Original Instructions
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EMERSON

GMX-L20A Controller

Operating Manual

Branson Ultrasonics (Shanghai) Co., Ltd.
No 758, East Rong Le Road, Song Jiang Industrial Zone, Shanghai,
PRC, 201613
86-021-3781-0588
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, ultrasonic 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 GMX-L20A Controller system is a 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 1.5 How to Contact Branson for information on how to contact them) or your local Branson representative.

NOTICE	
	This document is intended for use with the following Branson products: GMX-L20A Controller with a Welder.

This Instruction Set includes information for the GMX-L20A Controller and actuator. Please refer to the Table Of Contents of this Instruction Set to find specific information.

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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 be the 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 it's vicinity might get damaged. Application types and other important or useful information are emphasized.

1.1.2 Symbols found on the Product

The L20A Controller has several warning labels on it to indicate the presence of hazardous voltages inside the unit.

Table 1.1 Symbols found on the product

Symbol	Description
	Warning. Ground the unit before operating.
	High Voltage. Risk of electric shock or burn. Do not remove cover. Refer service to qualified personnel only.

1.2 General Precautions

Take the following precautions before servicing the L20A Controller:

- 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 L20A Controller into a grounded power source
- Power supplies produce high voltage. Before working on the L20A Controller module, do the following:

  Turn off the L20A Controller;

  Unplug main power;

  Allow at least 2 minutes for capacitors to discharge
- High voltage is present in the L20A Controller. Do not operate with the cover removed
- High line voltages exist in the ultrasonic L20A Controller 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 L20A Controller before setting a DIP switch
- Keep hands away from the horn. Force (pressure) and ultrasonic vibrations can cause injury
- Do not cycle the welding system if either the RF cable or converter is disconnected

CAUTION	Loud Noise Hazard
	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 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. 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 L20A Controller and Actuator are components of an ultrasonic welding system. These are designed for a wide variety of welding or processing applications.

1.3 Regulatory Compliance

This product meets electrical safety requirements and EMC (Electromagnetic Compliance) requirements for North America and the European Union.

1.4 Warranty

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

1.5 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.

Branson Ultrasonics (Shanghai) Co., Ltd.

No 758, East Rong Le Road, Song Jiang Industrial Zone, Shanghai

PRC, 201613

86-021-3781-0588

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.

1.5.1 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:

_____

_____

_____

1.6 Returning Equipment for Repair

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).

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- 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.

1.6.1 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).

1.6.2 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?

   _____
   _____

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.

1.6.3 Contact Information

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

1.6.4 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.

1.7 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: Introduction

2.1 Introduction

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

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

2.2 Model Covered

This document is intended for use with a Touchscreen Controller. This document is intended for use in conjunction with others to form a complete manual for your Branson system. Please refer to the Table Of Contents of this Instruction Set to find specific information.

2.3 Overview of this Model

Figure 2.1 Metal Welding Power Supply

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, 20kHz) or the desired power range (for example, 4.0kW). The GMX-L20A Controller also contains a microprocessor-based controller module that provides for control and monitoring of welding operations.

Ultrasonic Power Supply

The ultrasonic power supply module generates ultrasonic energy at the resonant frequency to drive the converter-booster-horn stack. The ultrasonic power supply contains six main modules as following:

Ultrasonic Power module

This module contains following functional circuits:

- Power Supply: The rectifier and filter circuit to convert single phase or 3 phase AC line input to direct current
- FET bridge: Switches the direct current into ultrasonic pulses at the resonant frequency
- Output circuit: Matches the impedance of the output power device to the Converter-Booster-Horn-Stack; and provides feedback to the Control circuit for feedback control
- Control circuits: Perform the following functions:
  - Provide drive signal to output power device
  - Determine true percentage of ultrasonic power used over a range of amplitudes
  - Allow control of the resonant frequency

- Control starting amplitude
- Provide overload protection (Voltage, Current, Phase, Temperature, Power) for the Ultrasonic Power Module
- Store operating frequency of last weld (frequency memory) and use the stored frequency as a starting point for the next weld
- Check and update frequency memory on start-up
- Provide switch-selective starting ramp times (Start)

DC Power Module

The Switching DC Power Module has the below functions:

- 5VDC Output: Provides +5VDC for the analog and digital circuitry on the System Control Module
- 24VDC Output: Provides +24VDC for the System Control Module control signal and user I/O voltage
- 12VDC Output: Provides +12VDC for the Supervisory Control Board
- –12VDC Output: Provides -12V for the Supervisory Control Board

Line Board Module

To filter out the ultrasonic signals from entering the AC main line and ensure the stability of the input voltage of the power supply.

Machine Controller Board

Provides a standard interface for automation and is accessed on the rear of the power supply. It gives the customer the ability to make their own interface for automation or special control and/or special reporting needs. It is mounted to the CPU Board on standoffs, and is connected to the rear of the controller case by its end panel.

Supervisory Control Board

Controls the following functions of the Power Supply:

- Responding to start and stop signals
- Responding to alarm and reset signals
- Responding to user input from HMI
- Activating and monitoring ultrasonics
- Provides information to HMI
- Generate alarms
- Communicating with user device via Ethernet port which is on rear plane
- Control communications

This board mounts to the upper level of the Machine Controller Board by standoffs and is connected to the rear of the controller chassis by its end panel.

Front GMX-L20A Panel and Bezel Assembly

It is held by 3 upper screws which are accessible from inside the enclosure and 5 lower screws which are accessible from outside the enclosure through the ventilation slots in the bezel. Removal of the front bezel allows access to the following components which are housed inside it:

- LCD Module: This LCD module has 7 inches 16:9 visual area and supports touch features. The image and touch signals are transferring by FPCB.
- Raspberry Pi Kit: This kit contains Raspberry Pi 4B module and heatsink. It mounts on the LCD Module. The HMI-related software was running on it. And it also handles the communication between Supervisory control board and HMI.
- Power Switch: Used to turn the Controller on and off.

2.4 Compatibility with Branson Products

The Branson GMX-L20A is designed to be used with Branson Metal Welding Actuators: GMX-L20A, GMX-MICRO.

2.5 Ultrasonic Theory

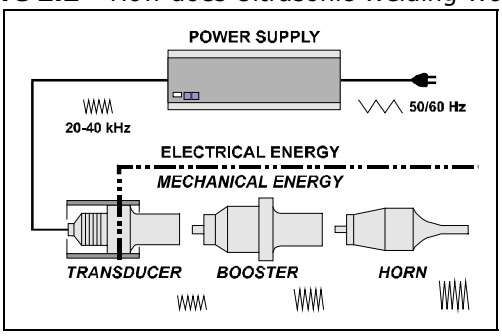
2.5.1 What Is An Ultrasonic Weld?

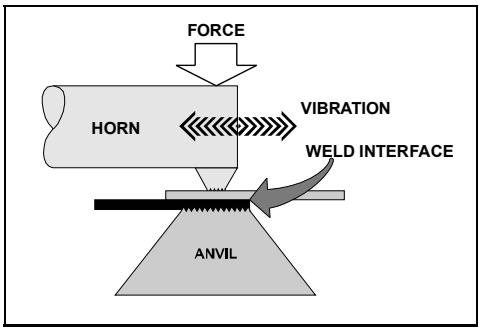
Ultrasonic welding joins metal parts by applying the energy of high frequency vibrations onto the interface area between the parts to be welded.

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 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 2.2 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)

*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.

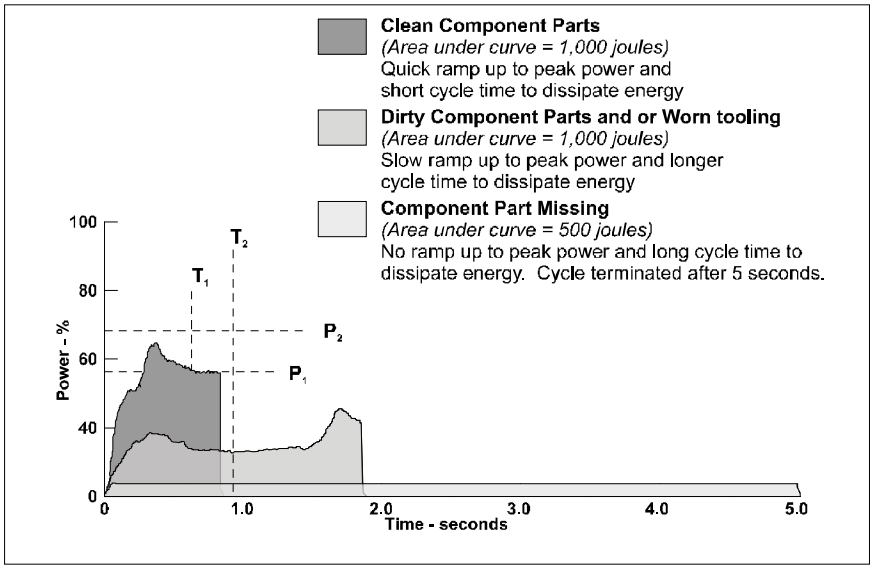
2.5.4 Welding To Energy - Why?

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

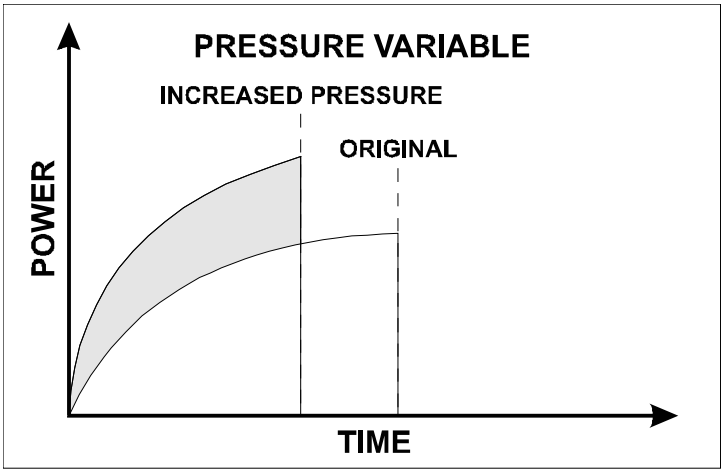


2.5.5 Power

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

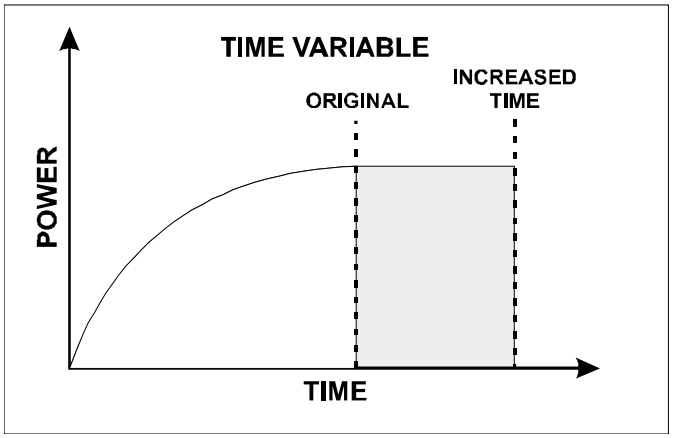


The difference in the appearance of each of the above weld graphs is the result of increased Power loading. Based upon an increase in Pressure, additional Power is required to maintain the motion of vibration. Thus, the same amount of energy is delivered in less time. This approach is typically used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

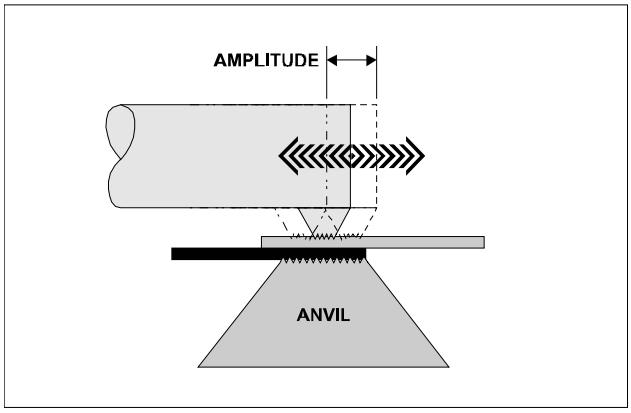
Figure 2.5 Pressure Variable with Increased Time



2.5.7 Amplitude

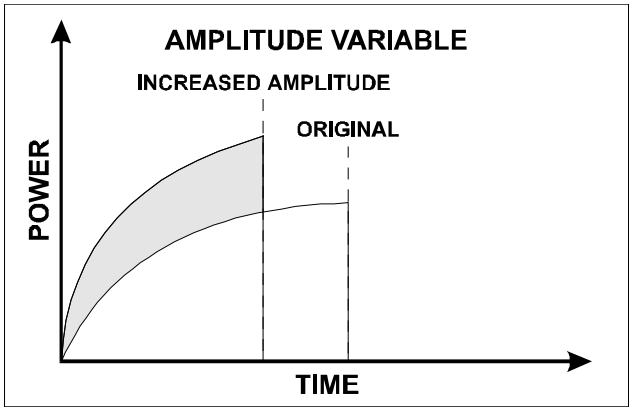
An ultrasonic tool is a resonant acoustical device. The term Amplitude is used to describe the amount of longitudinal expansion and contraction that the tooling endures as it vibrates (Figure 2.6). The amplitude correlates to the scrubbing action at the weld interface. This scrubbing action combined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

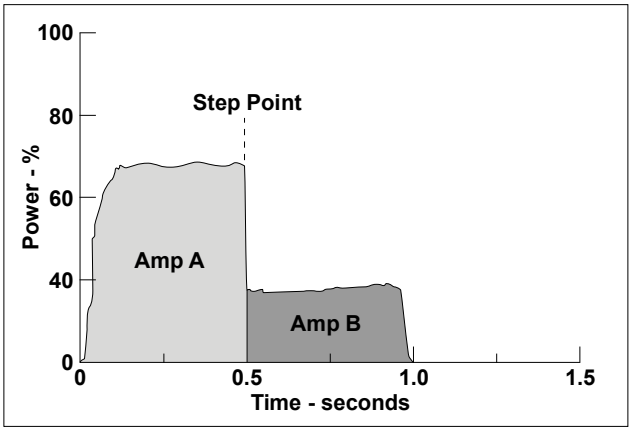
Figure 2.7 Amplitude's Influence on Weld Power and Time



2.5.8 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 2.8 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 2.8 Amplitude Stepping Profile



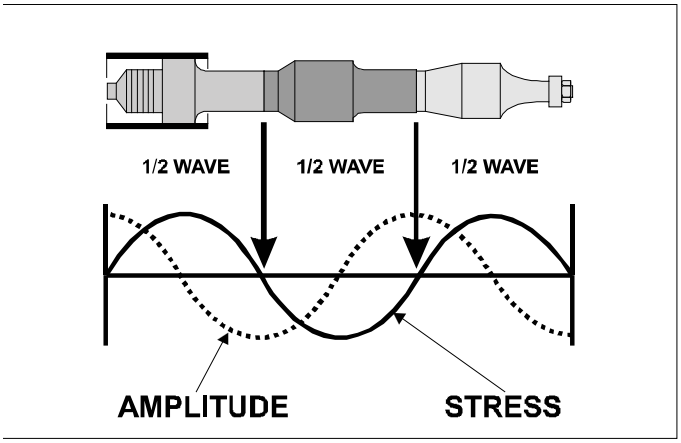
2.5.9 Resonant Frequency

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 2.9). 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 2.9 Harmonic Resonance on Ultrasonic Tooling.



2.5.10 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.

2.5.11 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

2.5.12 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.

2.6 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 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.

HMI: Human Machine Interface

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.

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Chapter 3: Shipping and Handling

3.1 Shipping and Handling

CAUTION	High Voltage Hazard
	The Touchscreen 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 Touchscreen 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 Touchscreen Controller:

Table 3.1 Environmental Requirements

Environment	Range
Storage / Shipping Temperature	-13º F to +131º F (-25º C to +55º C)
Humidity	Non-condensing +30 to +90% at maximum temperature of +40C.

*Above 40° C the humidity drops to 90%

3.2 Receiving

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

CAUTION	Heavy Object
	The Actuator and the Touchscreen 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 Touchscreen Controller when it is delivered, take the following steps:

Table 3.2 Inspection procedure after 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).

3.3 Unpacking

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

When unpacking the Touchscreen Controller, take the following steps:

Table 3.3 Unpacking

Step	Action
1	Unpack the Touchscreen Controller as soon as it arrives. Save the packing material.
2	Inspect the unit for signs of damage.
3	Remove the cover of the Touchscreen Controller (see 6.2 Parts Replacement) to check if any components became loose during shipping.
4	Store or ship the Touchscreen 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 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 of this manual, for appropriate procedure.

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Chapter 4: Technical Specifications

4.1 Environmental Requirements

The Touchscreen Controller has the following Environmental Requirements:

Table 4.1 Environmental Requirements

Environmental Concern	Controller/Power Supply
Ambient Operating Temperature	+41º F to +104º F (+5º C to +40º C)
Storage / Shipping Temperature	-25 to +55ºC.
Humidity	Non-condensing +30 to +90% at maximum temperature of +40C.
Operating Altitude	2500 m (8202 ft)
IP Rating	2X

*70° C for 24 hours.
**Above 40° C the humidity drops to 90%.

4.2 Electrical Requirements

The following table 4.2 lists input voltages, current requirements, and fuse requirements for the GMX-L20A Controller Welding System, and includes power required when it is used with Branson Metal Welding Actuators. More information contact Branson to get support.

Table 4.2 Electrical Input Operating Voltages

Power	Nominal AC Input	Current Rating	Packaged product EDP
4.0kW	200-230V, 50-60 Hz, Single Phase	20 Amp	BU-1036882
4.0kW	200-230V, 50-60 Hz, Single Phase	20 Amp	BU-1038147
4.0kW	200-230V, 50-60 Hz, Single Phase	20 Amp	BU-1039641
5.5kW	460V-480V, 50-60 Hz, 3x Phase	15 Amp	BU-1036883
5.5kW	380V-400V, 50-60 Hz, 3x Phase	15 Amp	BU-1038148
5.5kW	380V-400V, 50-60 Hz, 3x Phase	15 Amp	BU-1039642
8.0KW	460V-480V, 50-60 Hz, 3x Phase	25 Amp	BU-1039060
8.0KW	380V-400V, 50-60 Hz, 3x Phase	25 Amp	BU-1039061
8.0KW	380V-400V, 50-60 Hz, 3x Phase	25 Amp	BU-1039643

For more information, please contact Branson for technical support.

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).

Chapter 5: Operation

5.1 Before Operating the Unit

Before attempting to operate the controller, make sure you have reviewed the entire manual and have an understanding of safety procedures. Check that connections between the controller and actuator are as shown in the Hookup Diagram provided in Special Information Instruction Set. The power button on the front of the system may then be used to turn the system on.

WARNING	High Voltage Hazard
	High voltage might be present in the Branson Touchscreen Controller (GMX-L20A). When setting up and operating the welding system, observe the potential hazards listed below.

- Do not operate the Touchscreen Controller with the cover removed
- To prevent the possibility of electric shock, always plug the Touchscreen 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
- Ensure power switch is in the OFF state before making or breaking any electrical or pneumatic connections to the Controller and/or Welder
- Do not touch Ultrasonic Horn during or immediately following the welding cycle. Vibrations and heat can burn skin
- When operating the controller keep clear of the actuator moving parts

Interactive user screens supply a means of function selection and data entry for setting up the controller. The following pages provide illustrations, function descriptions and screen navigation instructions.

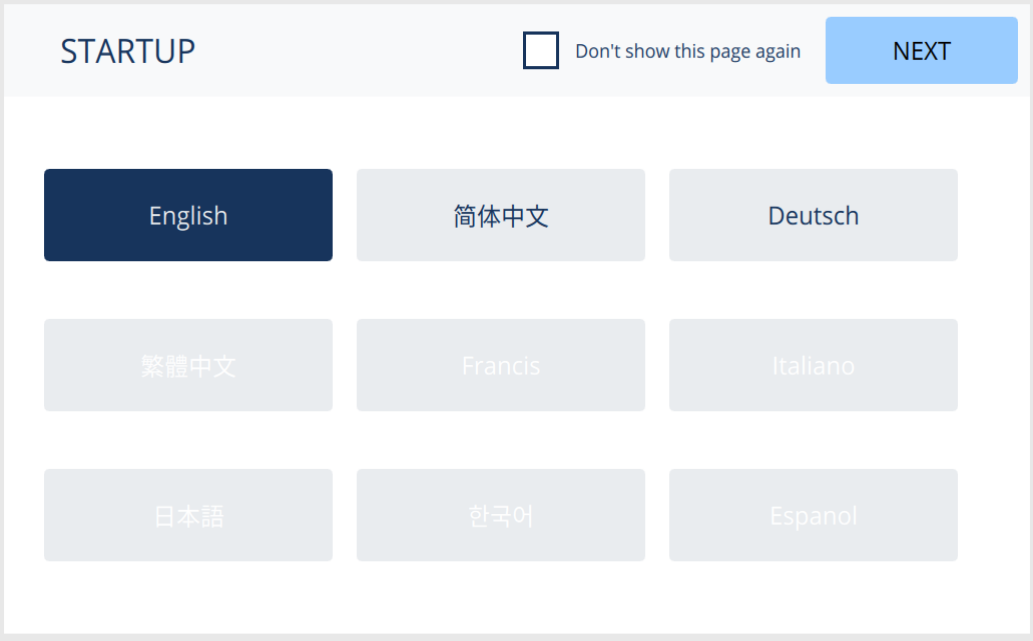
In the event of a system fault or an improper keyed entry, the controller will provide an instructional prompt screen in order to remedy the condition.

Controller User Screen Hierarchy:

A drawing included in the Special information Instruction Set provides an overview of the controller user screens and functions shown in tree structure. It serves as a useful tool for navigating the command structure of the controller.

5.2 STARTUP Screen

Figure 5.1 STARTUP screen



This is the STARTUP Screen. When you turn on your Controller it will start at this screen. Two languages are provided for you to select a controller display language in English and Simplified Chinese.
Press one of the following options for this screen:

Don’s show this page again

Once this option is selected, this page will not be displayed when the next time the controller is turned on.

NEXT

Enter the Home screen to monitor various welding parameters in the production process.

See 5.3 Home Screen.

5.3 Home Screen

Figure 5.2 Home Screen (three pages)

This is the home screen, which displays the actual value of current weld settings, Power/time, Height/time and Frequency/time graphs, run chart, alarm and weld result.

Press one of the following options for this screen:

MENU

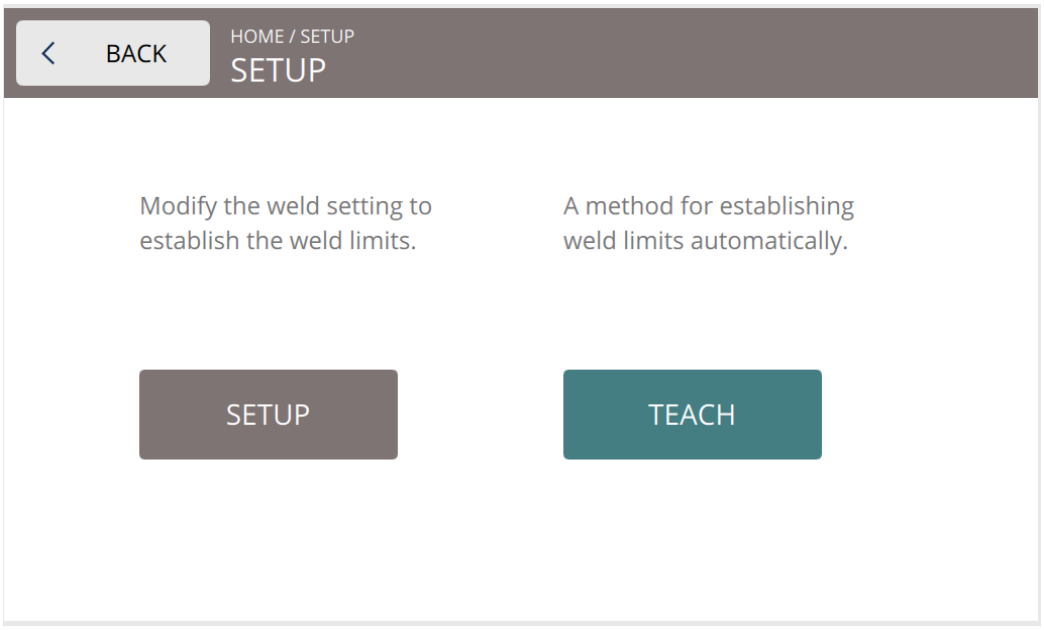
To go to the MENU which allows access to the settings and features of the controller. See 5.5 Menu Screen.

SETUP

To go to the Setup Mode screen. See 5.4 Mode Selection Screen.

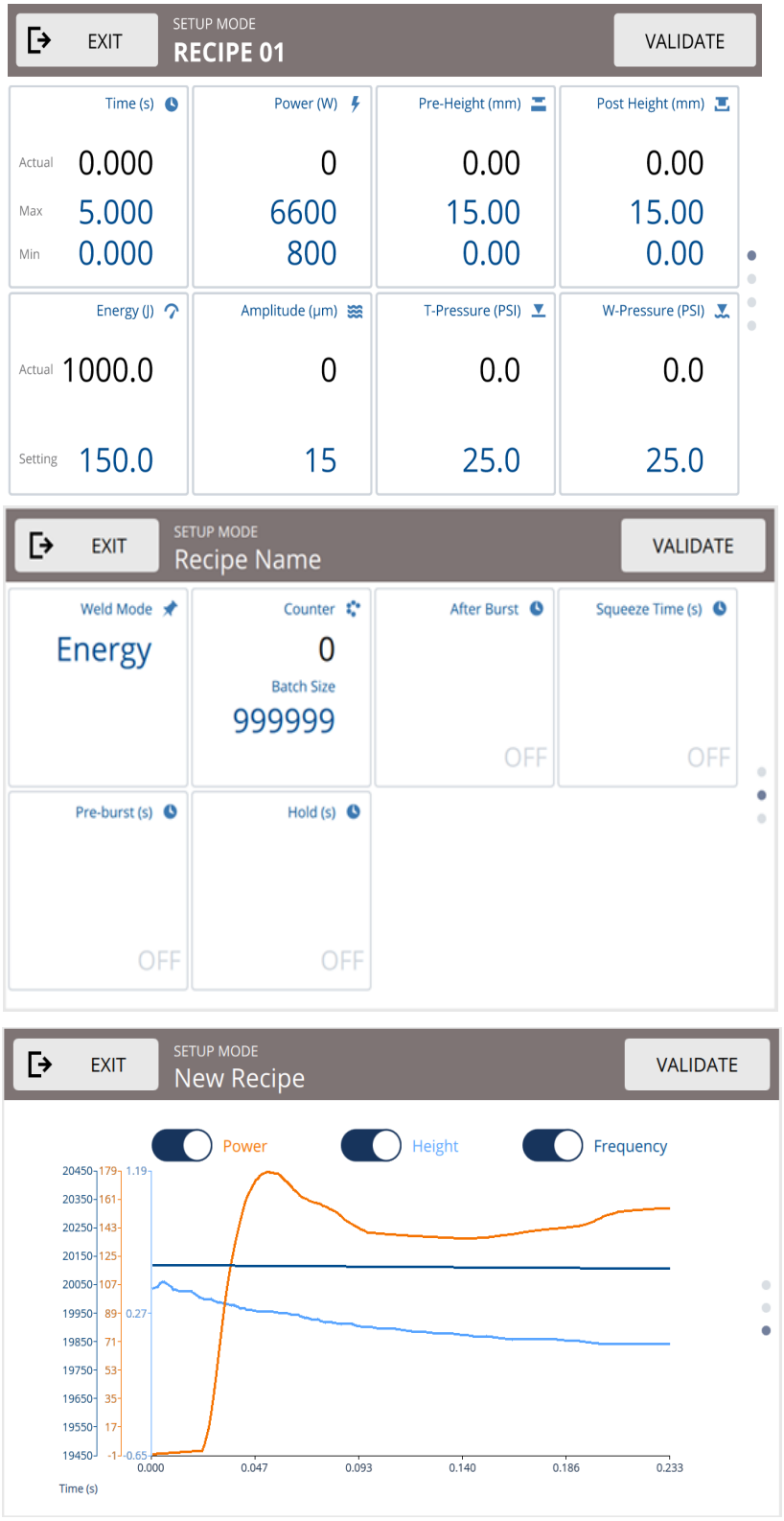
5.4 Mode Selection Screen

Figure 5.3 Mode Selection Screen



5.4.1 Setup Mode Screen

Figure 5.4 SETUP Mode Screen



This screen allows access to change individual weld parameters which are the basic elements required to make a weld.
Press one of the following options for this screen:

Time(s)

To set the min/max time (sec) that ultrasonic energy may be applied to a weld.

Power(W)

To set the min/max power (watts) which may be applied to a weld.

Pre-Height (mm)

To allow setting min and max parameters for weld preheight.

Post Height (mm)

To allow setting min and max parameters for weld post height.

Energy(J)

To set the amount of energy (joules) delivered for each weld.

Amplitude

To set the amplitude value.

T-Pressure(PSI)

To change the pressure used to engage the knurl pattern into the component parts prior to initiation of ultrasonic energy.

W-Pressure(PSI)

To change the clamping pressure delivered by the actuator while the weld is taking place.

Weld Mode

To select the determining criteria for cut off of the ultrasonic energy.

Counter

To reset the batch counter.

AFTERBURST

To turn on the function of a short burst of ultrasonic energy that begins after the ultrasonic welding cycle.

SQUEEZE TIME

To change the amount of time (sec) between when the horn engages the component(s) and when the delivery of ultrasonic energy occurs.

PREBURST

To change the amount of time (sec) of a short 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.

HOLD

To change the amount of time (sec) the components remain held under weld pressure after the delivery of ultrasonic energy.

VALIDATE

To validate the updated weld settings.

EXIT

To return to Home screen. See 5.4 Mode Selection Screen.

5.4.1.1 Weld Mode Screen

Figure 5.5 Weld Mode Screen

From this screen the weld mode may be selected. The weld mode dictates which weld setting variable will serve as the cutoff limit for the delivery of ultrasonic energy during each weld cycle.

Press one of the following options for this screen:

ENERGY

To weld in energy mode. The system delivers ultrasonic energy until a predetermined amount of energy (joules) is dissipated.

STEP MODE

To select the amplitude stepping mode if the weld mode is Energy. If the step mode switch has been turned on, there will be three stepping modes can be select. If an amplitude stepping mode has been selected on the Weld Mode screen, you will be able to enter Amplitude-A, Amplitude -B, and a Step Point.

For information on Amplitude Stepping, see 2.5.8 Amplitude Stepping.

TIME

To weld in time mode. The system delivers ultrasonic energy for a predetermined amount of time (sec).

HEIGHT

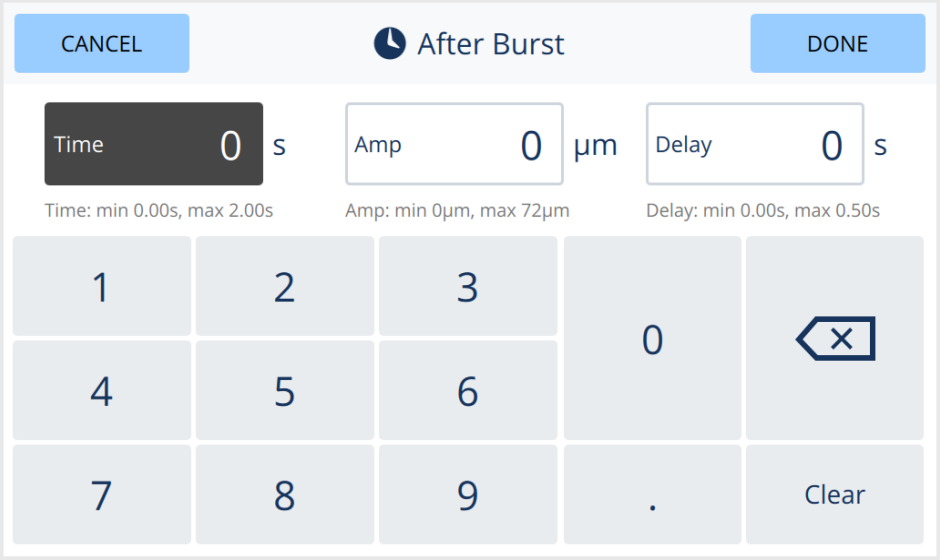
To weld in height mode. The system delivers ultrasonic energy until the tooling reaches a predetermined height (mm).

ENERGY W/HEIGHT COMPENSATION

To weld in energy with height compensation mode. The system first delivers the predetermined amount of energy. If after the energy is delivered the welded part size does not fall within the height (mm) window, the system will deliver as required up to 300% more energy in order to achieve a mid-window weld height.

5.4.1.2 After Burst Screen

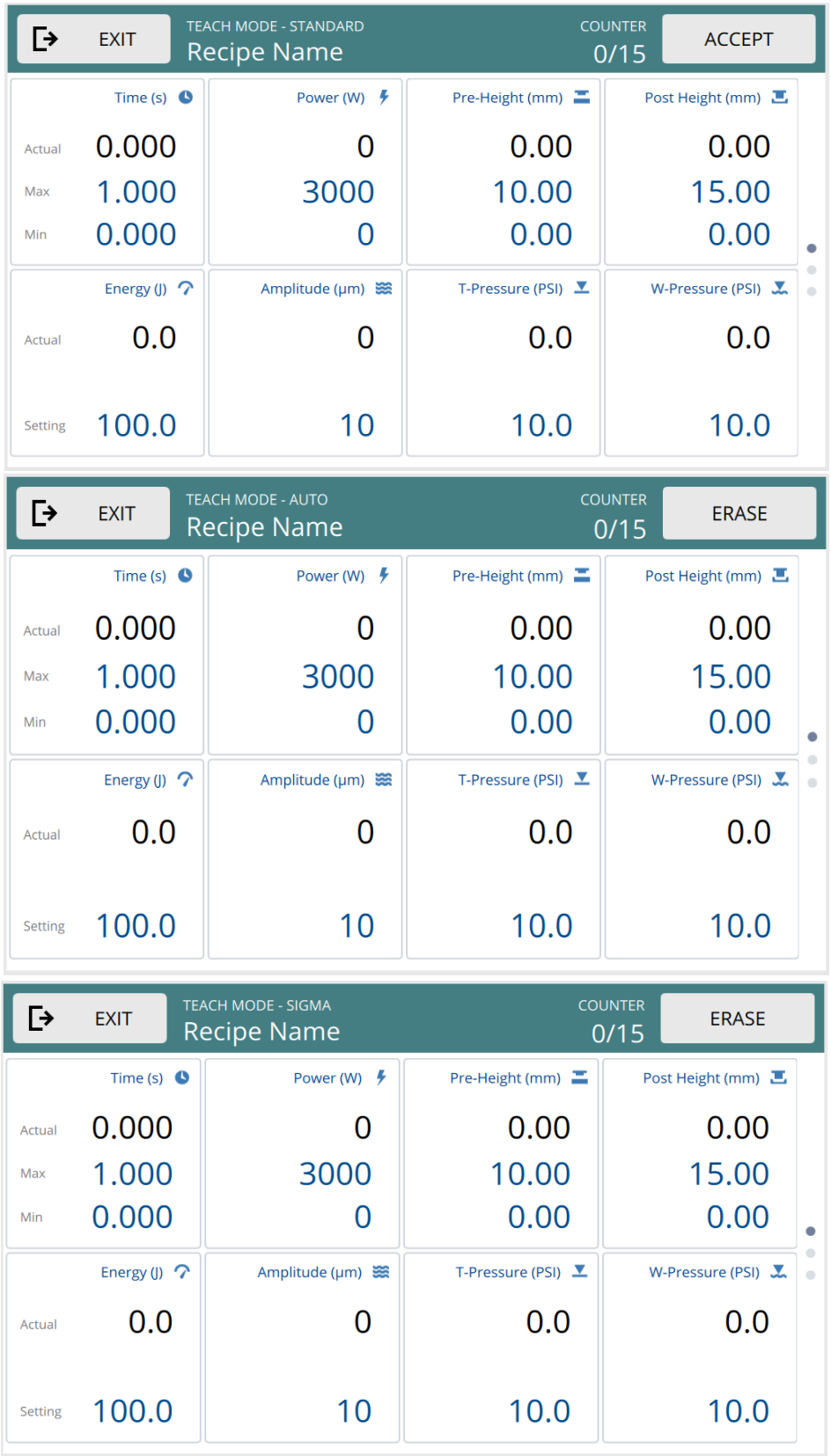
Figure 5.6 After Burst Screen



From this screen, you can change the amount of time (sec) of a short burst of ultrasonic energy that begins after the ultrasonic welding cycle in Time input box. And change the amount of time (sec) between the completion of the ultrasonic weld cycle and the start of the after burst in Delay input box. You can also change the value of amplitude for the amplitude during after burst in Amp input box.

5.4.2 Teach Mode Screen

Figure 5.7 Teach Mode Screen



Users can teach the welding quality window on this screen. There are three teach modes available as means to do sampling. Users can configure them on the 5.12.4 Teach Mode Configuration Screen.These modes as follows:

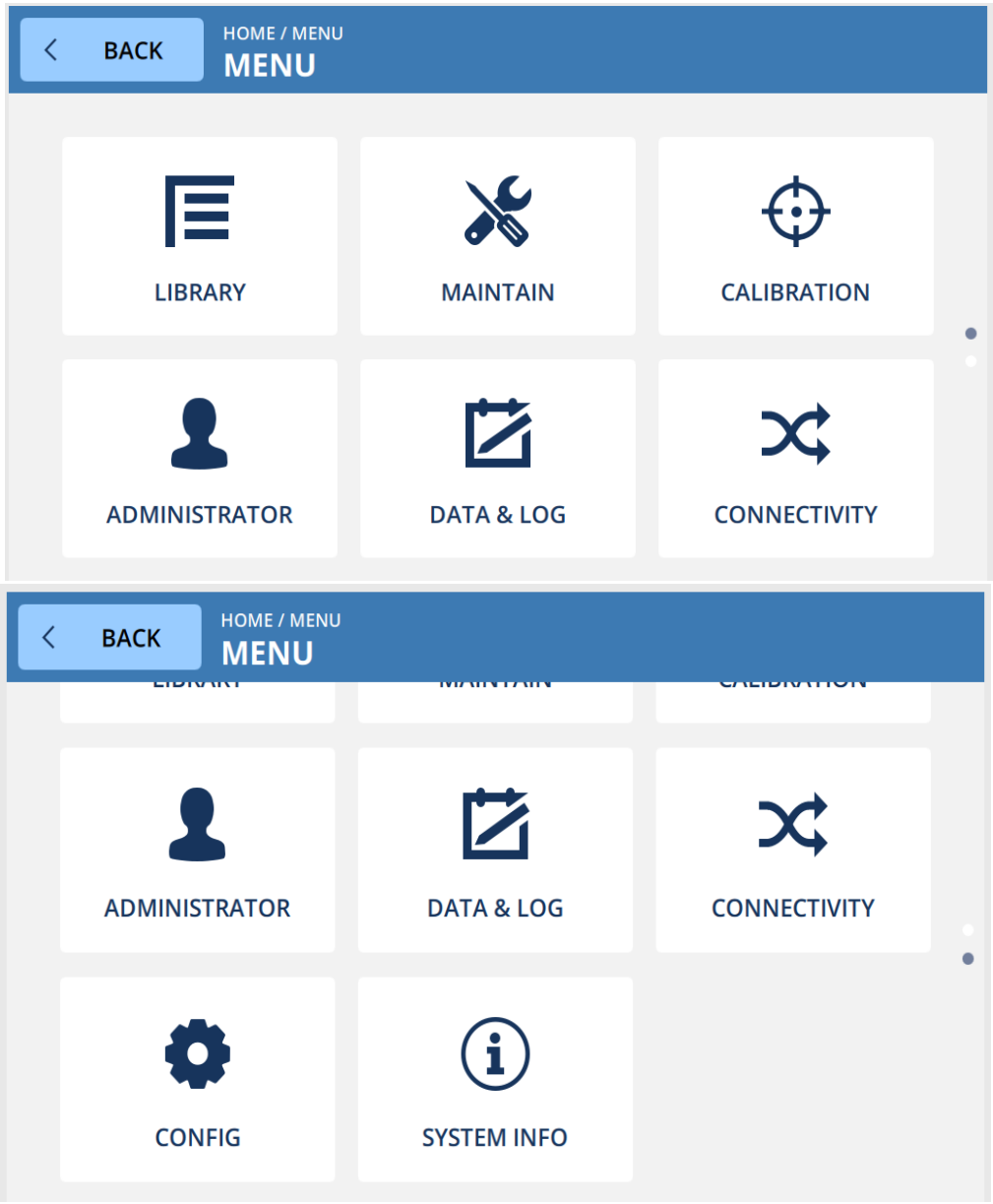
In the standard teach mode, after each welding is completed, the user needs to manually select whether to apply the welding data as the sampleset. Click to accept, and the data will be recorded as a sample. Otherwise, the data will not be included as the teaching sample. Until exiting or reaching the teaching sample setting value, teaching is completed.

In automatic mode, the system will automatically include the first five welding data as samples, and after the fifth welding, calculate the initial welding quality window. In the subsequent welding, the welding data will be automatically included in the sampleset or discarded based on whether it is within the initial welding quality window. When the three welding data are not within the initial welding quality window, the system will automatically discard all previous sample data and restart automatic teaching.

In sigma mode, the system accepts welding samples from all perspectives by default. When the number of samples reaches the set value, the welding quality window is calculated.

5.5 Menu Screen

Figure 5.8 MENU screen



This screen allows access to the features of the controller. Features are divided into related groups. Access to Home screen is protected by a user changeable password. The password is initially set to 000000.

Press one of the following options for this screen:

LIBRARY

To access to recipe library. See 5.6 Library Screen.

MAINTAIN

To allow adjustment and on demand control of the various motion devices in the weld actuator. Also allows access to Actuator Maintenance Screen and Sonics Maintenance screen. See 5.7 Maintenance Screen.

CALIBRATION

To calibrate height and amplitude. See 5.8 Calibration Screen.

ADMINSTRATOR

To change passwords that control operator access to the GMX-L20A commands, and to set permission. See 5.9 Administrator Screen.

DATA&LOG

To view the Weld Result History and Alarm Log. See 5.10 Data & Log Screen.

CONNECTIVITY

To set up the Ethernet and Gateway. See 5.11 Connectivity Screen.

CONFIG

To access config features of the controller. These include units and language selection as well as various other operational settings. see 5.12 CONFIG Screen.

SYSTEM INFO

To check and upgrade the system infomation. See 5.13 System Information Screen.

BACK

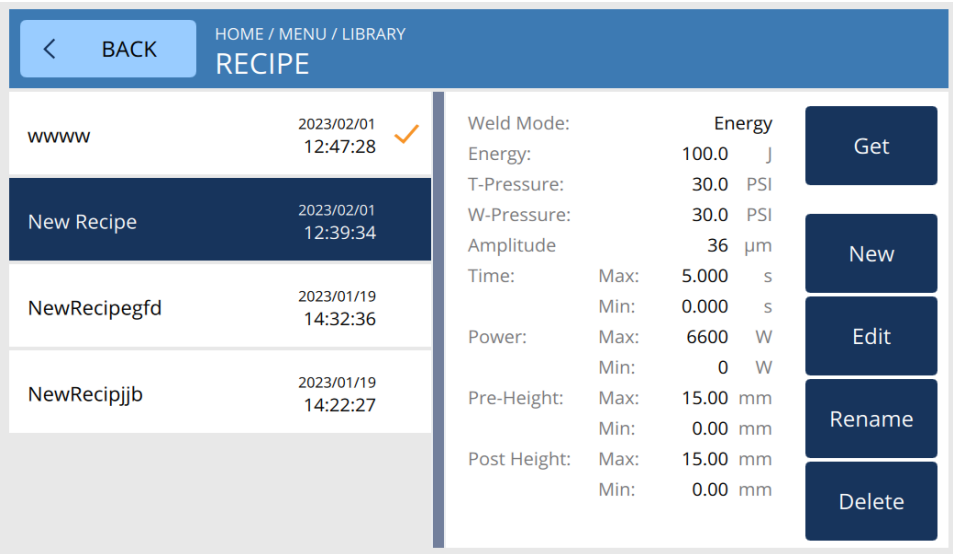
To return to Home screen. See 5.3 Home Screen.

5.6 Library Screen

This screen allows access to Recipe Library, after entering Library screen, the Recipe Library screen is displayed by default, see Figure 5.9 Recipe library screen.

5.6.1 Recipe Library Screen

Figure 5.9 Recipe library screen



When recipes have been named and configured they must be stored in the library memory in order to retrieve them at a later date. Previously stored recipes are also retrieved from this screen. The storage registers are shown left screen starting with the latest recipe. The library may store up to **1000** recipes.

Press one of the following options for this screen:

Get

To apply this recipe.

New

To create a new recipe name and content.

Edit

To edit an existing recipe name and content.

Rename

To change an existing recipe name.

Delete

To delete an existing recipe.

Back

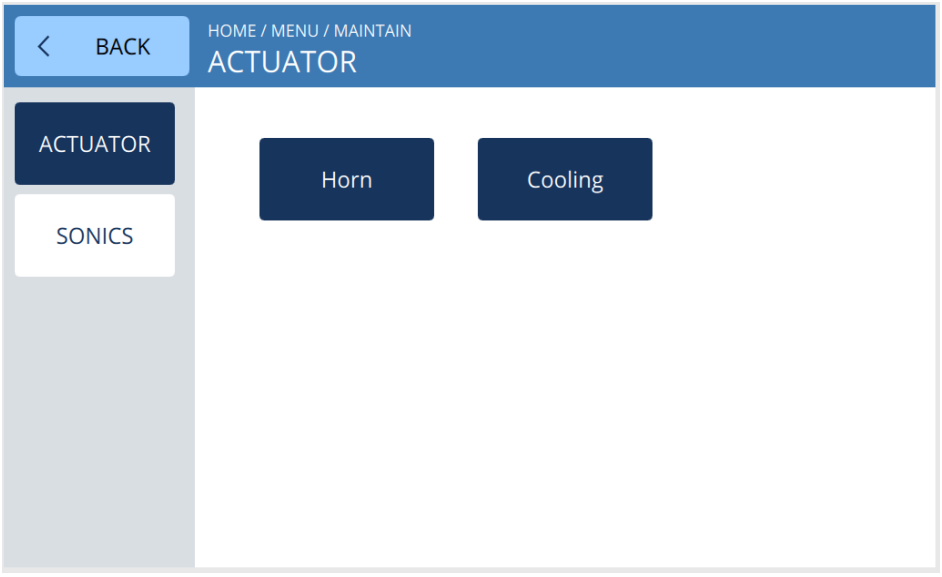
To return to MENU screen. See 5.5 Menu Screen.

5.7 Maintenance Screen

The maintenance screen allows adjustment and on demand control of motion devices that are used in the weld actuator. This screen also allows access to limit settings.The maintenance screen contains two functions: actuator maintenance and sonics maintenance . When you enter the maintenance screen, the actuator maintenance screen is displayed by default, see 5.7.1 Actuator Maintenance Screen.

5.7.1 Actuator Maintenance Screen

Figure 5.10 Actuator Maintenance Screen



Press one of the following options for this screen:

ACTUATOR

To set up actuator. See 5.7.1 Actuator Maintenance Screen.

SONICS

To allow on demand control of ultrasonic weld energy and calibrate amplitude. See 5.7.2 Sonics Maintenance Screen.

HORN

To toggle the horn between up and down positions.

COOLING

To toggle the cooling air control solenoid on and off.

Back

To return to MENU screen. See 5.5 Menu Screen.

WARNING	
	Clicking the button on the Actuator Maintenance Screen will trigger the up and down movement of the horn. Operators need to prevent pinching injuries before clicking the buttons.

5.7.2 Sonics Maintenance Screen

Figure 5.11 Sonics Maintenance screen

Press one of the following options for this screen:

TEST

To fire ultrasonic energy at the current amplitude setting.

100% TEST

To fire ultrasonic energy at 100% amplitude. This is used when calibrating amplitude.

RESET

To reset the controller if a weld overload should occur.

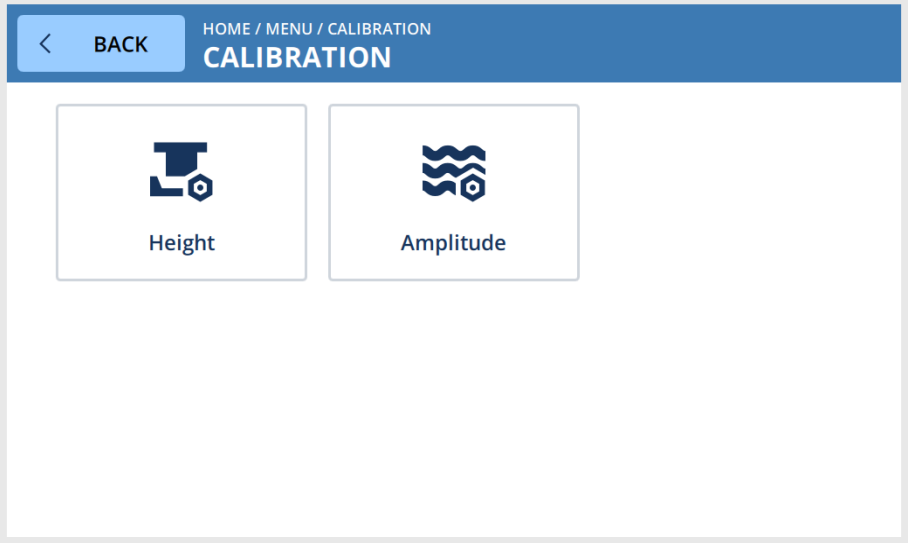
Back

To return to MENU screen. See 5.5 Menu Screen.

NOTICE	
	Clicking the button on the Sonics Maintenance Screen will start the sonics. Be sure to ensure that there are no interfering objects around the horn to prevent horn damaging from the ultrasonic startup.

5.8 Calibration Screen

Figure 5.12 Calibration Screen



The calibration is a process of adjusting a device to a known position for purposes of inspection and/or monitoring position, direction, speed, and/or velocity. The height and amplitude can be calibrated in this screen.

Height

To calibrate height.See 5.8.1 Height Calibration Screen.

Amptitude

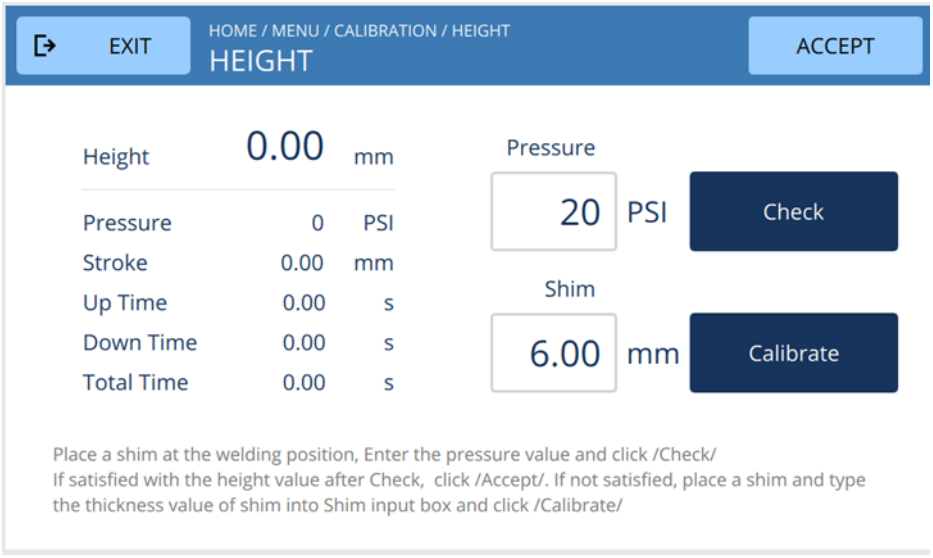
To calibrate amplitude. See 5.8.2 Amplitude Calibration Screen.

BACK

To return to MENU screen. See 5.5 Menu Screen.

5.8.1 Height Calibration Screen

Figure 5.13 Height Calibration screen



This screen is for height (horn to anvil) calibration. The instructions on the screen explain the procedure for calibrating.

Press one of the following options for this screen:

Pressure

To change the amount of mechanical pressure supplied to the ultrasonic stack assembly while delivering ultrasonic energy to the components.

Shim

To change the value of shim thickness.

check

To check that the height of the workpiece itself is correct.

Recheck

Double check that the height of the workpiece itself is correct.

Calibrate

To calibrate the height of the equipment.

Accept

To accept the calibration results.

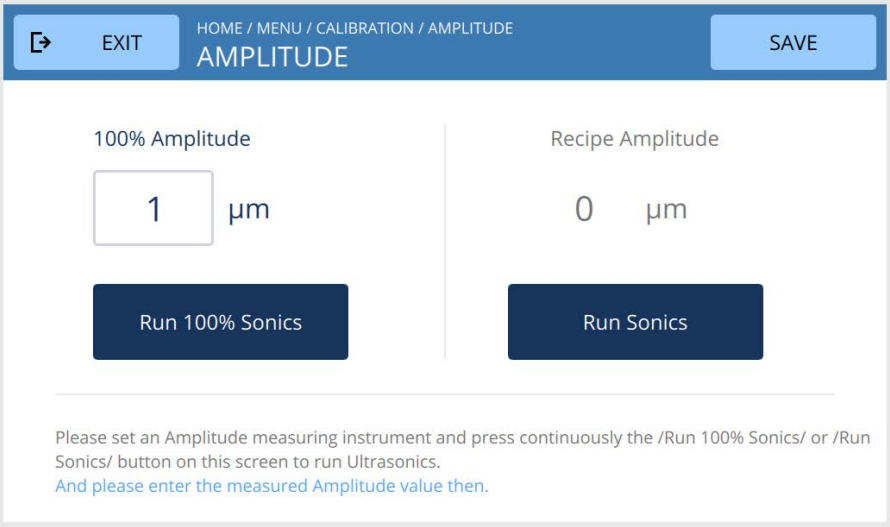
Exit

To return to Calibration Screen. See 5.8 Calibration Screen.

WARNING	
	Clicking the button on the Height Calibration screen will trigger the up and down movement of the horn. Operators need to prevent pinching injuries before clicking the buttons.

5.8.2 Amplitude Calibration Screen

Figure 5.14 Amplitude Calibration screen



Press one of the following options for this screen:

Run 100% Sonics

Sonics are produced at 100% amplitude.

Run Sonics

Sonics are produced at the amplitude of the current active recipe.

Exit

To return to Calibration Screen. See 5.8 Calibration Screen.

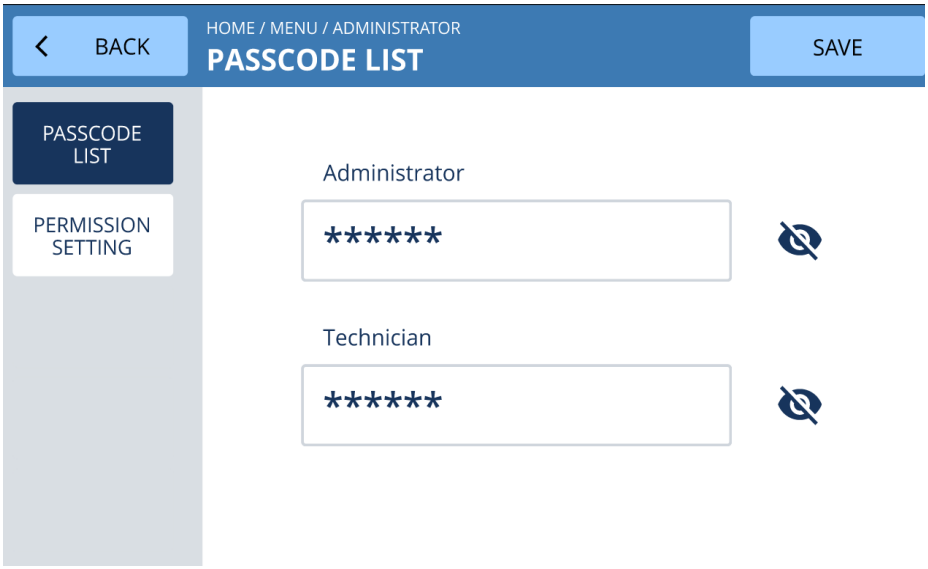
NOTICE	
	Clicking the button on the Amplitude Calibration Screen will start the sonics. Be sure to ensure that there are no interfering objects around the horn to prevent horn damaging from the ultrasonic startup.

5.9 Administrator Screen

This screen is used to edit the passcode that control operator accesses to the GMX-L20A commands and permission settings. After entering administration screen, the passcode list screen is displayed by default, see 5.9.1 Passcode List Screen for reference.

5.9.1 Passcode List Screen

Figure 5.15 Administrator Screen



This screen is for editing or viewing the passcodes of administrator and technician. The passcode must consist of six digits.

Press one of the following options for this screen:

PASSCODE LIST

To edit or view the passcodes of administrator and technician.

PERMISSION SETTING

To set permission for operator. See 5.9.2 Permission Setting Screen.

Save

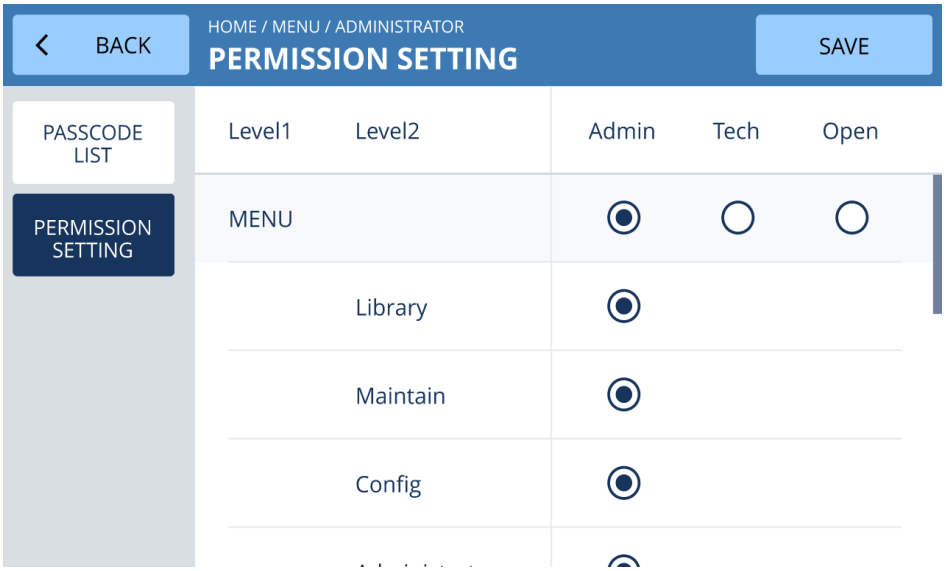
To save your settings.

BACK

To return to MENU screen. See 5.5 Menu Screen.

5.9.2 Permission Setting Screen

Figure 5.16 Permission Setting Screen



There are 3 level of permission, and they are admin, tech and open. Admin is the highest level. The Open is the lowest level. The passcode of admin and tech can be updated if necessary. The features can be assigned to different roles and one feature can only be set under one role. High privilege can access to features assigned only to lower level.

Press one of the following options for this screen:

Save

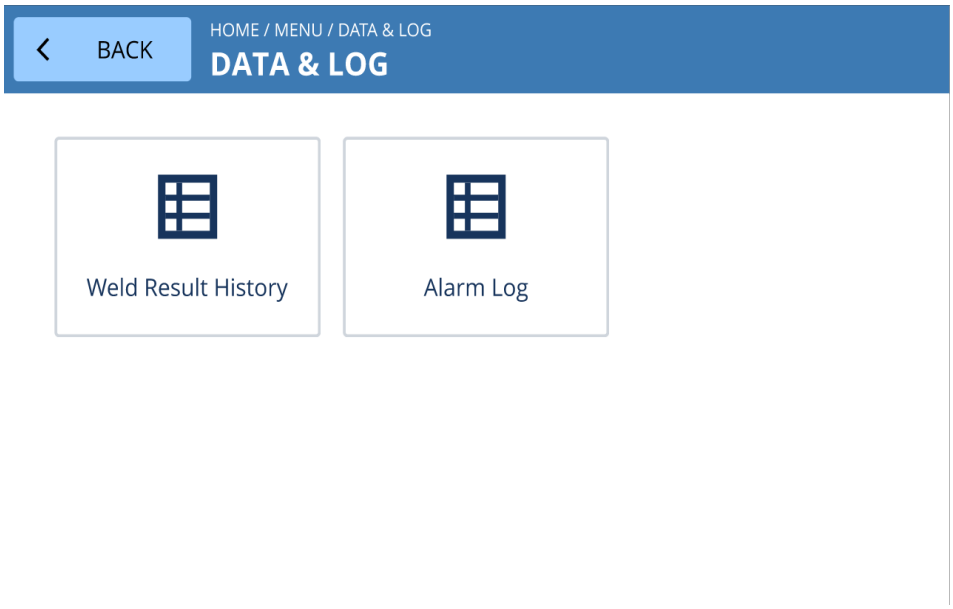
To save your settings.

BACK

To return to MENU screen. See 5.5 Menu Screen.

5.10 Data & Log Screen

Figure 5.17 Data & Log screen



This screen is for checking weld result history and alarm log.

Press one of the following options for this screen:

WELD RESULT HISTORY

To look into weld result history. See 5.10.1 Weld Result History Screen.

ALARM LOG

To look into alarm log, including alarm id and alarm description.See 5.10.2 Alarm Log Screen.

BACK

To return to MENU screen. See 5.5 Menu Screen.

5.10.1 Weld Result History Screen

Figure 5.18 Weld Result History Screen

This screen is for looking into the weld result history of the equipment.

Click the graph icon will bring you to the weld graph screen for the selected record. See Figure 5.19 Weld Result Screen. The table can be slip up/down by touch the screen or scroll up/down.

Press one of the following options for this screen:

BACK

To return to Data & Log screen . See 5.10 Data & Log Screen.

Figure 5.19 Weld Result Screen

5.10.2 Alarm Log Screen

Figure 5.20 Alarm Log Screen

In this screen, user can view alarm log. It allows the user to scroll up and down.

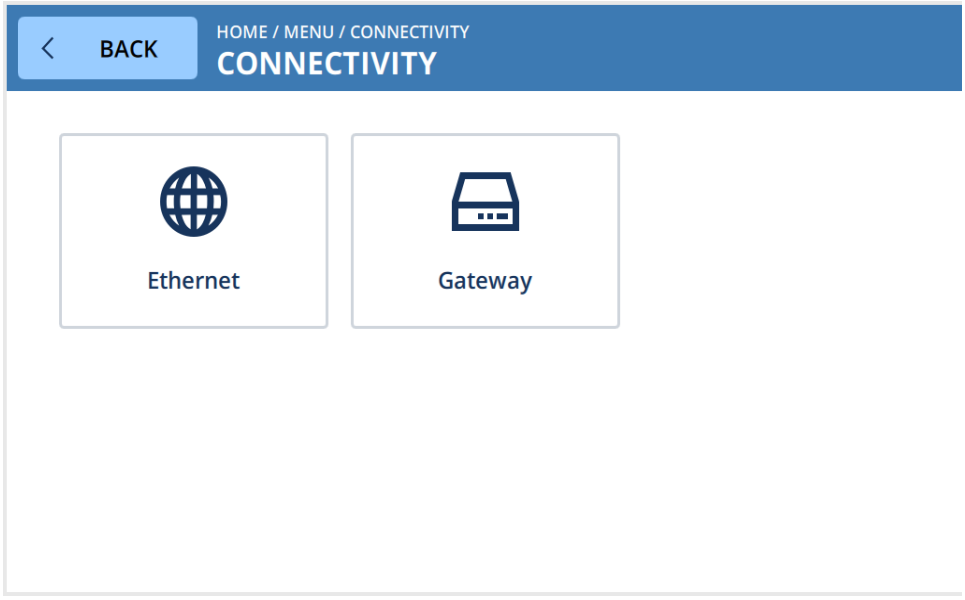
Press one of the following options for this screen:

BACK

To return to Data & Log screen . See 5.10 Data & Log Screen.

5.11 Connectivity Screen

Figure 5.21 Connectivity Screen



This screen allows access to Ethernet and Gateway settings.

Press one of the following options for this screen:

ETHERNET

To set up Ethernet. See 5.11.1 Ethernet Screen.

GATEWAY

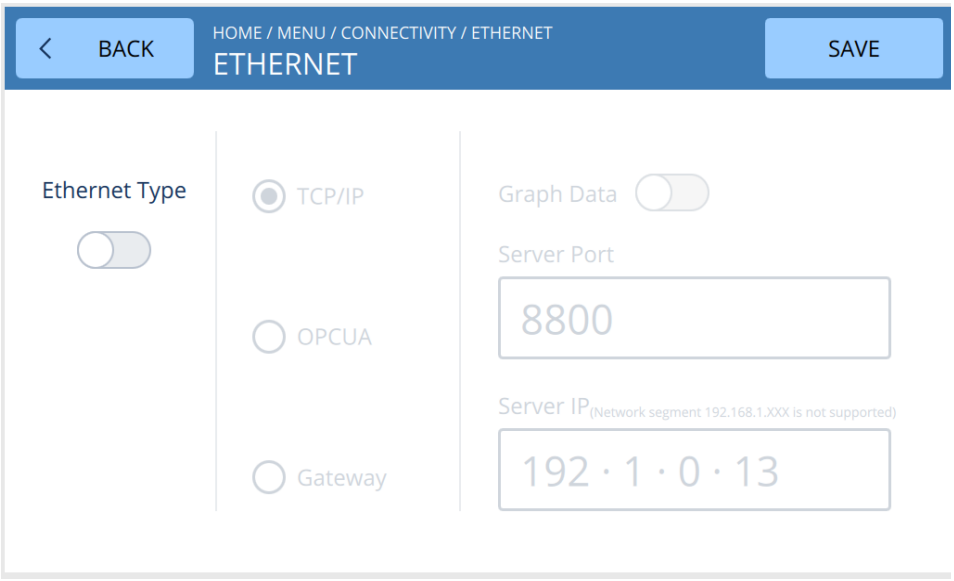
To set up Gateway. See 5.11.2 Gateway Screen.

BACK

To return to MENU screen. See 5.5 Menu Screen.

5.11.1 Ethernet Screen

Figure 5.22 Ethernet screen



This screen is used to set up Ethernet type which includes TCP/IP, OPCUA and Gateway. Once TCP/IP is enabled, the Server port and Server IP can be set up, and you can choose whether to send out graph data by Ethernet or not.

Press one of the following options for this screen:

Ethernet Type

To enable/disable Ethernet Type functionality.

TCP/IP

To enable/disable TCP/IP functionality.

OPCUA

To enable/disable TCP/IP functionality. If the OPCUA is enabled, the system configuration, weld result and current recipe can be send out through OPCUA. Users can set welding recipe data in the OPCUA client. (See 5.11.1.4 OPCUA node comparison table)

Gateway

To enable/disable Gateway functionality. If the Gateway is enabled, the Gateway data can be set up in Gateway screen. see _.

Graph Data

To enable/disable Graph Data functionality. If the Graph Data is enabled, the power, height and frequency curve can be send out through Ethernet.

Server Port

To edit Server Port.

Server IP

To set up Server IP.

Save

To save your settings.

BACK

To return to connectivity screen. See 5.11 Connectivity Screen.

5.11.1.1 Ethernet data structure

After users enable the TCP/IP switch, the client can be used to connect with the server, and the welding data and graph data can be received from the server after the connection is successful. The data structure received by the client is as follows:

Table 5.1 The data structure received by the client

Index	Name	Type	RANGE	Example (Hex)	Example Conversion	Note
1	Start Frame	Unique	N/A	0x 55 AA 02 10	Start 4 bytes	The Start Frame is fixed
2	Function	UINT32	1~10	0x 00 00 00 01 0x 00 00 00 02 0x 00 00 00 03 0x 00 00 00 04 0x 00 00 00 05 0x 00 00 00 0A	Weld Data output Weld Power Curve output Weld Height Curve output Weld Frequency Curve output Active Recipe output REMOTE RECALL inquire	The output function is for SC send Data to Client The inquire function is for Client to ask for Data from SC
3	Length	UINT32	N/A	0x 00 00 00 5C	Data Length 92	From Index 4 to Index 26 (The Real byte length of Weld data)
4	Cycle Count	UINT32	100,000 d	0x 00 00 27 10	10,000 cycles	
5	Actuator Type	UINT32	N/A	0x 00 00 00 01	GMX_L20A	
6	Power Supply	UINT32	Bit 3	0x 00 00 00 00 0x 00 00 00 01 0x 00 00 00 02 0x 00 00 00 03	4.0 KW 5.5 KW 8.0 KW	

7	Alarm	UINT32	N/A	0x 00 00 00 00 0x 00 00 00 01 0x 00 00 00 02 0x 00 00 00 04 0x 00 00 00 08 0x 00 00 01 00 0x 00 00 02 00 0x 00 00 04 00 0x 00 00 08 00 0x 00 00 09 00 0x 00 00 0A 00	ERR_BATCH_SIZE 1 //BIT(0) ERR_OVERLOAD BIT(1) ERR_TIME_MS BIT(2) ERR_TIME_PL BIT(3) ERR_POWER_MS BI.T(4) ERR_POWER_PL BIT(5) ERR_PRE_HEIGHT_MS BIT(6) ERR_PRE_HEIGHT_PL BIT(7) ERR_POST_HEIGHT_MS BIT(8) ERR_POST_HEIGHT_PL BIT(9) ERR_WELD_ABORT BIT(10)	
8	Amplitude Setting	UINT32	72 um	0x 00 00 00 32	50 = 50um	
9	Mode Value Setting	INT32	10000.0 Joules	0x 00 00 8D 8B	Energy Mode and Energy/Height Mode:1000 = 100J Time Mode: 100=0.1s Height Mode: 30 = 0.03mm	
10	Time Setting	INT32	5.000 s	0x 00 00 02 0B	523 = 0.523 second	
11	Trigger Pressure Setting	INT32	80.0 PSI	0x 00 00 00 FB	25100 = 25.1 PSI	
12	Weld Pressure Setting	INT32	80.0 PSI	0x 00 00 00 FB	25100 = 25.1 PSI	
13	Weld Mode Setting	UINT32	0~3	0x 00 00 00 00	0 Energy Mode 1 Time Mode 2 Height Mode 3 Energy/Height Mode	
14	Actual Weld Time	UINT32	5.000 s	0x 00 00 02 0B	523 = 0.523 second	
15	Actual Weld Engery	UINT32	10000.0 Joules	0x 00 00 8D 8B	36235 = 3623.5 Joules	
16	Actual Peak Power	UINT32	7000W	0x 00 00 0D FC	3580W	

17	Actual Pre-Height	INT32	100.00 mm	0x 00 00 07 D0	2000 = 20.00mm	
18	Actual Post-Height	INT32	100.00 mm	0x 00 00 03 E8	1000 = 10.00mm	
19	Quality Time Upper	UINT32	5.000 s	0x 00 00 02 0B	523 = 0.523 second	
20	Quality Time Lower	UINT32	5.000 s	0x 00 00 02 0B	523 = 0.523 second	
21	Quality Power Upper	UINT32	7000W	0x 00 00 0D FC	3580W	
22	Quality Power Lower	UINT32	7000W	0x 00 00 00 5A	90W	
23	Quality Pre-Height Upper	UINT32	100.00 mm	0x 00 00 07 D0	2000 = 20.00mm	
24	Quality Pre-Height Lower	UINT32	100.00 mm	0x 00 00 03 E8	1000 = 10.00mm	
25	Quality Post-Height Upper	UINT32	100.00 mm	0x 00 00 07 D0	2000 = 20.00mm	
26	Quality Post-Height Lower	UINT32	100.00 mm	0x 00 00 03 E8	1000 = 10.00mm	
27	Checksum	UINT32	N/A	0x 00 00 07 97	1943	Added All BYTES from Index 2 to Index 26
28	Year	Value	9999	0x 00 00 07 E6	2022 year	
29	Month	Value	12	0x 00 00 00 0C	December	
30	Day	Value	31	0x 00 00 00 19	25th	
31	Hour	Value	24	0x 00 00 00 0D	13 PM	
32	Minute	Value	59	0x 00 00 00 0E	14 minutes	
33	Second	Value	59	0x 00 00 00 0F	15 seconds	
34	End Frame	Unique	N/A	0x 10 02 AA 55	End 4 bytes	The End Frame is fixed

If the value of the Function field is 2, 3, or 4, the received data is graph data. An example of its data structure (taking the power curve as an example) is as follows:

Table 5.2 The example of graph data structure

Index	Name	Type	RANGE	Example (Hex)	Example Conversion	Note
1	Start Frame	Unique	N/A	0x 55 AA 02 10	Start 4 bytes	The Start Frame is fixed
2	Function	UINT32	1~10	0x 00 00 00 02	Weld Power Curve output	The inquire function is for Client to ask for Data from SC
3	Length	UINT32	N/A	0x 00 00 00 5C	Data Length 1600	The Real byte length of Graph data
4	Graph Data	UINT32	N/A	0x 00 00 00 01	1	First value of x-axis
	Graph Data	UINT32	N/A	0x 00 00 00 00	0	First value of y-axis
	Graph Data	UINT32	N/A	0x 00 00 00 02	2	Second value of x-axis
	Graph Data	UINT32	N/A	0x 00 00 00 00	0	Second value of y-axis
	…	…	…	…	…	…
5	Checksum	UINT32	N/A	0x 00 00 AE 9E		Added All BYTES from Index 2 to Index 4
6	Year	Value	9999	0x 00 00 07 E6	2022 year	

7	Month	Value	12	0x 00 00 00 0C	December	
	Day	Value	31	0x 00 00 00 19	25th	
	Hour	Value	24	0x 00 00 00 0D	13 PM	
	Minute	Value	59	0x 00 00 00 0E	14 minutes	
8	Second	Value	59	0x 00 00 00 0F	15 seconds	
9	End Frame	Unique	N/A	0x 10 02 AA 55	End 4 bytes	The End Frame is fixed

5.11.1.2 Remote Recall

Users can send messages to the server through the client to set the active recipe. When using Remote Recall function, the message sent needs to conform to the data structure.

Table 5.3 The data structure sent by the client

Index	Name	Type	RANGE	Example (Hex)	Example Conversion	Note
1	Start Frame	Unique	N/A	0x 55 AA 02 10	Start 4 bytes	The Start Frame is fixed
2	Function	UINT32	N/A	0x 00 00 00 0A	REMOTE RECALL inquire	
3	Length	UINT32	N/A	0x 00 00 00 5C	Data Length 92	From Index 4 to Checksum (The Real byte length of Recipe name)
4	Recipe Name	UINT8	N/A	0x 52	"R"	The hexadecimal ASCII code of each letter in Recipe Name
5	Recipe Name	UINT8	N/A	0x 65	"e"	The hexadecimal ASCII code of each letter in Recipe Name
6	Recipe Name	UINT8	N/A	…	…	

7	Recipe Name	UINT8	N/A	0x 00	/0	It indicates the end of the recipe name
8	Checksum	UINT32	N/A			Added All BYTES from Index 2 to Index 7
9	End Frame	Unique	N/A	0x 10 02 AA 55	End 4 bytes	The End Frame is fixed

For example, users can send the following message to call a recipe named "RRTest1".

10 02 AA 55 0A 00 00 00 08 00 00 00 52 52 54 65 73 74 31 00 87 02 00 00 55 AA 02 10

If the call is successful, the server will return the following data:

10-02-AA-55-05-00-00-00-04-00-00-00-02-00-00-00-0B-00-00-00-E7-07-00-00-03-00-00-00-0F-00-00-00-0F-00-00-00-2B-00-00-00-3A-00-00-00-55-AA-02-10

The data structure sent by the server is as follows:

Table 5.4 The data structure sent by the server

Index	Name	Type	RANGE	Example (Hex)	Example Conversion	Note
1	Start Frame	Unique	N/A	0x 55 AA 02 10	Start 4 bytes	The Start Frame is fixed
2	Function	UINT32	1~10	0x 00 00 00 05	Active Recipe output	
3	Length	UINT32	N/A	0x 00 00 00 04	Data Length 4	
4	Recipe ID	UINT32	N/A	0x 00 00 00 02	Recipe ID =2	
5	Checksum	UINT32	N/A	0x 00 00 00 0B	11	
6	Year	Value	9999	0x 00 00 07 E7	2023 year	
7	Month	Value	12	0x 00 00 00 03	March	
8	Day	Value	31	0x 00 00 00 0F	15th	
9	Hour	Value	24	0x 00 00 00 0F	1F PM	
10	Minute	Value	59	0x 00 00 00 2B	43 minutes	
11	Second	Value	59	0x 00 00 00 3A	52 seconds	
12	End Frame	Unique	N/A	0x 10 02 AA 55	End 4 bytes	The End Frame is fixed

5.11.1.3 Weld Result Recall

Users can send "10 02 AA 55 0B 00 00 00 04 00 00 00 01 00 00 00 10 00 00 00 55 AA 02 10" to the server through the client to recall the lateset weld result.

Table 5.5 The data structure sent by client

Index	Name	Type	RANGE	Example (Hex)	Example Conversion	Note
1	Start Frame	Unique	N/A	0x 55 AA 02 10	Start 4 bytes	The Start Frame is fixed
2	Function	UINT32	N/A	0x 00 00 00 0B	Weld Result RECALL inquire	
3	Length	UINT32	N/A	0x 00 00 00 04	Data Length 4	From Index 4 to Checksum
4	Recipe Type	UINT8	N/A	0x 00 00 00 01	0x 00 00 00 01 Active recipe	
5	Check sum	UINT32	N/A	0x 00 00 00 10		Added All BYTES from Index 2 to Index 4
6	End Frame	Unique	N/A	0x 10 02 AA 55	End 4 bytes	The End Frame is fixed

5.11.1.4 OPCUA node comparison table

Table 5.6 OPCUA node comparison table

Weld Result				
NodeID	Node Name	Example Transform	Used	Read/Write
101	WeldResultID		T	R
102	CycleCounter		T	R
103	RecipeID		T	R
104	RecipeName		T	R
105	PartID		T	R
106	WeldMode	0: Energy Mode 1: Time Mode 2: Height Mode 3: Energy/Height Mode	T	R
107	Energy	1000 = 100J	T	R
108	Amplitude	36 = 36um	T	R
109	WeldTime	100 = 0.1s	T	R
110	PeakPower	100 = 100W	T	R
111	TriggerPressure	30000 = 30PSI	T	R
112	WeldPressure	30000 = 30PSI	T	R
113	PreHeight	445 = 0.445 ≈ 0.45mm	T	R
114	PostHeight	30 = 0.03mm	T	R
115	AlarmFlag		T	R
116	ModeValueSetting	Energy Mode and Energy/ Height Mode:1000 = 100J Time Mode: 100=0.1s Height Mode: 30 = 0.03mm	T	R
117	AmplitudeSetting	36 = 36um	T	R
118	TPressureSetting	30000 = 30PSI	T	R
119	WPressureSetting	30000 = 30PSI	T	R
120	MaxWeldTime	3000 = 3s	T	R
121	MinWeldTime	1000 = 1s	T	R
122	MaxPower	6600 = 6600W	T	R
123	MinPower	1000 = 1000W	T	R

124	MaxPreHeight	15000 = 15mm	T	R
125	MinPreHeight	1000 = 1mm	T	R
126	MaxPostHeight	15000 = 15mm	T	R
127	MinPostHeight	1000 = 1mm	T	R
128	DateTime		T	R

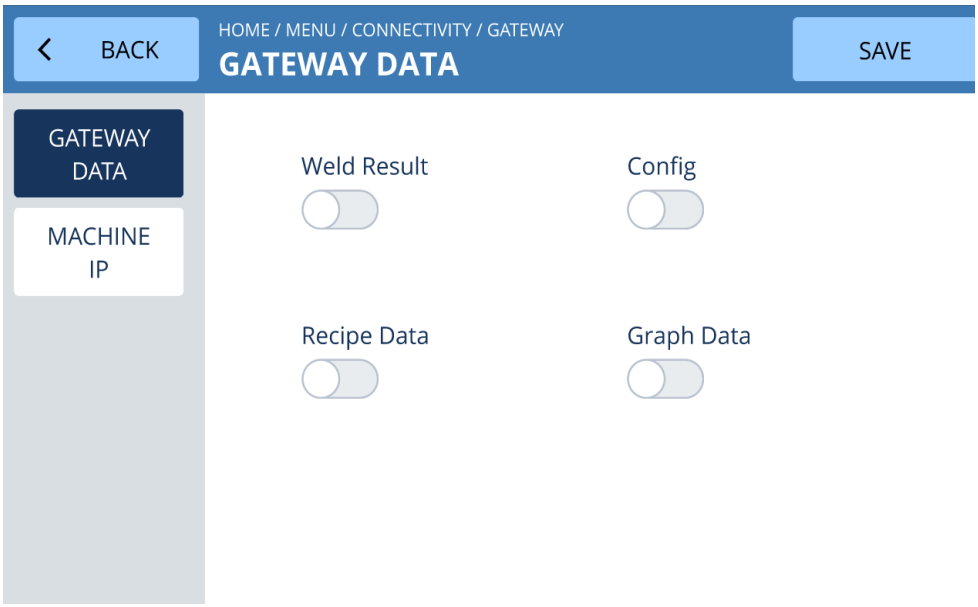
System Config				
NodeID	NodeName	Example Transform	Used	Read/Write
201	Language	0 : English 1 : Simplified Chinese 2 : Deutsch	T	R
202	PowerSupply	0 : 4000W 1 : 5500W 2 : 8000W	T	R
203	Frequency		T	R
204	HeightEncoder	0 : close 1 : open	T	R
205	FootPedalAbort	0 : close 1 : open	T	R
206	LockOnAlarm	0 : close 1 : open	T	R
207	FirstScreen		T	R
208	Cooling	0 : close 1 : open	T	R
209	CoolingDuration	1000 = 1s	T	R
210	CoolingDelay	1000 = 1s	T	R
211	Amplitude_Unit	0 : um 1: %	T	R
212	Pressure_Unit	0 : PSI 1 : Bar 2 : kPa	T	R
213	Height_Unit	0 : mm 1 : inch	T	R
214	MaxAmplitude	72 = 72um	T	R
215	TeachModeType		T	R
216	DateTime		T	R

Active Recipe				
NodeID	NodeName	Example Transform	Used	Read/Write
301	RecipeID		T	R
302	RecipeNumber		T	R
303	RecipeName		T	R
304	RecipePicPath		F	R
305	TeachMode		T	RW
306	BatchSize		T	RW

307	WeldParameter		F	RW
308	EnergySetting	1000 = 100J	T	RW
309	TimeSetting	100 = 0.100 s		
310	HeightSetting	1300 = 1.30 mm		
311	TPressure	30000 = 30PSI	T	RW
312	WPressure	30000 = 30PSI	T	RW
313	Amplitude	36 = 36um	T	RW
314	EnergyStep		F	RW
315	Order		F	RW
316	StepValue		F	RW
317	AmplitudeValue		F	RW
318	TimeStep		F	RW
319	Order		F	RW
320	StepValue		F	RW
321	AmplitudeValue		F	RW
322	PowerStep		F	RW
323	Order		F	RW
324	StepValue		F	RW
325	AmplitudeValue		F	RW
326	WidthSetting		F	RW
327	QualityWindowSetting		F	RW
328	TimeMax	3000 = 3s	T	RW
329	TimeMin	3000 = 3s	T	RW
330	PeakPowerMax	6600 = 6600W	T	RW
331	PeakPowerMin	6600 = 6600W	T	RW
332	PreHeightMax	15000 = 15mm	T	RW
333	PreHeightMin	15000 = 15mm	T	RW
334	HeightMax	15000 = 15mm	T	RW
335	HeightMin	15000 = 15mm	T	RW
336	AdvancedSetting		F	RW
337	WeldMode	0: Energy Mode 1: Time Mode 2: Height Mode 3: Energy/Height Mode	T	RW
338	WeldStepMode		F	RW
339	Trigger		F	RW
340	PreBurst	1000 = 1s	T	RW
341	HoldTime	1000 = 1s	T	RW
342	SqueezeTime	1000 = 1s	T	RW
343	AfterBurstDelay	1000 = 1s	T	RW
344	AfterBurstTime	1000 = 1s	T	RW
345	AfterBurstAmplitude	36 = 36um	T	RW
346	DisplayedHeightOffset		F	RW
347	MeasuredHeightOffset		F	RW

5.11.2 Gateway Screen

Figure 5.23 Gateway Data screen



The Data Interface Gateway (DIG) is a communication controller with proprietary Branson equipment software embedded that securely connects Branson equipment to a user's network., e.g. MES or local production supervisory systems.

DIG provides machine data by an integrated OPC-UA server.

This screen allows you to send your selected data type to the gateway.

Press one of the following options for this screen:

Weld Result

Enable Weld Data to be sent to the Gateway.

Config

Enable System Configuration information to be sent to the Gateway.

Recipe Data

Enable Recipe Data to be sent to the Gateway.

Graph Data

Enable Graph Data to be sent to the Gateway.

Save

To save your settings.

BACK

To return to connectivity screen. See 5.11 Connectivity Screen.

Figure 5.24 Machine IP screen

The DIG supports up to 8 machines. Each machine has assigned a static IP address and communicates with DIG on predefined port.

The network is defined as follows:

IP Address: 150.150.150.xx*

Subnet mask: 255.255.255.0

*(xx defines unique machine number, see Figure 5.17)

Settings are specific to product type.

Press one of the following options for this screen:

Save

To save your settings.

BACK

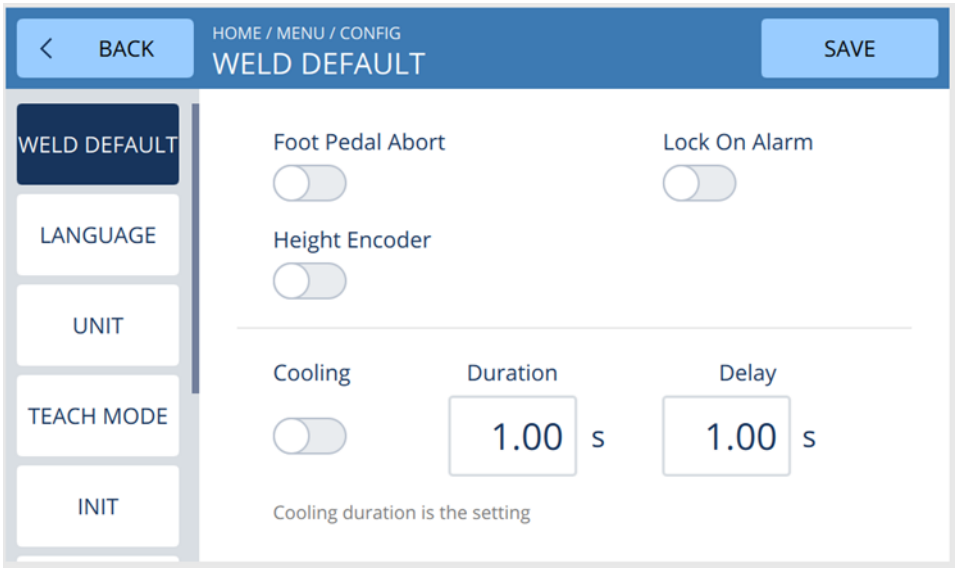
To return to connectivity screen. See 5.11 Connectivity Screen.

5.12 CONFIG Screen

This screen provides access to configuration features of the controller. Features in this screen are global and remain unchanged regardless of other weld setting or recipes that are currently in use. Navigating from this screen will allow configuration of the weld default, language, UNIT, INIT, power supply and time for your application. After entering configuration screen, the weld default configuration screen is displayed by default, see 5.12.1 Weld Default Configuration Screen.

5.12.1 Weld Default Configuration Screen

Figure 5.25 Weld Default Configuration screen



This screen allows access to configuration settings.

Press one of the following options for this screen:

FOOT PEDAL ABORT

When enabled, foot pedal must be maintained until sonic starts or the weld cycle will be aborted.

LOCK ON ALARM

To toggle between lock or allow a weld to continue when an alarm condition exists. When set to lock the actuator will not release the part.

HEIGHT ENCODER

To toggle height encoder on/off.

COOLING

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

DURATION

To change the length of time the cooling air is on after each weld cycle.

DELAY

To change the delay period after weld and before cooling air is turned on.

LANGUAGE

To select a controller display language. See 5.12.2 Language Configuration Screen.

UNIT

To set the unit of amplitude, height and pressure. See 5.12.3 Unit Configuration Screen.

INIT

To reinitialize the controller for software upgrades or in the unlikely event of a system failure. The full initialization will initalize all system configuration settings, and will not save all recipes and sequences stored in the controller library. See 5.12.5 INIT Configuration Screen.

POWER SUPPLY

To select the electrical energy you need. See 5.12.6 Power Supply Configuration Screen.

SET TIME

To set system time. See 5.12.7 Set Time Screen.

Database Formatting

To format database in this screen. See 5.12.8 Database Formatting Screen. If you need to format the database, please contact Branson after-sales service personnel.

BACK

To return to MENU screen. See 5.5 Menu Screen.

5.12.2 Language Configuration Screen

Figure 5.26 Language configuration screen

From this screen you may select an available controller display language.

Press one of the following options for this screen:

Save

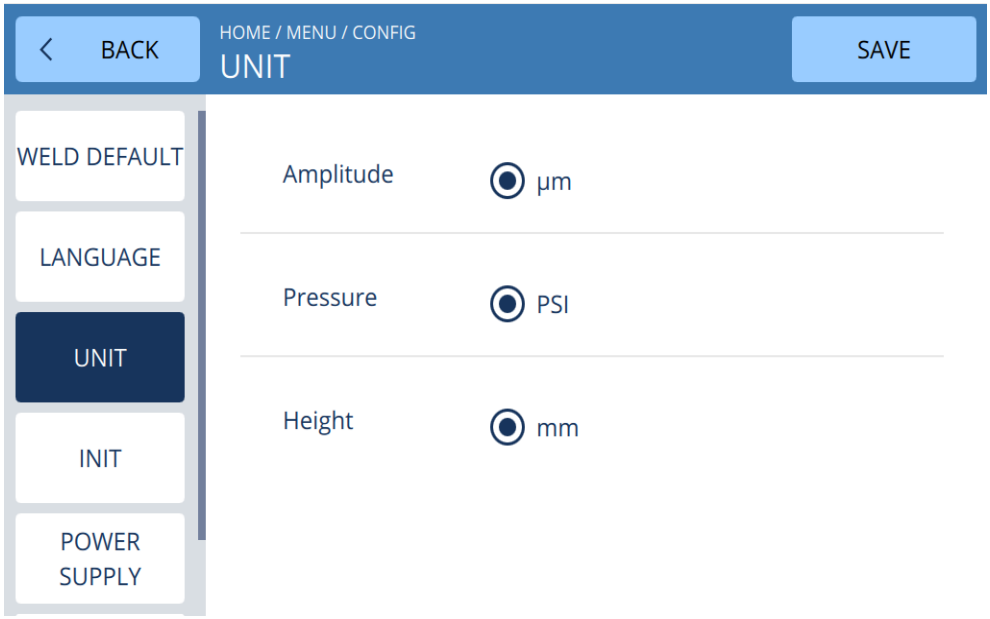
To save your settings.

BACK

To return to MENU screen. See 5.5 Menu Screen.

5.12.3 Unit Configuration Screen

Figure 5.27 Unit Configuration Screen



Press one of the following options for this screen:

AMPLITUDE

To select the unit of amplitude.

PRESSURE

To select the unit of pressure.

HEIGHT

To select the unit of height.

Save

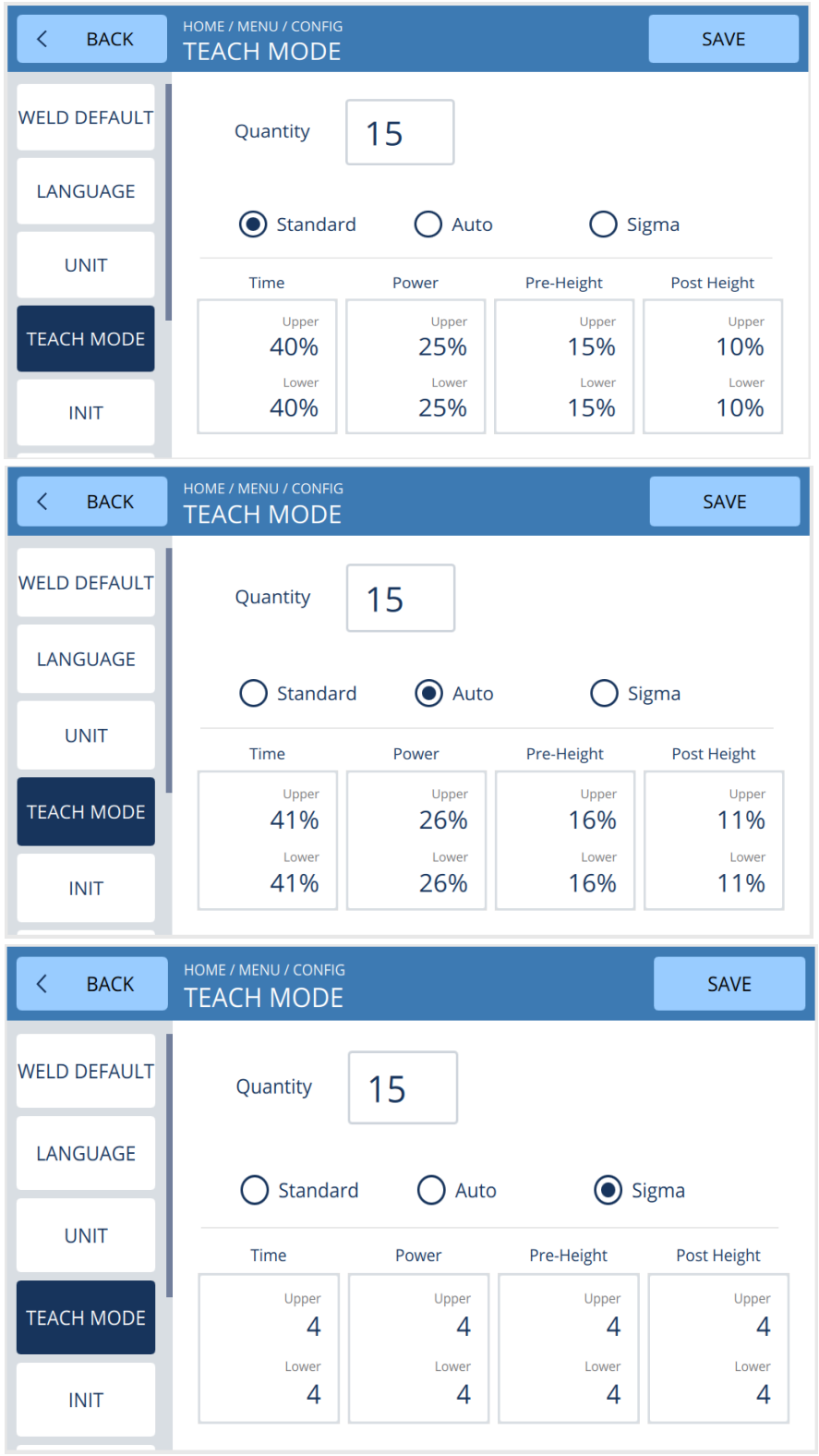
To save your settings.

BACK

To return to MENU screen. See 5.5 Menu Screen.

5.12.4 Teach Mode Configuration Screen

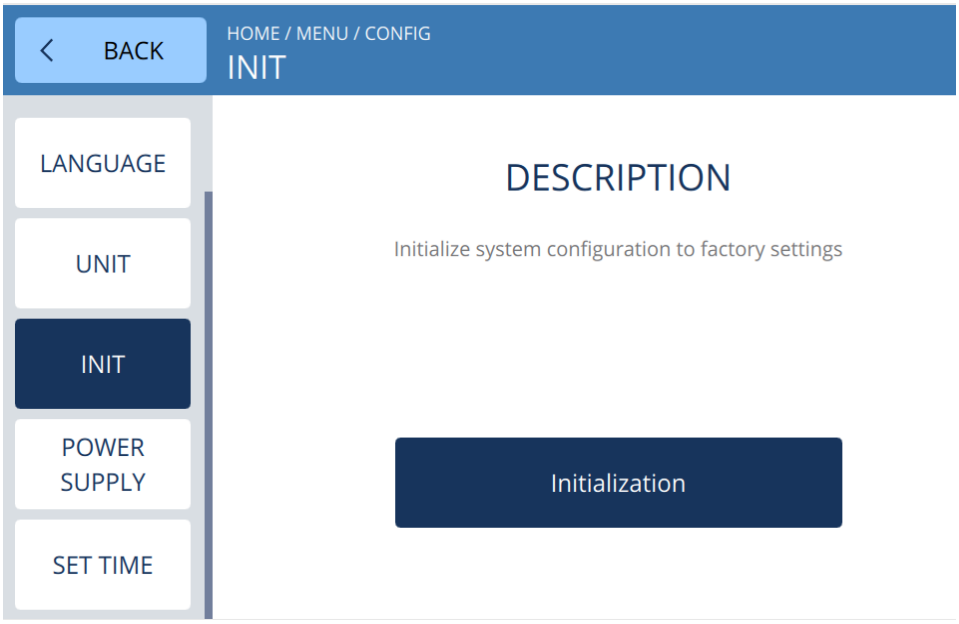
Figure 5.28 Teach Mode Configuration Screen



On this screen, users can select and configure teaching mode related parameters.

5.12.5 INIT Configuration Screen

Figure 5.29 INIT Configuration screen



This screen is used to reinitialize the controller for software upgrades or in the unlikely event of a system failure. The full initialization will initialize all system configuration settings, and will not save all recipes stored in the controller library.

Press one of the following options for this screen:

INITIALIZATION

To initialize system configuration to factory setting. The parameters and the default value of settings are shown below the table.

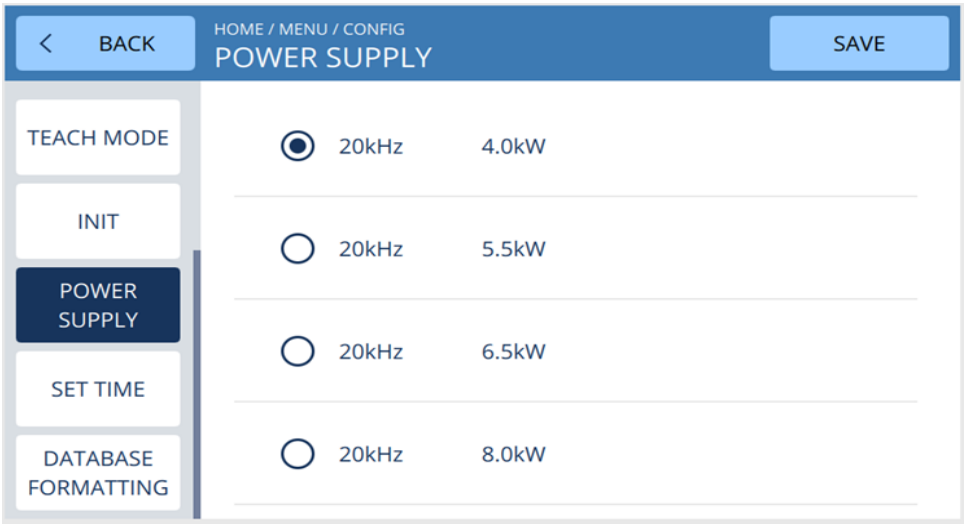
Parameter	Default Setting
Foot Pedal Abort	off
Lock On Alarm	off
Cooling	off
Cooling Duration	1.00
Cooling Delay	0.00
Language	English
Amplitude	µm
Pressure	PSI
Height	mm
Do not show this page again	uncheck

BACK

To return to MENU screen. See 5.5 Menu Screen.

5.12.6 Power Supply Configuration Screen

Figure 5.30 Power Supply Configuration screen



This screen is used to select the electrical energy.

Press one of the following options for this screen:

Save

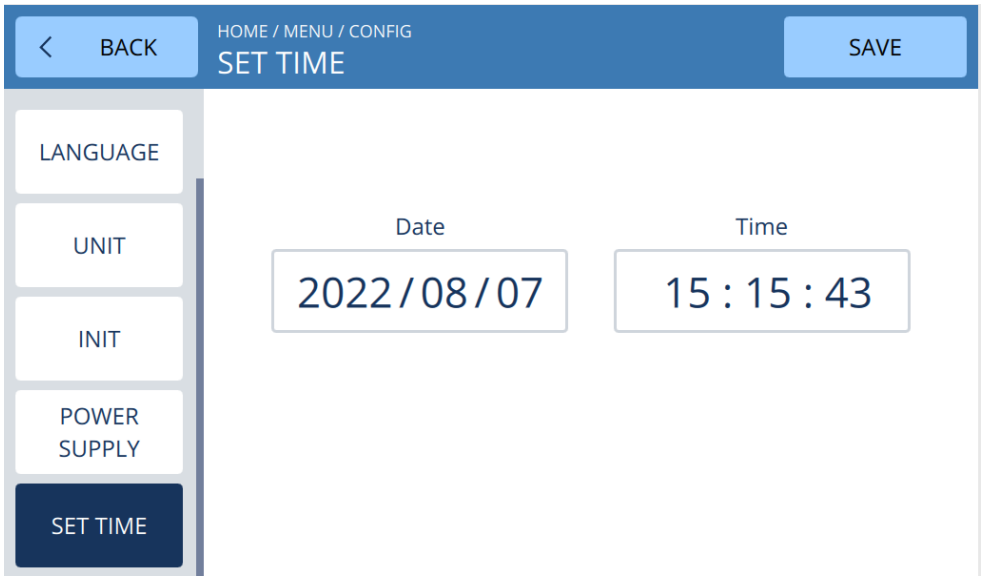
To save your settings.

BACK

To return to MENU screen. See 5.5 Menu Screen.

5.12.7 Set Time Screen

Figure 5.31 Set Time Screen



From this screen you may set system time.

Press one of the following options for this screen:

Save

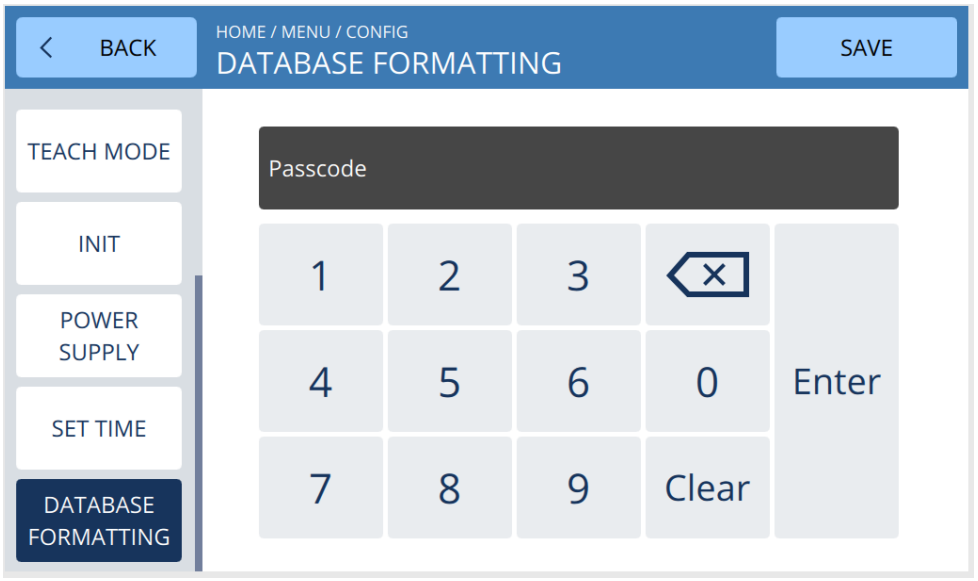
To save your settings.

BACK

To return to MENU screen. See 5.5 Menu Screen.

5.12.8 Database Formatting Screen

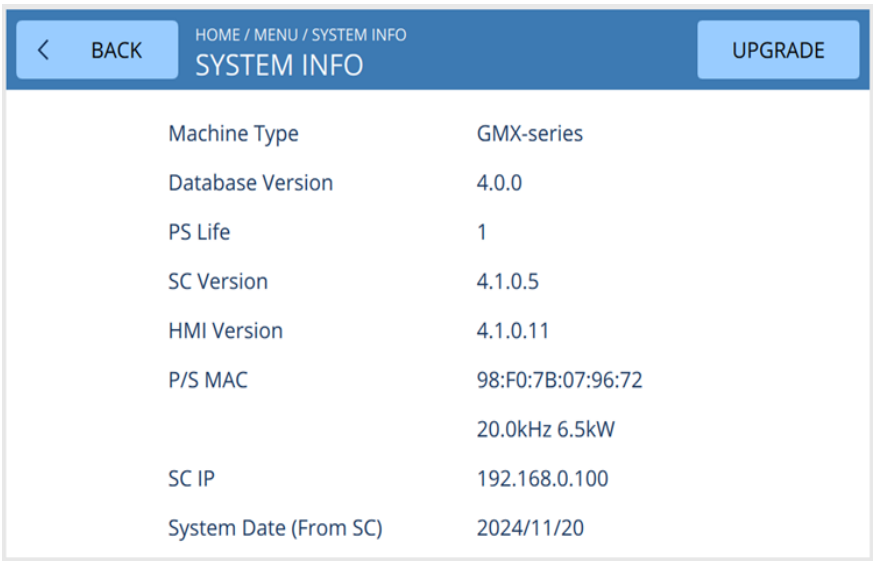
Figure 5.32 Database Formatting Screen



Users can format the database on this screen. If you need to apply this function, please contact Branson after-sales service personnel.

5.13 System Information Screen

Figure 5.33 System Infomation Screen



You can view system details and information about the current setup of your system from the System Information screen. Software upgrade can be performed from this screen.

Press one of the following options for this screen:

UPGRADE

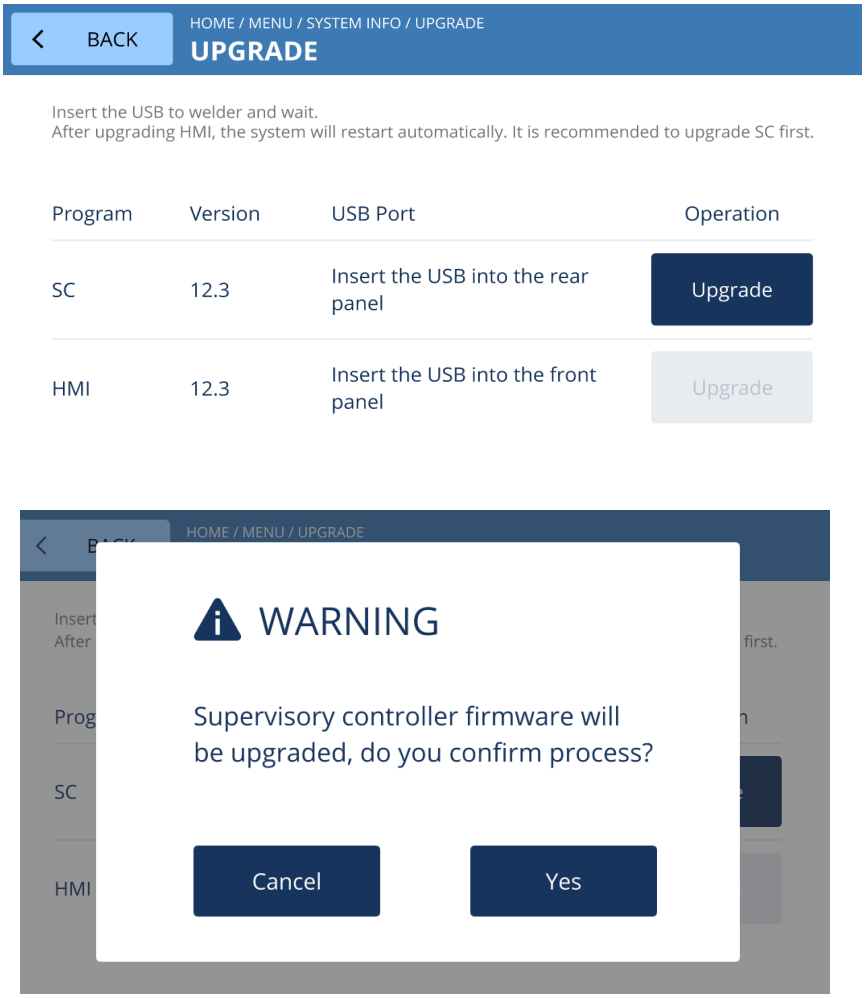
To upgrade the software.

BACK

To return to MENU screen. See 5.5 Menu Screen.

5.13.1 System Info Upgrade Screen

Figure 5.34 System Info Upgrade screen



These two screens are for software upgrade.

If you choose to upgrade SC, a warning appears on the screen: Supervisory controller firmware will be upgraded; do you confirm process? If you choose to upgrade HMI, you can see the message: UI controller software will be upgraded; do you confirm process?

Press one of the following options for this screen:

Upgrade

To upgrade SC or HMI.

Cancel

To cancel the upgrade of SC or HMI.

Yes

To upgrade SC or HMI.

Back

To save the new value and return to previous screen. See 5.13 System Information Screen.

5.14 Advanced Function Switch Select

Once you connect external controls to the power supply, you can set the following Advanced

Functions using the Switch Select block:

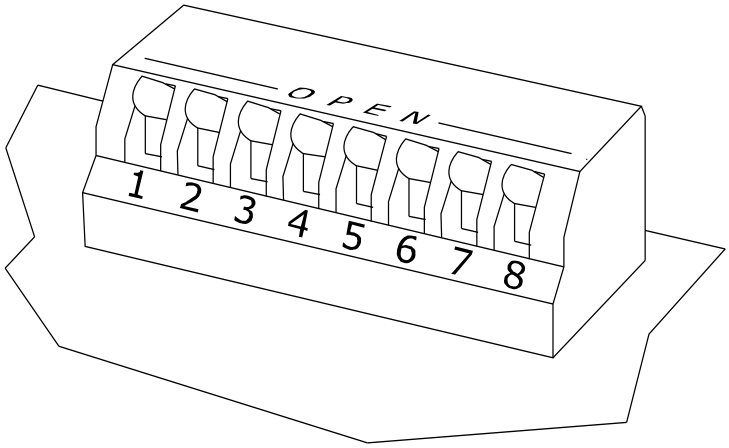
- **Seek:** Provides options for controlling, monitoring, and storing operating frequency
- **Amplitude Control:** Allows for varying amplitude (50% - 100%) via external controls or keeping the amplitude fixed
- **Select Start:** Provides four starting ranges. Select start allows the power supply to ramp amplitude to accommodate different converter and load requirements
- **Memory:** Stores horn frequency at end of each weld

See Figure 5.35 Advanced Functions Dip Switch for switch location. Refer to Table 5.7 Advanced Function Switch Select Table for switch settings.

Table 5.7 Advanced Function Switch Select Table

Function	Options	Set Toggles...
Seek	Seek on power up - Checks horn frequency upon power up and stores it in memory.	1 – Closed = OFF (Default) 1 – Open = ON
	Auto Seek - Checks horn frequency once each minute, timed from the last activation of ultrasonics.	2 – Closed = OFF (Default) 2 – Open = ON
	Auto Seek Duration - Indicates the length of time the Auto Seek function is active.	3 – Closed = 100 ms (Default) 3 – Open = 500 ms
	Store at End of Weld - Updates horn frequency memory at the end of each weld.	4 – Closed = OFF (Default) 4 – Open = ON
Amplitude Control	Variable - Front panel adjustment of amplitude (50% to 100%) **NOTICE** Pin 6 must be Open or Amplitude Control will not work.	6 – Closed = Fixed at 100% 6 – Open = Variable (Default)
Start	Short - Sets ramp time to 10 ms.	7 – Closed 8 – Closed
	Medium - Sets ramp time to 35 ms.	7 – Open 8 – Closed
	Standard - Sets ramp time to 80 ms.	7 – Closed (Default) 8 – Open (Default)
	Long - Sets ramp time to 105 ms.	7 – Open 8 – Open

Figure 5.35 Advanced Functions Dip Switch



5.15 Safety Circuit Alarms

The Safety Control System within the Controller constantly monitors the system's safety related components for protecting operation. When this system detects a fault condition, operation will be interrupted immediately, and the system goes to a safety lock state. Under the safety lock state, the ready signal becomes unavailable, and a beeper is used to indicate the safety system alarm by beeping.

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. Verify the Emergency Stop is in release state.
3. Power down and then power up the Controller to reset the system.
4. If the alarm persists, call Branson Support.

5.16 I/O Signal Assignments

Table 5.8 I/O Signal Assignments

Pin	Function	I/O Type	Values
1	I/O return	Power return	0V
3	Remote start	Digital Input	Apply +24V to run when PS in ready mode
13	Estop2 return	Digital Input	NO, No connect to indicate normal state
14	+24VDC IO Source	Power Source	+24V
15	Estop1 return	Digital Input	NC, Apply +24V to indicate normal state
16	Estop-R return	Digital Input	NC, Apply +24V to indicate normal state
17	Air press monitor	Digital Input	NC, Apply +24V to indicate normal state
18	Reset Signal	Digital Input	Apply +24V to perform reset
19	Ready Signal	Digital Output	+24V indicates the system is ready
24	Alarm	Digital Output	+24V indicates an alarm occurred
25	Sonic Monitor	Digital Output	+24V indicates ultrasonics are active

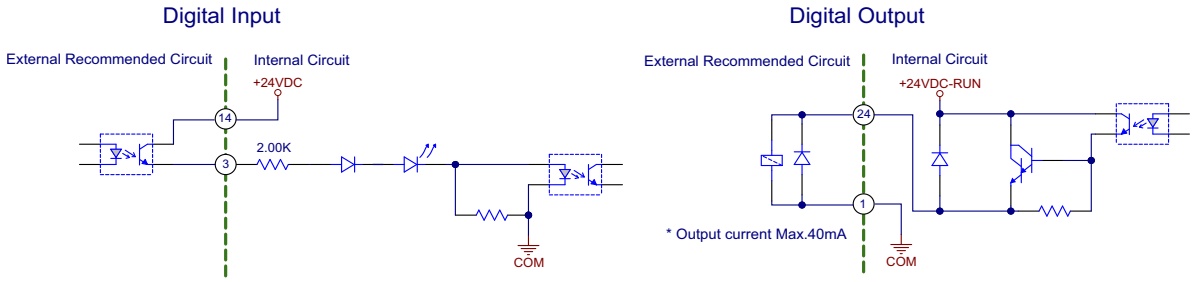
*+24V source Max. 200mA.

*Max.40mA per output channel.

*More details about automation interface see A.3 Automation cable interface.

5.17 Typical Digital I/O Wiring Examples

Figure 5.36 Typical Digital I/O Wiring Examples



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Chapter 6: Maintenance

6.1 Preventive Maintenance

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

WARNING	General Warning
	• 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 • 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 • Before you begin to disassemble any parts of the controller, ensure that it is turned off, and the main power is disconnected. Wait at least two minutes to allow capacitors to discharge • High voltage is present in the power supply. 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

6.1.1 Periodically Clean the Equipment

Air is continuously drawn into the Branson Touchscreen 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 Touchscreen Controller 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®*.

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

NOTICE	
	When it is necessary to clean the touch screen, wipe gently with a soft cloth dampened with a mild detergent or a window glass commercial cleaner. Give a final wipe to the entire screen with the soft damp cloth. Under no circumstances should you use solvents or ammonia to clean the screen.

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.

6.2 Parts Replacement

WARNING	General Warning
	If a particular module has failed, it should be replaced or repaired at an Branson Depot Facility.

CAUTION	High Voltage Hazard
	The Branson Touchscreen 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 Touchscreen Controller.

The Touchscreen Controller is designed for a long service life. In the event the system malfunctions, many of the internal components (Modules) are replaceable as a unit.

Power Supply Cover

The cover is held in place with seven screws, three on each side of the case and one on the rear. Lift the rear of the cover up to remove it. The cover must be in place when the system is operating due to fan-forced ventilation design.

Circuit Boards and Modules

Replaceable modules are shown in Figure 6.1 4000W controller internal layout, Figure 6.2 5500W & 8000W controller internal layout. Be sure to note ribbon cable and connector orientation prior to removing components for maintenance or replacement. The cooling fans use identical wiring harnesses, with one tying back the 'extra' lead length. Make note of any wiring paths if you are removing a module, before you disassemble. In some cases, there are several possible paths, but one preferred location. Be especially careful with harnesses and wires that go between the two portions of the case, as they can be pinched by the metal case if miss-routed.

6.3 Parts List

This section provides the list of replacement parts.

Table 6.1 Suggested spares

Item	Description	Part Number
1	Power Supply Module	159-244-069R (4000W) 100-244-081 (5500W) 1029963 (8000W)
2	Line Filter Module	100-242-1293R (4000W) 1030144 (5500W & 8000W)
3	DC Power Module	1020804
4	Cooling Fans	100-126-015R (4000W) 100-126-022R (5500W & 8000W)
5	LCD Module	BU-1036458
6	Raspberry Pi Programmed	BU-1036331 (Full)
		BU-1039666 (Basic)
7	Power Switch	BU-1036486 (4000W) 1029133 (5500W & 8000W)
8	Power Switch Control Board	BU-1036455 only for 4000W
9	Machine Controller Board	102-242-968
10	Supervisory Control Board	1034234 (Full)
		BU-1039647(Basic)

Figure 6.1 4000W controller internal layout

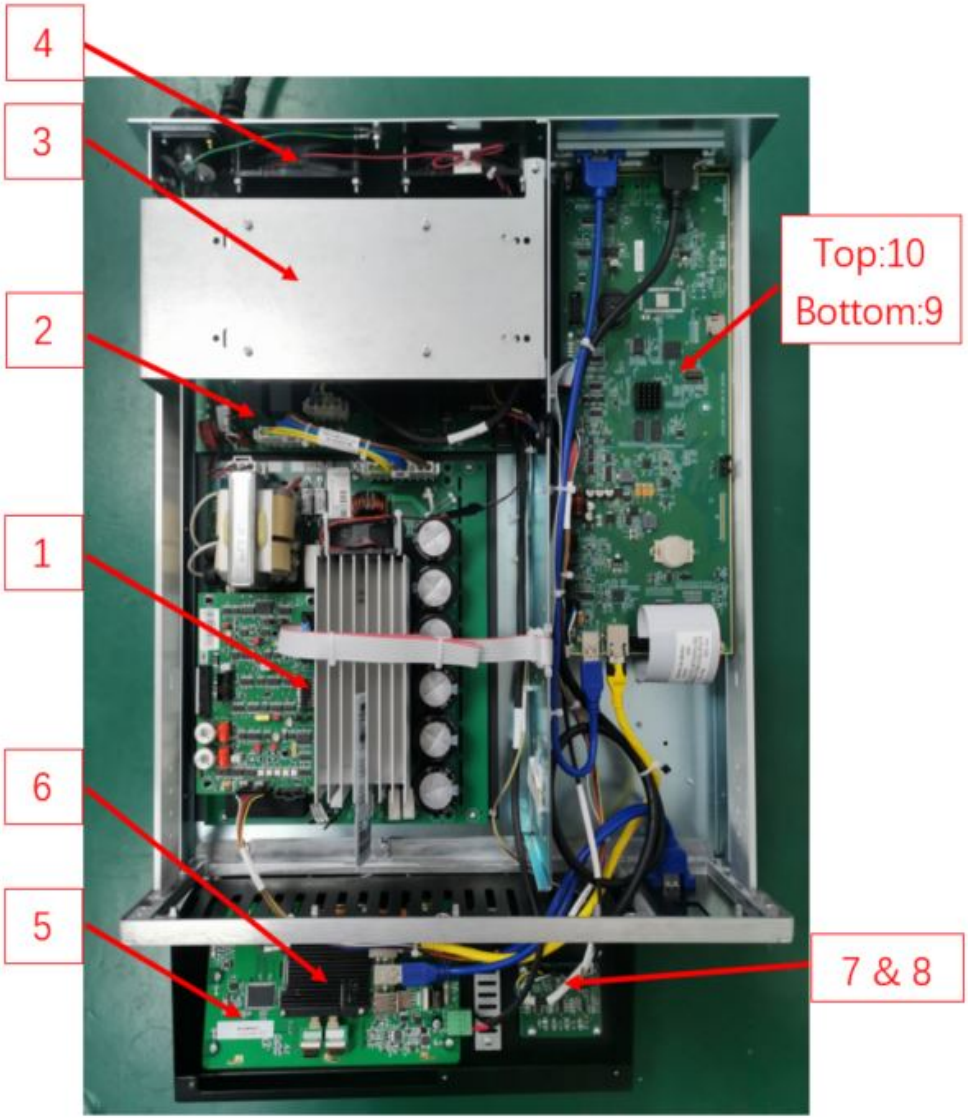
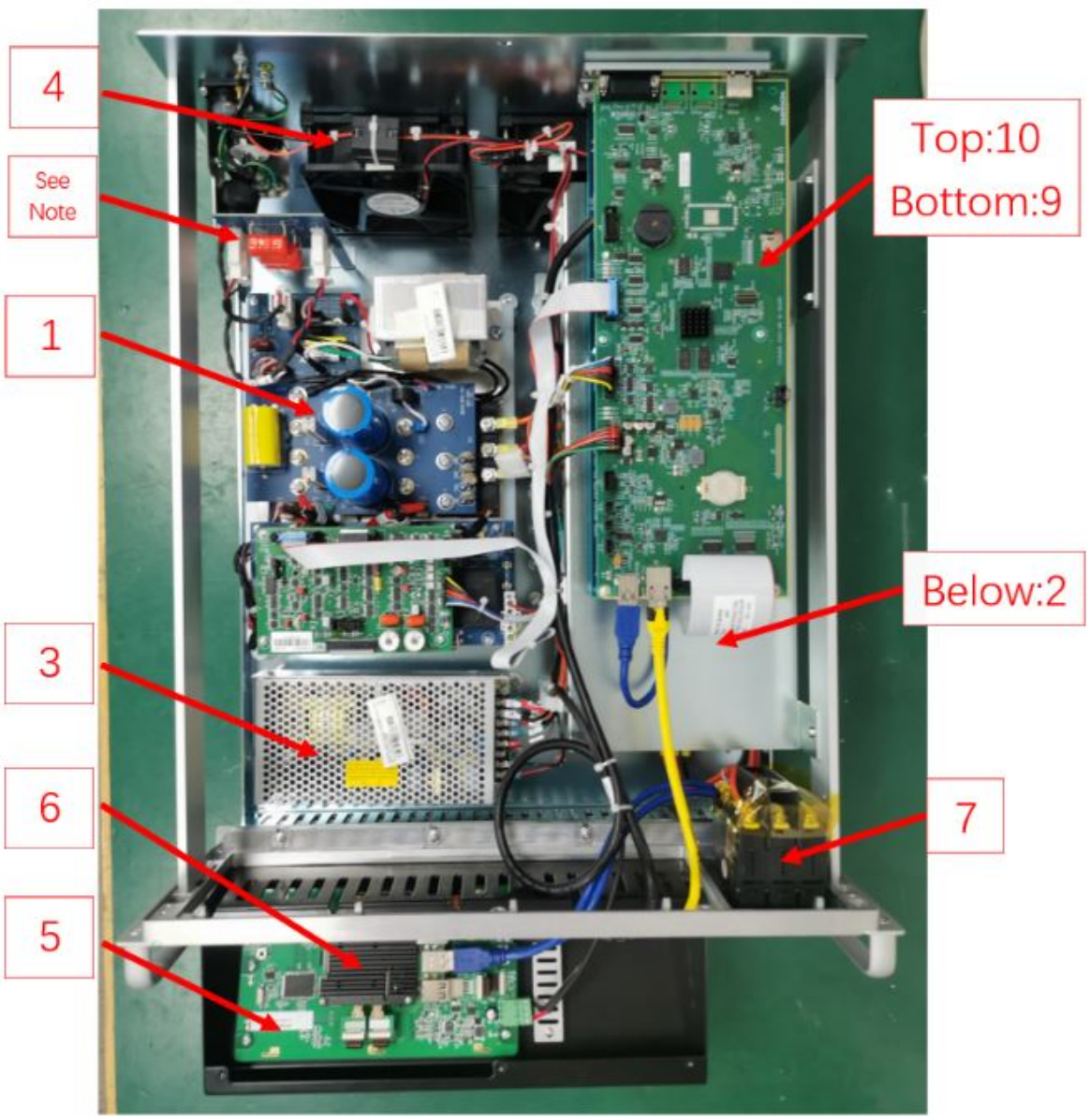


Figure 6.2 5500W & 8000W controller internal layout



Note: 5500W used the shunt board, 8000W didn’t use the shunt board.

6.4 Service Events

DANGER	
	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.

6.4.1 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

6.4.2 Voltage Test Points

Table 6.2 Voltage Test Points

DC Power Supply
+V1 to COM 5V
+V2 to COM 12V
V3 to COM 24V
-V4 to COM -12V

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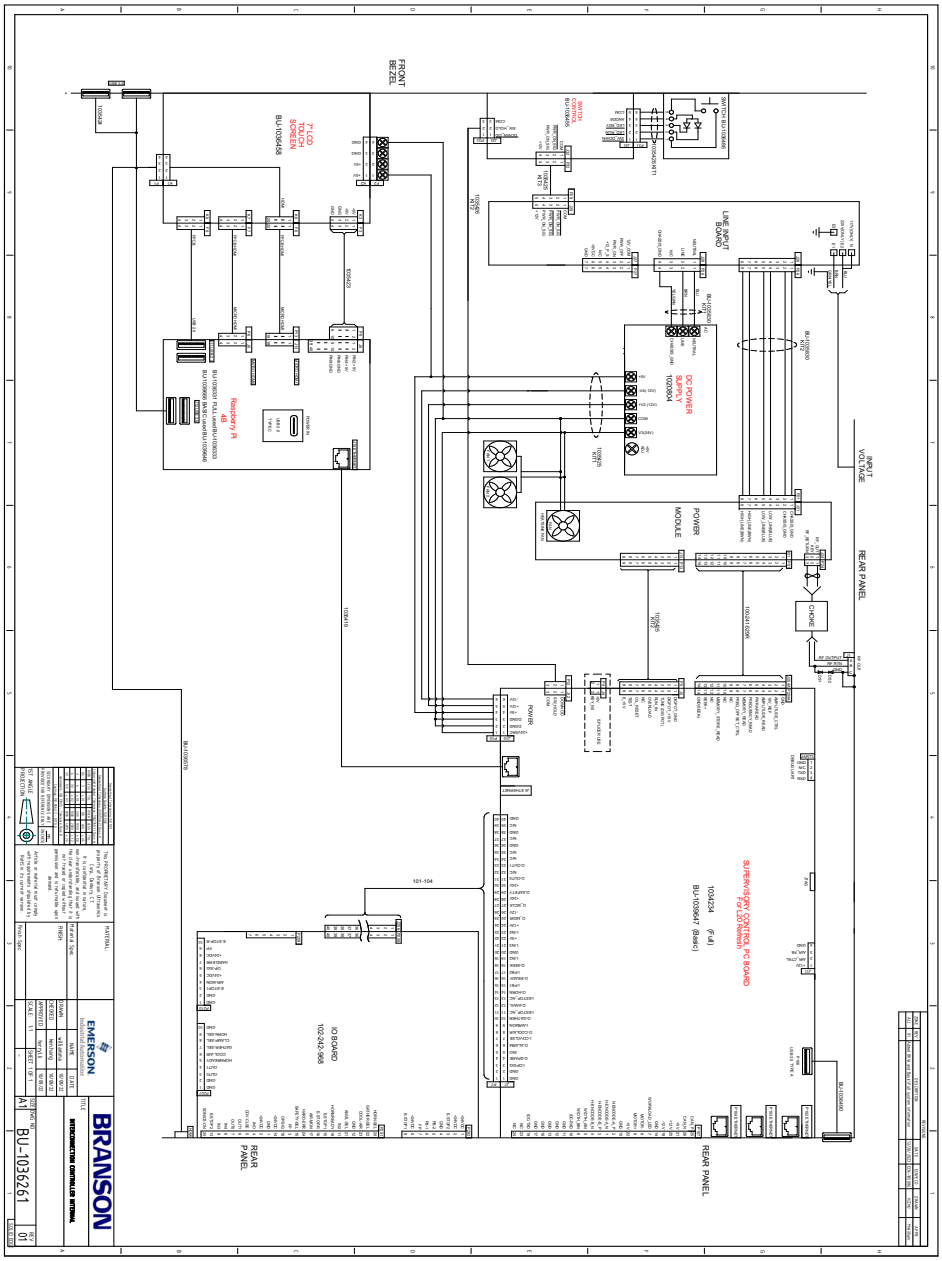
Appendix A: Interconnect Diagram

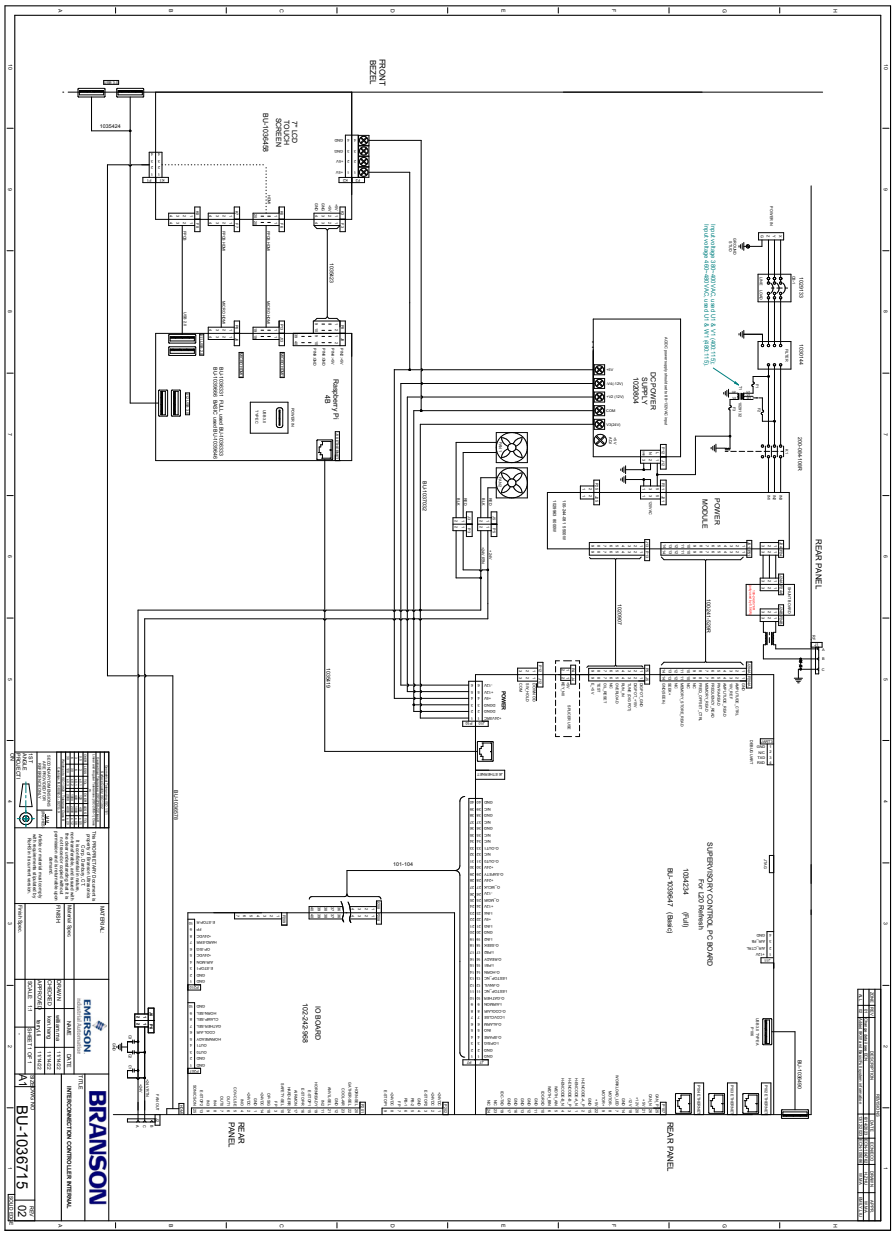
A.1 4.0KW Controller Interconnection

Figure A.1 4.0KW Controller Interconnection



A.2 5500W & 8000W Controller Interconnection

Figure A.2 5500W& 8000W Controller Interconnection



A.3 Automation cable interface

Figure A.3 Automation cable interface