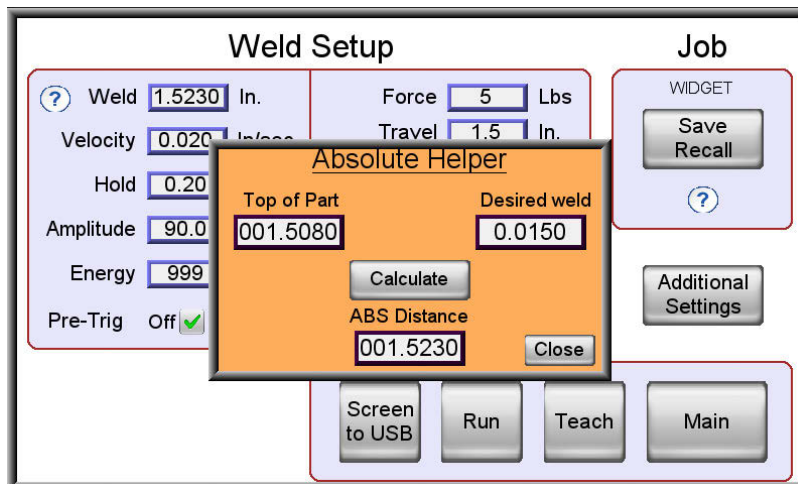
Enter the actual melt distance in the *Desired weld* box and tap Calculate. Close the pop up and the value will be entered for welding.

Job, Save & Recall

From the Supervisor login, the system can be configured to store as many jobs as desired. This configuration is accessed through the Supervisor screen, Job Setup button.
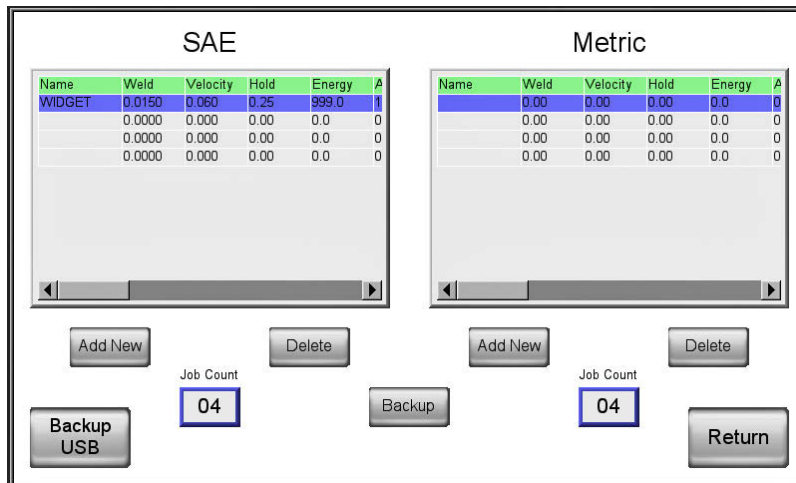
From this screen, the number of jobs can be added or deleted.

Once the jobs are added, the job values can be saved from the setup screen Save Recall button, which can be accessed from the Setup login or higher.
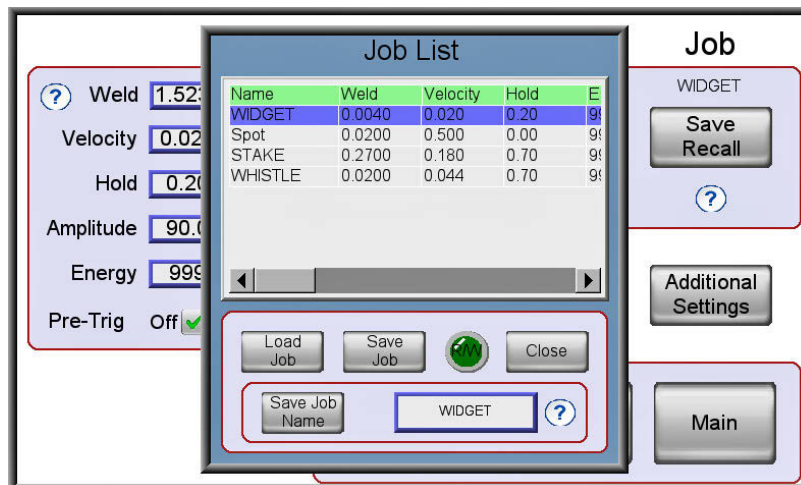
Once the weld parameters are added from above, these values can be saved in a job. The Job name is saved as a separate function. Tap the job you wish to name or change the name of then tap the Save Job Name box. Enter the job name desired then tap the Save Job Name button. This changes the name only and does not load the job.

Load Job: This button will load the current job stored in memory.

Save Job: This button will save any weld parameters changed in the setup screen.

**Close:** This button will close the window with no changes.

Note: If changes are made to the weld parameters and they are not saved, they will be lost if the power is removed and the values will revert back to the last loaded job.

Teach

This is a very important function in the setup of a new application. The system needs to know where the parts are in the stroke in order to prevent high velocity part impacts which could damage tooling and parts.

Weld values need to be determined and saved prior to this step. Importantly the **Travel** value must be determined.

From the Setup login or higher, tap the Setup button. This can also be accessed from the Setup screen.
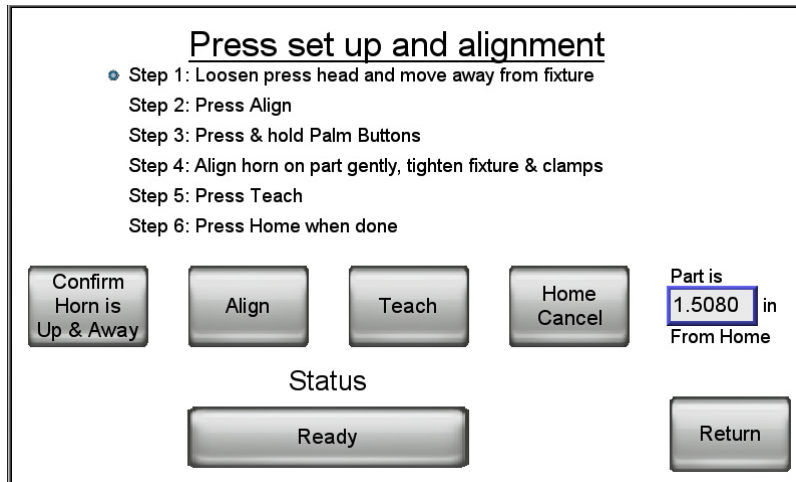
- Loosen the press clamps and raise the horn at least 5" above the fixture.

- Place an **UNWELDED** part assembly into the fixture.

- Press **Confirm Horn is Up & Away** as confirmation that the horn is raised away from the fixture.

- Tap the **Align** button.

- Press both palm buttons and hold until the horn stops moving.

- Loosen the press clamps and gently lower the horn onto the unwelded part assembly. With the press and fixture loose, align the horn to the part. Tighten the press clamps and fixture bolts.

- Press the **Teach** button. The horn will slowly move to the part and apply the programmed trigger pressure and stop. The true distance will be displayed in the box to the right indicating that the part has been taught.

- Press the **Home Cancel** button to return the horn to the home position.

- Press **Return** to return to the setup screen.

This completes the Teach process and the part is ready to be welded.

Note: If the system is being used in an automated system in impulse mode, the following will pop up as a safety warning to make sure the work area is clear as the horn will move with a single button press. This is necessary as there are no palm buttons installed in this mode.

In this mode, proceed with caution.

Controls

The Controls screen is for the controls engineer who is responsible for the integration of the welder into an automated system. This screen can only be accessed by the Controls login.
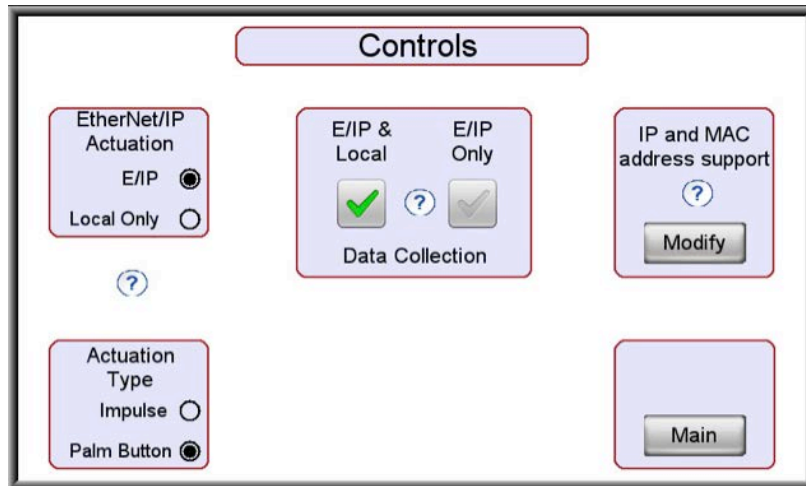
Actuation Type: This allows the welder to be cycled by Impulse actuation or by Palm Buttons only. If Impulse is selected, the Palm Buttons will still cycle the welder in a safe mode. If Palm Button is selected, the welder will only cycle by Palm Buttons.

EtherNet/IP Actuation: If E/IP is selected, the welder may be cycled via an EtherNet/IP connection to an Allen Bradley PLC. Note: Impulse must be selected in Actuation Type in order to cycle via an EtherNet/IP connection.

Data Collection: The E/IP & Local selection will allow the collection of Data locally at the welder and remotely from the PLC connected via EtherNet/IP. The E/IP Only selection will turn off the local Data collection and only send data to the PLC via the EtherNet/IP connection. This option is only needed for extremely fast cycle times in excess of 50 welds per minute. The collection of data in the welder slows the system slightly preventing extremely high cycle rate.

IP and MAC Control: This will bring up a screen to allow the setting of the IP address for the HMI and internal controller. The MAC address of a Allen Bradley PLC needs to be added here in order to communicate via EtherNet/IP.

IP and MAC Address

This screen will allow the setup of the IP address if the welder is going to be connected to an automated system network via EtherNet/IP.

Enter the desired IP address for the controller and the HMI. Be sure these addresses do not conflict with other devices on the network. The welder requires 2 free addresses.

Set IP: This button will write the IP addresses to the Controller and the HMI and then reset the system.

Test Connection: This will test the link between the HMI and the controller.

MAC Support: This will enter a screen to input the MAC address of the Allen Bradley PLC.

Enter the first 4 bytes of the PLC's MAC address here. Note: The welder MUST be disconnected from the network before proceeding. Failing to do so could result in a software crash and the welder may need to be returned to the factory. If there is any doubt, contact the factory before proceeding.

This message pops up if the link from the HMI to the controller is lost. This will require a System IP Recovery.

System IP Recovery: If for some reason the IP addresses become corrupt, there is a process to recover the factory set IP addresses.

The first step is a manual procedure of shorting a jumper on the interface board inside the welder. This jumper is 2 small pads labeled IP Reset and they need to be shorted with a small screw driver or needle nose pliers. The LED to the right will light once the jumper is made at which point the jumper can be removed. This will reset the IP address in the controller to 192.068.1.200
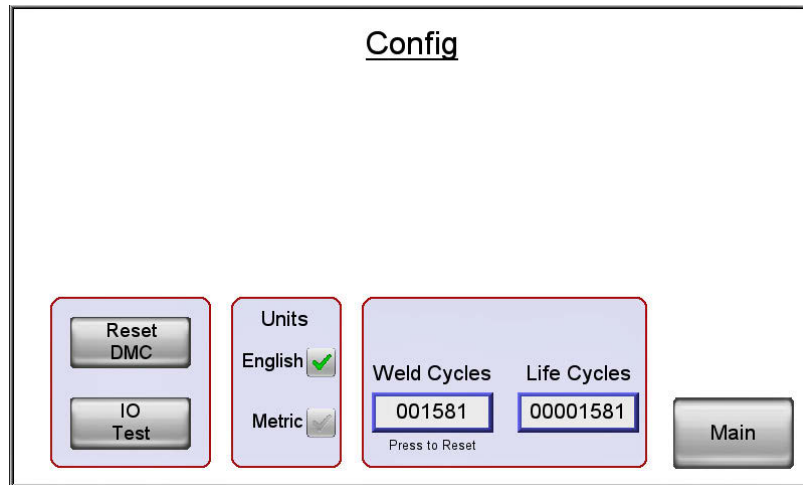
The second step is to press the button on the screen HMI IP Recover. This will reset the IP address in the HMI to 192.168.1.201

Once the system resets, the IP address can be set as desired.

Follow these steps closely and if there is any doubt, contact the factory for assistance.

Config

This screen can be accessed from the Setup login or higher.

Reset DMC: This button will reset the motion controller. This will also switch the screen back to the main screen.

IO Test: This will display a screen of the inputs and outputs of the welder and will allow for testing.

Units: Switches the setup measurements and settings between English and Metric units.

Weld Cycles: Displays the number of weld cycles since last reset. Tap the box to reset the count. A confirmation dialog box will pop up for confirmation.

Life Cycles: Displays the number of cycles over the life of the welder.

Note: The cycle counters will not increment if the data collection is set to Remote Only.

Supervisor

This screen can be accessed from the Supervisor login.
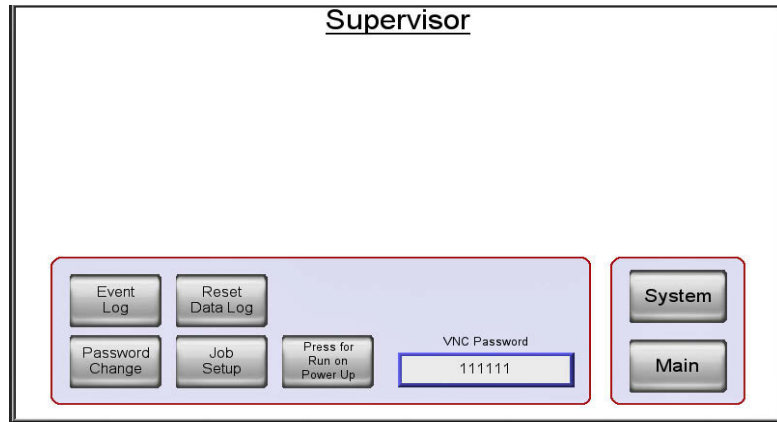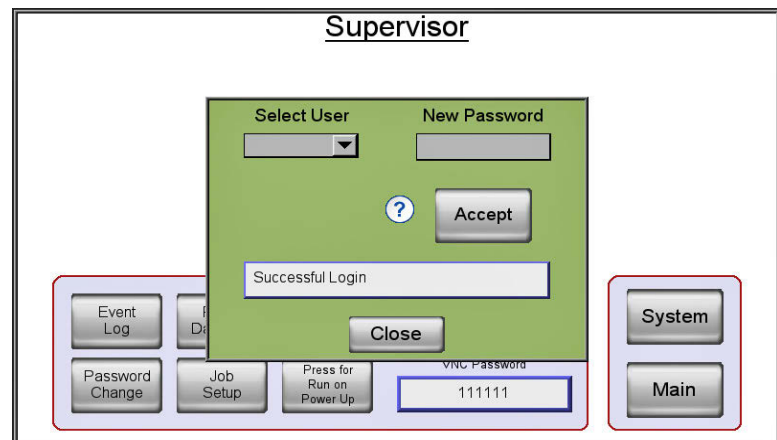

Event Log: This log records events such as Overloads, over & under welds, E-Stop & Motor stall conditions along with login information.
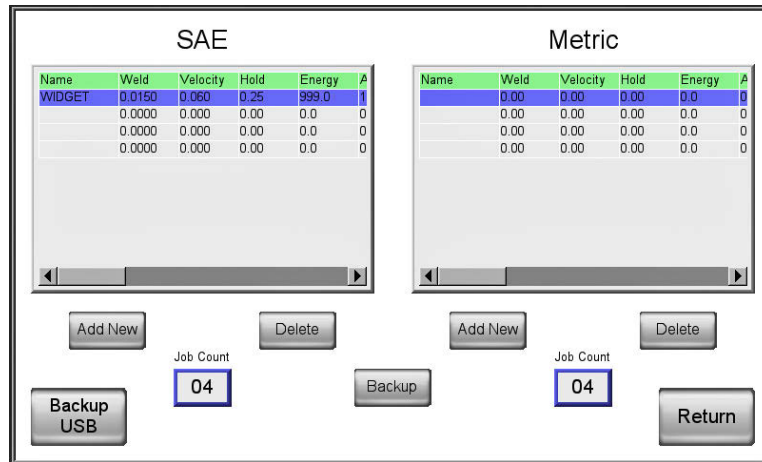

Reset Data Log: This will clear the weld data accumulated in the Data Log

Password Change: This is where the Supervisor can change the password assignment for each login. Select the User, change the password and Accept. Close to exit.

Job Setup: This was mentioned above. The Supervisor can choose how many jobs can be saved in the system both in Metric and English.

Note: This screen only creates a location to save a job; it does not save the job data. This is done in the Save Recall screen from Setup.

Press for Run on Powerup: At times the welder power supply need to run unattended. With this option selected, the welder will power up in the run screen when power is applied and the rear power switch is on.

VNC Password: This is the password used to access and set up the power supply remotely over a network.

System: This allows access to some system settings: buzzer on or off, screen brightness, software revisions and the System Bar. This bar provides access into more panel setting like time and date adjustments.

6.0 Stepper Welding Operation <u>TOC</u> **–** The stepper welding process is similar to the conventional ultrasonic process. The application parts are positioned in the fixture and dual palm buttons are pressed simultaneously to initiate a weld. A cycle begins by advancing the horn to the parts at a fixed approach velocity. The approach velocity has been selected based on the mass of the head mechanism and the maximum acceleration that can be used without stalling the stepper motor.

Just above the parts, the velocity is reduced to a search speed in order to locate the parts for assembly. This protects the parts from impact damage that could result from a higher speed contact. The parts search will continue for a distance equal to the width of the programmed tolerance window or until the parts are found.

When the ultrasonic horn contacts the assembly, pressure will increase quickly. The applied force is measured and monitored until the trigger set-point is reached defining the parts' location and positively seating the plastic interface joints. The trigger is satisfied and ultrasonics will be turned on to begin the plastic weld. The defined weld motion profile will continue as the ultrasonic energy melts the plastic joints.

When the weld velocity and distance profiles have been executed, the weld is complete and ultrasonics will be turned off. If a hold time has been programmed, the motion will be stopped and the system will wait for the specified time period. Hold time is normally used to allow the plastic joint to solidify while the parts are held in position to complete the bonding process.

The system will retract to the home position to end the weld cycle. The final weld results will be reported on the stepper controller panel and the system will be ready for another weld operation.

The following sequence of events defines the "typical" weld cycle.

Typical Weld cycle:

1. The weld cycle is initiated by simultaneous palm button commands.

2. The stepper drive head assembly will descend at a high speed to the parts position taught by the "Teach Command," less the upper tolerance setting.

3. The system searches for the parts at a slower search speed. The parts are detected when the force builds to the programmed Force Trigger set-point. If the parts are not found by the time the system has traveled to the lower tolerance setting, the cycle is aborted and the head retracts automatically. Parts may not be positioned in the fixture.

4. When the parts are found, the specified incremental or absolute weld will begin. The ultrasonics is turned on and the motor continues to travel at the programmed Velocity until the programmed Distance is reached.

5. When the distance has been satisfied, the ultrasonics will be turned off.

6. The system waits for the hold time specified for the welder controls.

7. When the weld cycle is complete, the system ascends to the home position.
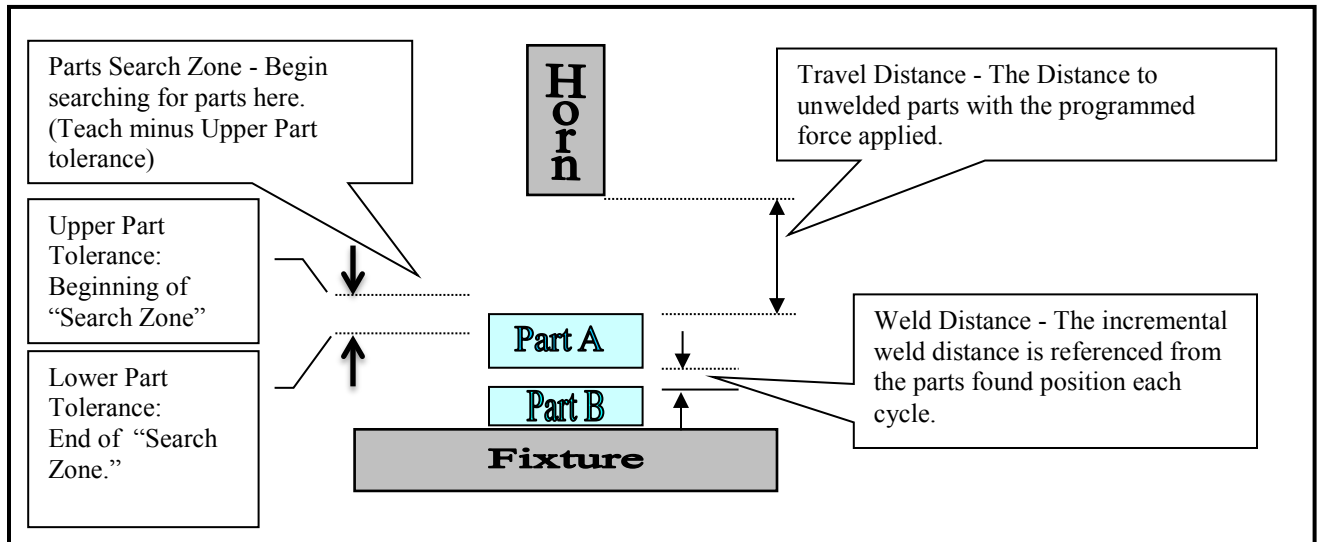
Power Up – The main power switch is located on the lower right side of the back panel. This switch powers the controls, motor and the user interface. The Ultrasonics is powered after the user has logged in and the setup or run screen is selected.

Safety Note – The stepper welding system will retract to the head up position whenever the Red Emergency Stop button on the front of the press is engaged. The Stepper Controller will remain powered during an emergency stop condition in order to step the mechanism in the reverse direction. It does not power down with engagement of the Emergency Stop button. This action is necessary due to the force that can be applied by the screw mechanism! Just stopping all movement is not an acceptable action because the applied pressure will not be removed. The pitch of the screw mechanism is very small, it may not be easy to release the pressure by human intervention. It could be difficult for the operator to manually lift the press assembly. Depending on the customer application, additional protection may be required by local laws or the European community. In some applications where operators may be directly exposed to danger areas additional guarding may be required. The ultrasonic power supply section is CE marked and has been tested in standard air actuated ultrasonic systems. The motor controls are not CE marked.

Position Accuracy – The system uses a stepper motor drive and ball screw which is controlled to 42666 counts per inch and a feedback encoder which reads to 6660 counts per inch (1679 counts per millimeter and 262 counts per millimeter respectively). The purpose of the encoder is for position maintenance only. The weld resolution is controlled by the motor. The indicated position numbers on the stepper and logger screens represent the measured motor movement. Any mechanical deflection caused by large pressures applied to the "Parts to be Welded" will degrade the accuracy numbers (with respect to the part dimensions). The operator should be aware that large pressures approaching 500 LBS can be applied very quickly. If the ultrasonic amplitude is too low and the plastic is not hot enough to melt, then large pressures can be applied with only a few steps of the motor system. If pressures exceeding 500 LBS are applied, the motor system may stall. The system must be reset with the RESET button on the back of the controller panel.

Applications – A stepper application project involves careful setting of the distance, velocity and ultrasonic controls.

Parts Contact Diagram

Parts Search Zone - Begin searching for parts here. (Teach minus Upper Part tolerance)

Upper Part Tolerance: Beginning of "Search Zone"

Lower Part Tolerance: End of "Search Zone."

Horn

Travel Distance - The Distance to unwelded parts with the programmed force applied.

Weld Distance - The incremental weld distance is referenced from the parts found position each cycle.

Part A

Part B

Fixture

Parameters in English and Metric

Parameter	English-ABS	English-INC	Metric-ABS	Metric-INC
Force Trigger (FT)	05 – 150 LBS	05 – 150 LBS	25-650 Newtons	50-650 Newtons
Travel Distance (T1)	0.2 – 4.0 In	0.2 – 4.0 In	05 – 100 mm	05 – 100 mm
Weld Velocity 1 (R1)	0.001-1.00 in/s	0.001-1.00 in/s	0.02 - 25.00 mm/s	0.02 - 25.00 mm/s
Weld Distance 1 (WD)	0.0500 – 2.7500 In	0.0010 – 0.5000 In	1.000 – 100.00 mm	0.01 – 20 mm
Upper Tolerance (P1)	0.002 – 0.150 In	0.002 – 0.150 In	0.05 – 4.00 mm	0.05 – 4.00 mm
Lower Tolerance (P2)	0.002 – 0.150 In	0.002 – 0.150 In	0.05 – 4.00 mm	0.05 – 4.00 mm

Glossary of Terms

Align – The horn moves to the travel distance in order to position the unwelded parts and fixture.

Search Speed - A very slow final approach speed used to find the plastic parts. It is used to avoid impact damage to the parts that would occur if the travel speed were to be used all the way to the parts.

Deflection – A measurement taken at the parts position which indicates the expected bending of the ultrasonic press with applied pressure. Deflection will degrade the position accuracy of the system.

Encoder – Used internally for position maintenance. The encoder tracks the motion profile to ensure the motion is complete and the motor did not stall.

Force Trigger – The amount of force applied before the weld begins. Force is measured with a load cell mounted in-line to the stack assembly and the screw actuator.

Hold Time – The programmed duration which the horn is held on the part after the weld ends and before the horn travels home.

Home Position – The full upward start position.

Lower Tolerance – The search window position below the taught position which is the expected minimum limit where the parts will be found. If parts are not found before the lower limit position, the cycle will be aborted.

Press/Actuator – The mechanical assembly which holds the ultrasonic stack and provides a rigid platform to hold the parts and fixtures.

Stall/Slip – When the stepper motor fails to rotate when motion steps are applied. Caused by too much applied force or a field velocity too high to maintain physical alignment.

Stepper Motor – A special type of rotary positioning motor. Alternately energized phase coils will magnetically move the rotor in order to control its final position.

Teach – The method used to define the precise position of the parts to be welded. The system moves downward at slow speed until force is detected by the load cell. This defines the top of the parts!

Travel Velocity – Initial velocity used to approach the parts. The system will switch to a creep speed just above the parts and slowly find the parts.

Upper Tolerance – The search window position above the taught position which is the expected maximum limit where the parts will be found. This position is used to end the travel approach speed and defines the start of the creep speed zone used to detect the parts.

Weld Velocity – The programmed speed used to advance the head assembly during the weld time. Two speed changes can be programmed during the weld and/or hold times.

Weld Distance – The distance to travel during the weld. Two weld distance steps can be programmed during the weld time.

Logix 5000 EtherNet/IP Setup for Sonics model GXP

1. Open RS Logix 5000 software and connect to the AB PLC.

2. On the left side folder tree, right click on "Ethernet". Select "New Module". This will open the "Select Module" window.

3. Under Communications, select "ETHERNET-MODULE" for a Generic Ethernet Module.
This will open the "New Module" window.

4. Give the new Generic Module a name (ie. GXP), select comm format "Data-Real", enter the IP address of the GXP controller that was assigned. Set the following Assembly Parameters. Once finished click "OK".

Parameter	Assembly Instance	Size
Input	112	50
Output	111	50
Configuration	103	0
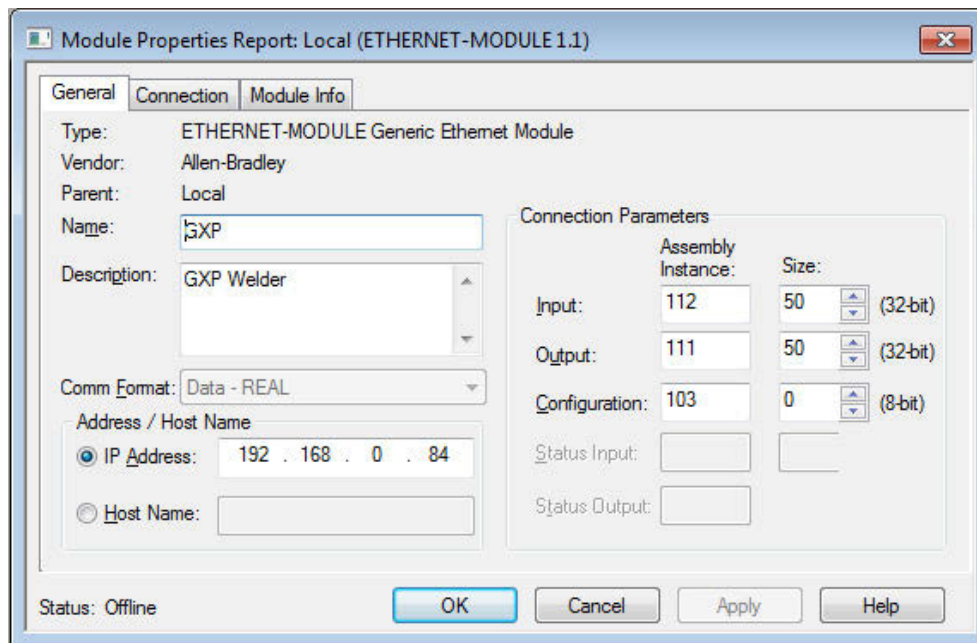
5. This will open the "Modules Properties Report" window. Select the Requested Packet Interval (RPI). Set to the rate you would like the controller to be updated at in milliseconds (minimum of 10msecs).

6. The connection from PLC to GXP will be a multicast connection. Make sure to UNCHECK the box marked "Use Unicast Connection for EtherNet/IP" then click "OK".

7. The implicit connection is now configured properly, so can be tested by navigating to the proper Path via "Who Active?", then changing from "Offline" to "Go Online". Follow the prompts which will download the project to the module and return to remote run.

IMPLICIT EIP CONNECTION OPERATION

Data will now be transmitting back and forth from PLC to GXP via the implicit connection. This data may be set/read on the PLC. Access to these parameters may be accomplished as follows.

Implicit data access via PLC and RSLogix

The implicit data may be accessed as Tags in the RSLogix software. These tags may be viewed by clicking on the Controller Tags in the folder tree.

Output data

This is data sent from the PLC to the Sonics GXP. The tags are named based on the name assigned in step 4 above. The output data for this example would be found under "GXP:O.Data". Data is found in elements [0] through [49].
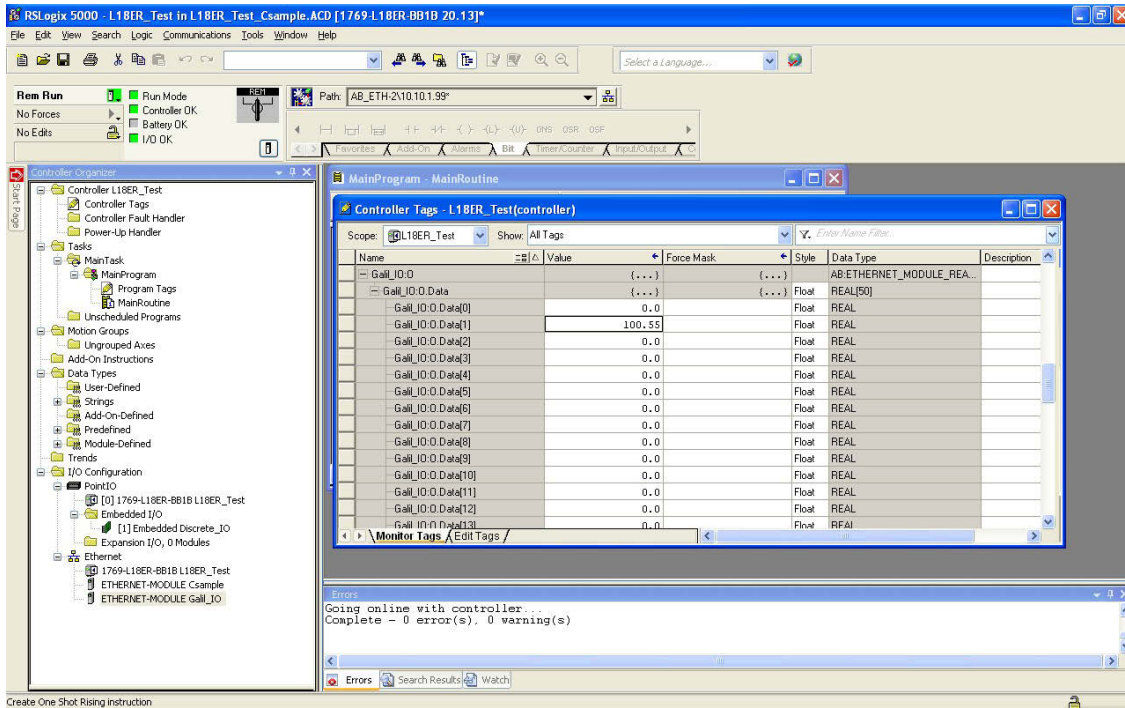
Input data

This is data sent from the Sonics GXP to the PLC. Similar to above, tags are named based on step 4 above. The input data for this example would be found under "GXP:I.Data". Data is found in elements [0] through [49].

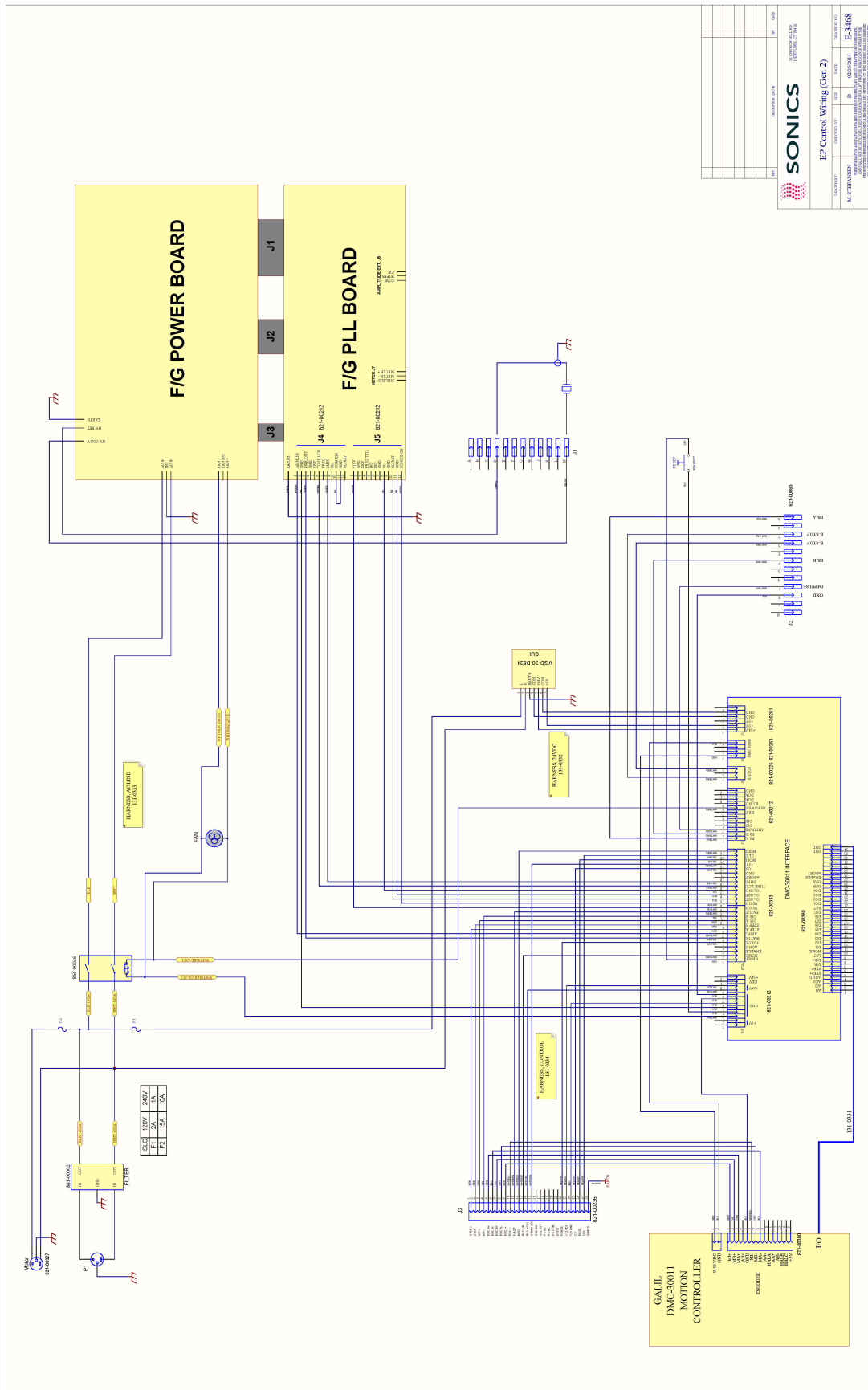| Logix Input Data[0] to Data[49]			Logix Output Data[0] to Data[49]		
In from GXP	Variable	Description	Out to GXP	Variable	Description
0	V104	Overload	0	V008	O.L. Reset
1	V107	SMPS Ready	1		
2	V106	Tune Lock	2		
3	V016	System RDY	3		
4	V019	Horn Home	4		
5	V020	Cycle RDY	5		
6	V010	Good Part	6		
7	V004	Limit +	7		
8	V005	Limit -	8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		
15			15		
16			16		
17			17		
18			18		
19			19		
20	F516	Pre-Trig	20		
21	F503	Weld Dist	21		
22	F504	Weld Vel	22		
23	F505	Hold	23		
24	F508	Force Trig	24		
25	F507	Ampl	25		
26	F510	"+" Tol	26		
27	F511	"-" Tol	27		
28	F512	Upper Lim	28		
29	F513	Lower Lim	29		
30			30		
31	F110	Weld Time	31		
32	F107	Weld Dist.	32		
33	F101	Energy	33		
34	F120	Cycle Time	34		
35	F104	Peak Power	35		
36	F108	Peak Force	36		
37	F507	Amplitude	37		
38	F121	Trig. Dist.	38		
39			39		
40			40		
41			41		
42			42		
43			43		
44			44		
45			45		
46		Clear to Read	46		
47		In Motion	47		
48		Motor Position	48		
49	V403	Screen Ind.	49		Impulse

Drawing List – The following drawings are contained in this document for user reference and maintenance purposes. In certain cases, if details are difficult to read because these drawings have been reduced to fit on one page, simply enlarge (zoom) your current on-screen view.

1. E-3225   Press Signal Conditioning PCB
2. E-3468   Power Supply GXP Wiring Diagram
3. E-3467   Power Supply GXP Interface Schematic Diagram
4. E-3229   Electric Press Wiring
5. Schematic   Layout Side View
6. Schematic   Base Layout
7. Schematic   Optional Stand-alone Mounting Hub Layout
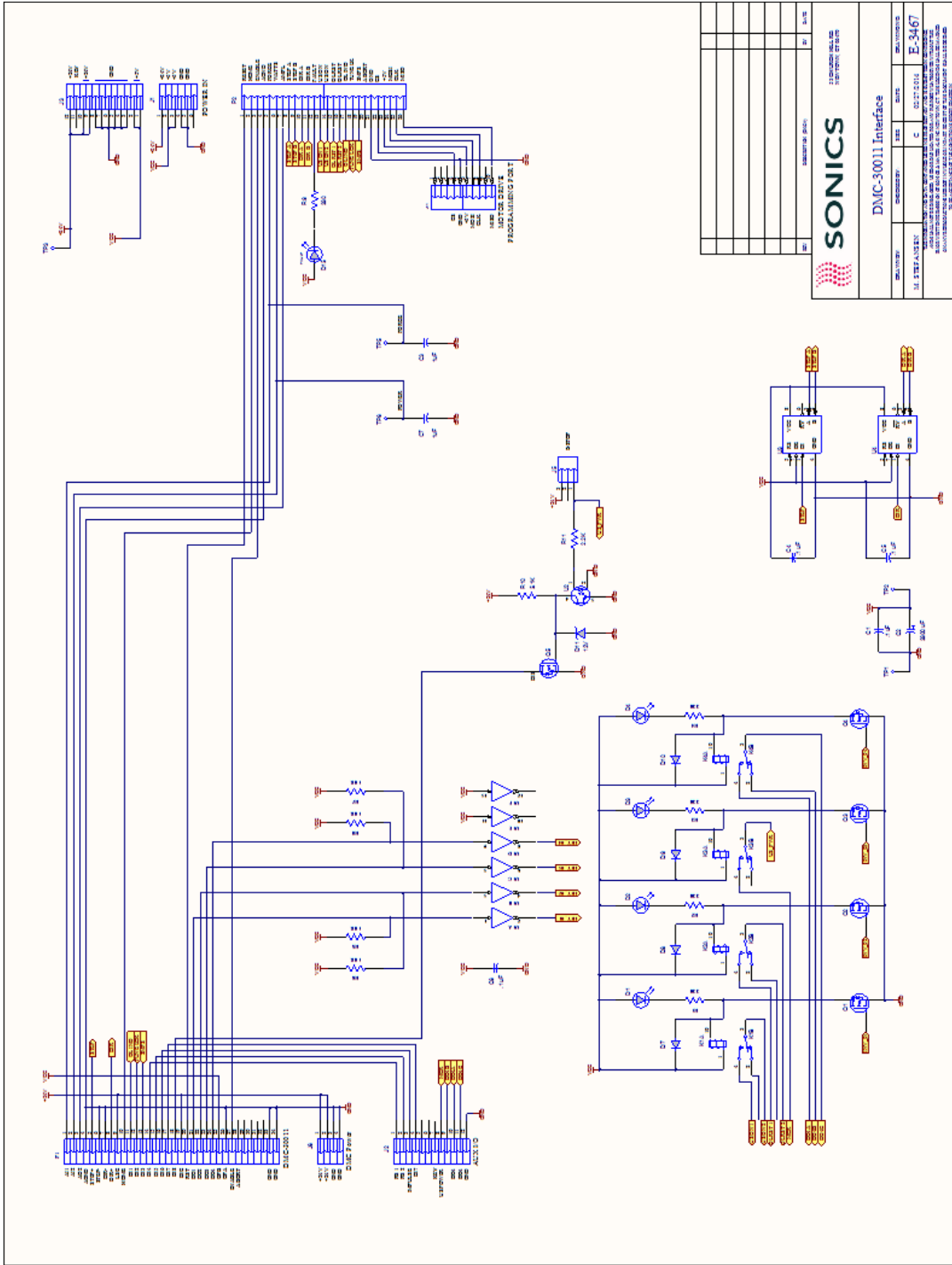8. Schematic   Exploded Assembly Drawing

CABLE TO POWER SUPPLY

HEAD SOLENOID
A + WHT
B − BLK

US−STOP
E BRN

HEAD DOWN
K
H

FORCE SENSOR
J
L
ORG

N.O. C
COM. F BLU
N.C. G RED

PRESSURE SWITCH
D
M High Voltage Coax

CONVERTER

TB1
GRN WHT BLK ORG BLU RED BRN

WHT/BLU WHT/VIO WHT/GRY YEL/BRN YEL/BLK YEL/RED

875−00145
REVERSE LIMIT PROX
BLK BRN BLU

IMS MOTOR
885−00055

FAULT
STEP
MISO
CLOCK
ENC A−
ENC I−
NC
GND
+5VDC
CS
MOSI
ENC A+
ENC B+
ENC I+
ENABLE
OPTO

20 BRN
19 GRY/BRN
18 PINK
17 YEL
16 WHT
15 BRN/GRN
14 YEL/BRN
13 BLK
12 WHT/GRY
11 YEL/YEL
10 WHT/GRN
9 GRN/PINK
8 RED/BLU
7 GRY
6 VIO

LOAD CELL
885−00018
RED BLK WHT GRN

TOP VIEW
RED WHT GRN BLK

161−0234

PRESS SIGNAL CONDITIONING PCB
161−0233

VCC
STEP
DIR
GND
VIO
GRY/BRN
YEL/BRN

BLK
GRN
WHT
RED

FORCE
STEP−A
STEP−B
DIR−A
DIR−B
GND
GND
GND
V−IN

YEL/GRN

J1
1 STEP +   BRN
2 STEP −   RED
3 DIR +   ORG
4 DIR −   YEL
5 ENC A+   GRY/PINK (MOTOR)
6 ENC A−   WHT (MOTOR)
7 ENC B+   RED/BLU (MOTOR)
8 ENC B−   GRN (MOTOR)
9 ENC I+   GRY (MOTOR)
10 ENC I− BRN/GRN (MOTOR)
11 FAULT   BRN (MOTOR)
12 MISO   PINK (MOTOR)
13 REV LIM BLK (PROX)
14 COM +12V BRN (PROX)
15 SOL 5V WHT/GRY (MOTOR)
16 SOL 24V WHT/BLU
17 PS NO   WHT/VIO
18 PS NC   WHT/GRY
19 PS COM YEL/BLK
20 USCO   YEL/BRN
21 FORCE   YEL/RED
22 +12 VDC YEL/GRN
23 12V GND YEL/BLU
24 CS   BLK
25 MOSI   WHT/YEL (MOTOR)
26 CLK   WHT/GRN (MOTOR)
27 N/C   YEL (MOTOR)
28

SONICS
ELECTRIC PRESS WIRING
53 CHURCH HILL RD.
NEWTOWN, CT 06470

DRAWING NO.
E−3229

DESCRIPTION
SCALE
DRAWN BY M. STEFANSEN
CHK'D
MATERIAL
DATE 03/10/09

TOLERANCES
(EXCEPT AS NOTED)
DECIMAL
.X= +/−0.030
.XX= +/−0.015
.XXX= +/−0.005
FRACTIONAL +/− 1/64
ANGULAR +/− 1/2 DEG.

CONFIDENTIAL INFORMATION

LAYOUT SIDEVIEW

42 (1066.8)

5¹/₄ (133.4) TYP

10 (254.0) MAX

4¹/₄ (108.0)

25 (635.0)

Dimensions are shown in inches and millimeters,
i.e., 1¹/₂ (38.1) signifies 1¹/₂" (38.1mm)

BASE LAYOUT

$3^3/4$ (95.2)

$3/8$ (16) TYP

$12^1/2$ (317.5)

$14^3/4$ (374.7)

7 (177.8) TYP

12 (304.8) TYP

$13^1/2$ (342.9)
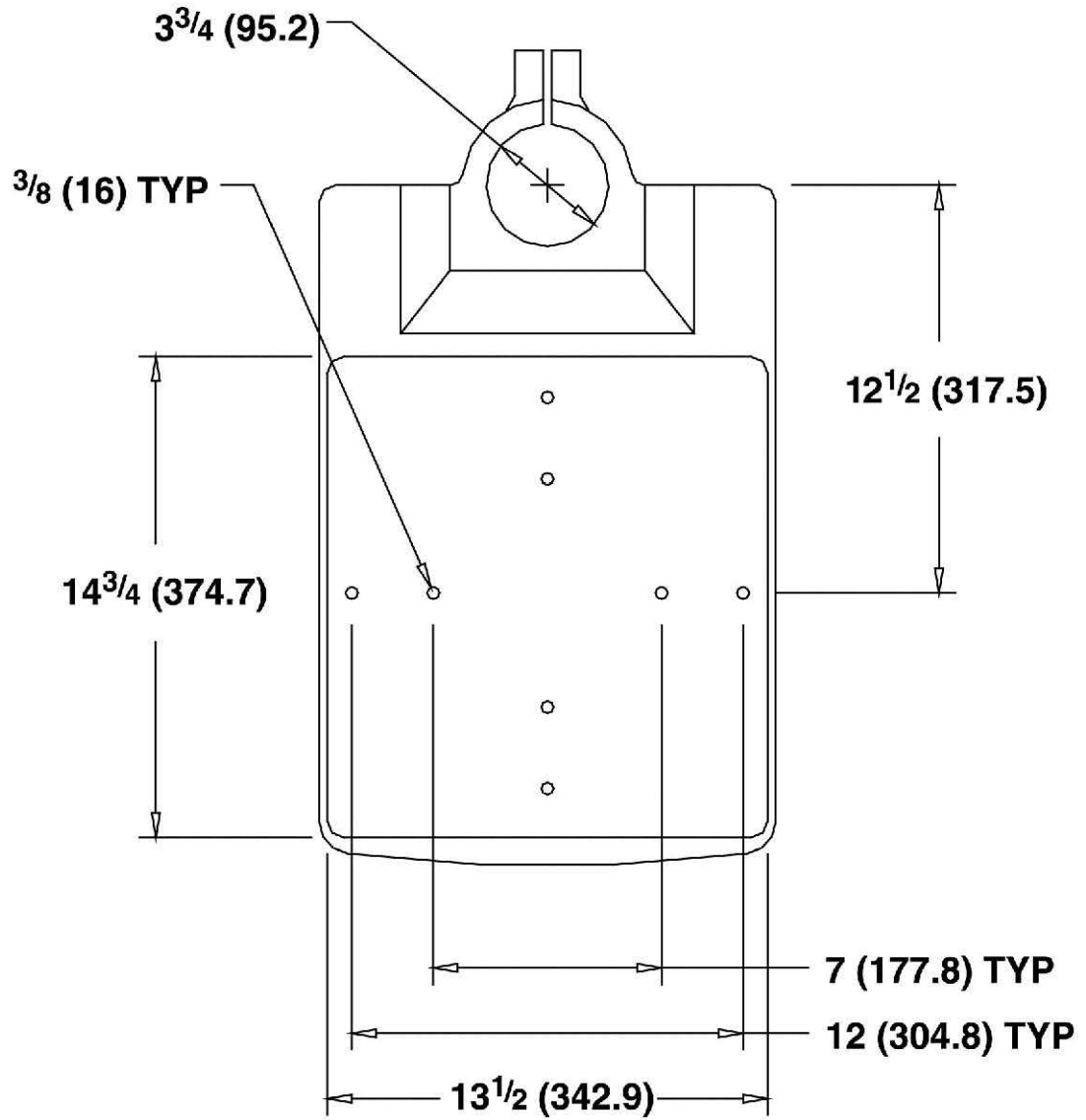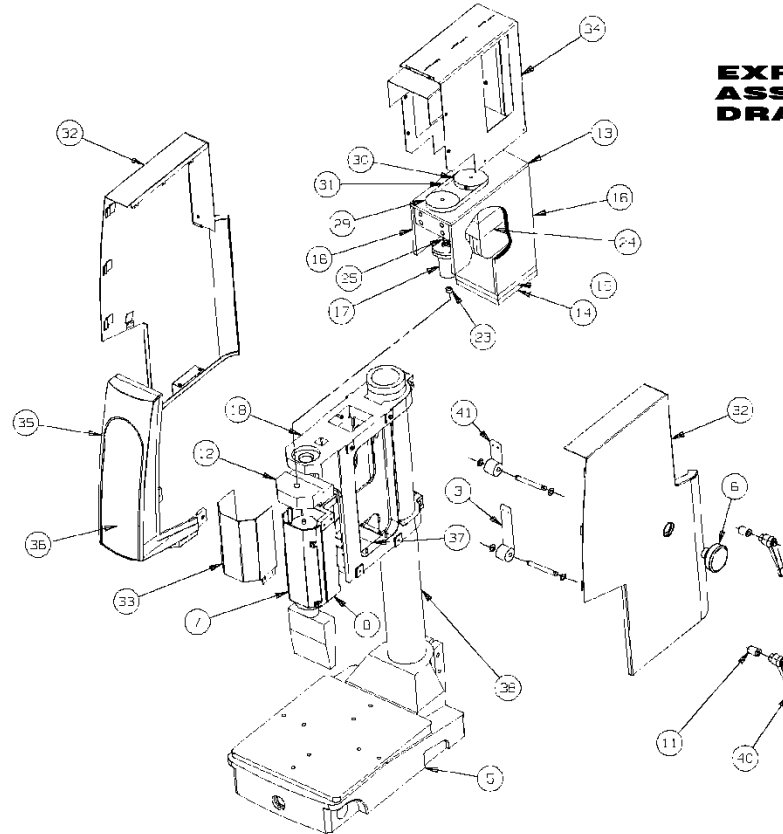
Dimensions are shown in inches and millimeters,
i.e., $1^1/2$ (38.1) signifies $1^1/2$" (38.1mm)

OPTIONAL STAND-ALONE
MOUNTING HUB LAYOUT

$3^3/_4$ (95.3)

$^{17}/_{32}$ (13.5) TYP

$7^1/_2$ (190.5)

9 (228.6)

$2^1/_8$ (54.0)

$5^1/_2$ (139.7)

7 (177.8)

1 (25.4)

10 (254.0)
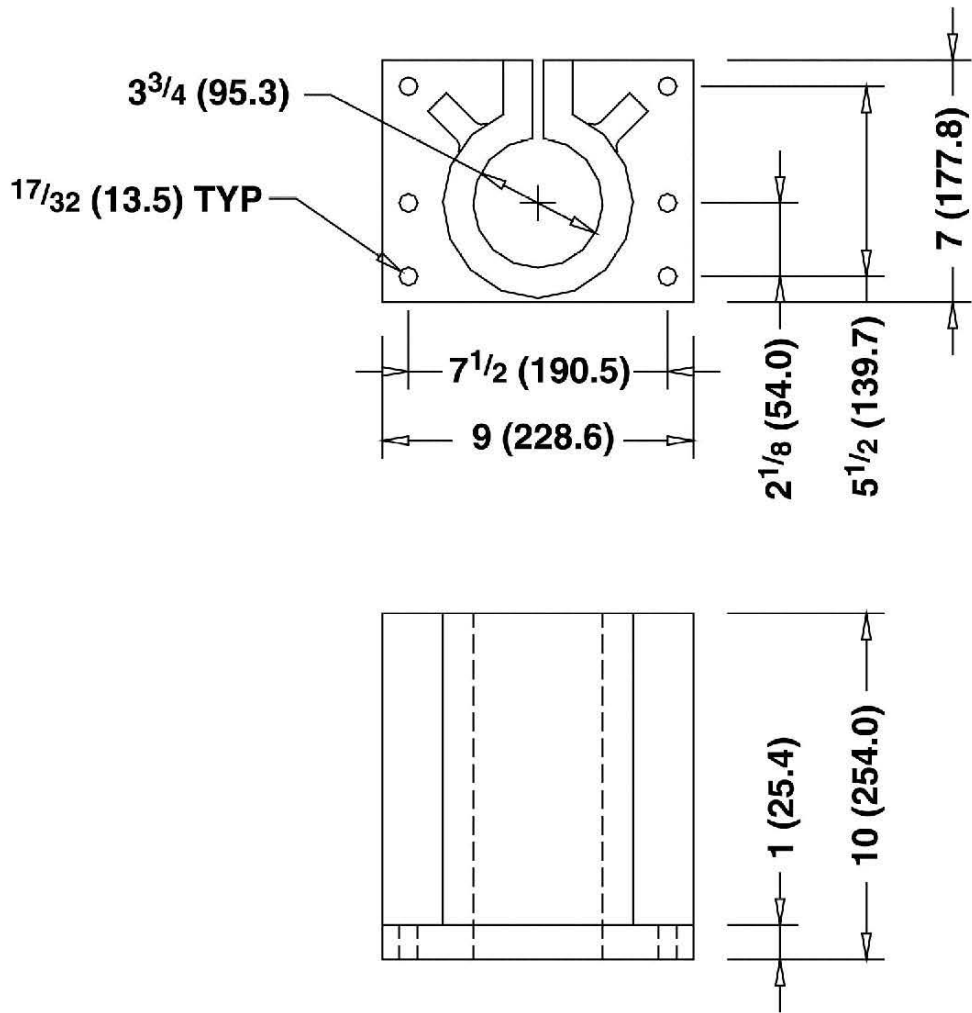
Dimensions are shown in inches and millimeters,
i.e., $1^1/_2$ (38.1) signifies $1^1/_2$" (38.1mm)

EXPLODED ASSEMBLY DRAWING

PART NO.	ITEM	QTY.	DRAWING NO.	DESCRIPTION
161-0233	1	1		PRESS SIGNAL CONDITIONER PCB
	2			
301-0108	3	1	SMI-2086-7	DUAL SPRING DRUM ASSY
301-0218	4	1	SMI-2082-15	CONVERTER CLAMP ASSY
301-0224	5	1	SMI-2079-38	BASE ASSEMBLY
515-0022	6	1	SMI-1053-27	KNOB
516-0002GY	7	1	SMI-1053-38C	CONVERTOR COVER
516-0114GY	8	1	SMI-2070-2	CONVERTOR HOUSING
516-0117GY	9	1	SMI-2079-5	COLUMN CAP
516-0119	10	2	SMI-2079-17	SPLINED SHAFT
516-0126	11	2	SMI-2079-18	CLAMP HANDLE EXTENSION
516-0137GY	12	1	SMI-2086-10	TOP MOUNTING PLT
516-0138	13	1	SMI-2086-1	MTG PLATE ELECTRO-PRESS
516-0139	14	1	SMI-2086-2	BASE PLATE
516-0140	15	1	SMI-2086-3	CENTER FRAME BASE PLT
516-0141	16	2	SMI-2086-4	SIDE PLATE
516-0142	17	1	SMI-2086-5	COUPLE
516-0143	18	1	SMI-2086-11	CENTER FRAME
516-0144	19	1	SMI-2086-15	POSITIVE STOP
701-0185	20	1	SMI-2086-12	PROX MOUNTING PLT
701-0186	21	2	SMI-2086-13	STOP BLOCK
701-0187	22	OPT	SMI-2086-14	FAN MOUNTING PLT
805-00018	23	1	PURCHASED	LOAD CEL. (500 B)
805-00055	24	1	PURCHASED	IMS MOTOR
805-00056	25	1	PURCHASED	BALL SCREW
810-00022	26	2	PURCHASED	RETAINING RINGS
810-00130	27	1	PURCHASED	LINEAR BEARING
810-00131	28	2	PURCHASED	LINEAR SLIDE
810-00139	29	1	SMI-2086-16	PULLEY (32T)
810-00140	30	1	SMI-2086-17	PULLEY (48T)
810-00141	31	1	PURCHASED	TIMING BELT
818-0309	32	1	SMI-2079-11	PANEL COVER LEFT & RIGHT 2050
818-00315	33	1	SMI-2079-9	CONVERTER SHIELD 2050
818-00318	34	1	SMI-2079-13	COVER FRAME 2050
818-00386	35	1	SMI-2086-6	BEZEL
818-00391	36	1	SMI-2086-8	CP OVER LAY
818-00393	37	1	SMI-2086-9	CONNECTOR MTG PLT
820-00011	38	1	SMI-2079-11	COLUMN 3 3/4 DIA
831-00012	39	OPT	PURCHASED	FAN
841-00007	40	1	PURCHASED	HANDLE
872-00034	41	1	SMI-2079-27	SPRING TRIPLE DRUM ASSY

RETURN/REPAIR NOTES

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

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

SHIPPING

Because of the problems in the handling of our equipment during shipment, it is asked that all customers check the following:

1. All module plug in units.

2. All wire plug in connections.

3. All I. C.

4. Sonics & Materials makes every effort to ship our units in proper working order. All units are tested and checked for problems prior to shipping. It is asked that when a problem does occur that all parts and components be inspected for damage (especially when the unit is not in working order when received).