Resodyn™
ACOUSTIC MIXERS

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1 Introduction

ResonantAcoustic® Mixing (RAM) is an advanced mixing/processing technology that is the only technology that uses low-frequency acoustic energy for mixing and processing. The RAM 5 is an innovative approach to multiple mixing applications from pilot to production scale. These applications include powder-powder systems, powder-liquid systems, and liquid-gas systems, as well as combinations thereof. The technology has also been adopted for use in many processing functions, such as coating, degassing, grinding and sieving.

The RAM system provides:

- Exceptionally uniform mixing and/or processing of virtually any materials.
- Significantly faster mixing and processing times than traditional methods.
- Completely sealed, dust-free process resulting in cleanliness and enhanced operator safety.
- Highly repeatable results, ensuring batch-to-batch product consistency and quality.
- The ability to process materials not possible by other methods.

RAM Operations

The primary driving mechanical driver of RAM mixing technology is Acceleration (rate of change of velocity). The unit of measure of acceleration in the International System of Units (SI) is meters per second squared or m/s^2. A familiar way to describe this phenomenon is the acceleration of gravity here on earth or ***g***. One ***g*** is the acceleration of gravity at the Earth's surface and uses the standard gravity symbol: ***g***, defined as ~9.81 meters per second squared.

The acceleration is generated by vertical motion of the mixing/processing vessel configured in a RAM machine. This vertical, sinusoidal motion operates at a frequency of between 58 and 62 Hz and at a peak displacement of up to 0.55" when operated at 100 ***g***. The combined low-frequency vibration and resulting displacement creates a physical mixing and processing motion that is, uniform, repeatable, intense, yet low shear.

All RAM systems operate at this frequency range in a resonant condition, which enables a process that requires low levels of energy for operation. The resonant condition of the system is established over a range of frequencies that enables a balance between the kinetic energy of the springs and potential energy of the oscillating plates that comprise the resonator platform. The materials being mixed are the impedance for the resonant system.

When the system is operating at resonance, virtually all of the energy from the system motors is applied directly to the materials being mixed and/or processed, resulting in a very energy efficient system. This resonant condition is frequency dependent and requires the frequency to allow a near perfect balance between the kinetic energy forces, the potential energy forces and the impedance of the process. Both the kinetic and potential energy forces are set by the system design, but the impedance depends upon the nature of the process that is contained in the mixing/processing vessel that is agitated by the plate/spring resonator. Moreover, as the materials properties in the processing vessel change properties the impedance to the system

changes, which requires careful control and adjustment of the system frequency in order to keep the RAM system at resonance. This operating frequency is automatically sensed and controlled by a proprietary system/methodology that is an integral feature of the RAM technology. The system/methodology continuously and automatically adjusts to changes in the mixing/processing conditions within the mixing vessel or processing container. The continuous maintenance of the resonant operation provides both power and economy to all RAM devices.

RAM Processing Parameters

RAM's mixing platform's intense vertical motion also generates acoustic effects within the mixing vessel. This "sound mixing" has different effects on different materials that are being processed.

In addition to the vessel acceleration, ***g***, other salient factors that affect the mixing and/or processing performance include pressure inside of the mixing/processing vessel (which can range from vacuum to pressurized), temperature of the vessel contents, vessel design and processed material fill height of the vessel, as well as order of material addition to the vessel for some processes.

For more information on the basics and practice of RAM technology, visit the Resodyn website at www.https//ResodynMixers.com, or contact Resodyn at 406 497-5333.

RAM Product Line

When considering the entire RAM product family, it is important to recognize that, generally speaking, the processing settings used for a particular material performs the similarly across *all* RAM technology platforms. This means that a finding of optimal settings on the bench scale LabRAM I or LabRAM II mixers is nominally equivalent to those that would be used to process the same materials on the OmniRAM, RAM 5, or RAM 55 mixers. As such, transition from discoveries made in the laboratory to the pilot, or product scale are seamless for most processes.

2 Definitions

Acceleration: A change in velocity with respect to time that is expressed in terms of "*g*." Different ingredients mix at different accelerations, based on the material and other processing variables. (See "*g*" below.)

Damping: A term to quantify the instantaneous amount of energy absorbed by the mix media while mixing

g: A measure of acceleration expressed as a multiple of the gravitational acceleration applied to the vessel and its ingredients during mixing. For example, 10 *g* is 10 times the force of gravity. Other terms are "*g*" and "gravities." (See "Acceleration" above.)

HMI: Human Machine Interface. The control and input system screen used to operate RAM devices

Headspace: The volume of compressible air, gas, or void space that is otherwise not occupied above the mixing media in the vessel

Millibar Or mbar, is unit of air pressure in the metric system based on an absolute scale. This method displays the same measure regardless of altitude

Mixing Ingredients: Defined as the material inside the mixing vessel

Mixing Power: The amount of power being delivered by the RAM system to perform mixing in terms of watts per kilograms

Mixing Regime: This term identifies certain modes of mixing. The mixing regime defines the bulk flow pattern of the media during mixing. A regime changes when the bulk patterns change. For example, a stable fluid mixing regime for thick pastes would be one that flows from the bottom of the vessel up the center and then across the top and down the sides. Another regime is indicated by a paste mix that is fully coupled to the sides of the mixing vessel and does not move.

NEC: National Electrical Code, or National Fire Protection Association (NFPA) 70

RAM: ResonantAcoustic® Mixing or ResonantAcoustic® Mixer

Resonance: A condition (nominally at 60 Hz for RAM devices) at which the RAM mechanical system operates in the most powerful and efficient manner

Torr: Units of vacuum used on Resodyn Manual Vacuum pressure based on an absolute scale. This method displays the same measure regardless of altitude.

Vacuum: Internal vessel pressure that is less than atmospheric pressure.

3 Safety

Every effort has been made to assure that the LabRAM II H is easy to use, reliable, and safe. This section outlines the general safety considerations and defines caution and warning symbols used throughout this manual.

3.1 General Safety Considerations

For safe operation, the LabRAM II H should be operated only within the limits outlined in the system specifications. The following classification defines acceptable use for the LabRAM II H.

- Indoor use only.
- Main supply voltage fluctuations do not exceed ±10% of the nominal supply voltage.
- This equipment is suitable for continuous operation.
- For use in non-hazardous and hazardous environments that are Class I Div I, and Class II, Div 1 and 2, Groups C-G as classified by the United States National Electrical Code (NEC).

3.2 Warnings and Cautions

Throughout the manual, the following symbols are used to identify warnings and cautions:

	The caution symbol indicates a potential hazardous situation which could result in minor injury or damage to the product.
	The high voltage symbol indicates the possibility of electrical shock. This symbol means turn off the electrical supply before removing any cover with the symbol attached. Failure to do so may cause exposure to electrical shock hazard. Access to electrical components should only be carried out by a licensed electrician or qualified electrical engineer. **NEVER** attempt to modify any electrical components or circuits as this may affect the safe operation of the machine.
	Electrostatic Discharge (ESD) sensitive components.

Important Safety Notes

	This equipment should only be operated by trained and qualified personnel. Mixing operations can generate heat and internal pressure depending on material and may be affected differently at varying mixer accelerations. Do not mix materials longer than what has been characterized as safe. Do not attempt to run the machine without a mix container or vessel holder. Equipment damage may result. Do not disable or tamper with any safety items, such as safety interlock switches located on the LabRAM II H system. **Note:** Changes in noise level or frequency are common during mixing operations. If rattling, metal-on-metal, or obnoxious noises occur, turn off the LabRAM II H and call or email the Resodyn Acoustic Mixers Technical Support. (406) 497-5333

3.3 Hazardous Location Notes

The LabRAM II H system is designed to be operated in Class I Div I, and Class II, Div 1 and 2, Groups C-G. The purge controller ensures that adequate positive air pressure is present inside of the LabRAM II H unit, before power is applied to internal electronics.

3.4 Location Advisory

	The LabRAM II system is designed to be operated in non-hazardous environments. The LabRAM II system is protected by an IP20 enclosure which is not rated for operation in dusty environments. The LabRAM II system is rated for operating in ambient environments between 0°C – 40°C (32°F – 104°F).

3.5 Component Replacement

The system is designed with components that are specifically rated for use with the LabRAM II H machine. Only replace worn or damaged components with direct factory replacement parts or parts approved by Resodyn Acoustic Mixers. Incorrect component replacement can impair the safety of the equipment and risk injury to personnel.

	Do not replace components with non-factory components. Non-factory replacement parts may not be rated to be used to the LabRAM II H machine requirements, which will compromise the safety of the operating personnel and may cause damage to the equipment.

3.6 Customer Responsibility

- Ensure that all operators have received the correct training to operate the mixer.
- Ensure that all operators have read and understood this instruction manual.
- Ensure that a qualified electrician carries out any electrical maintenance.
- Allow only Resodyn Acoustic Mixers Service Engineers to repair a LabRAM II H or return to Resodyn after receiving a Return Authorization.

3.7 Handling/Lifting

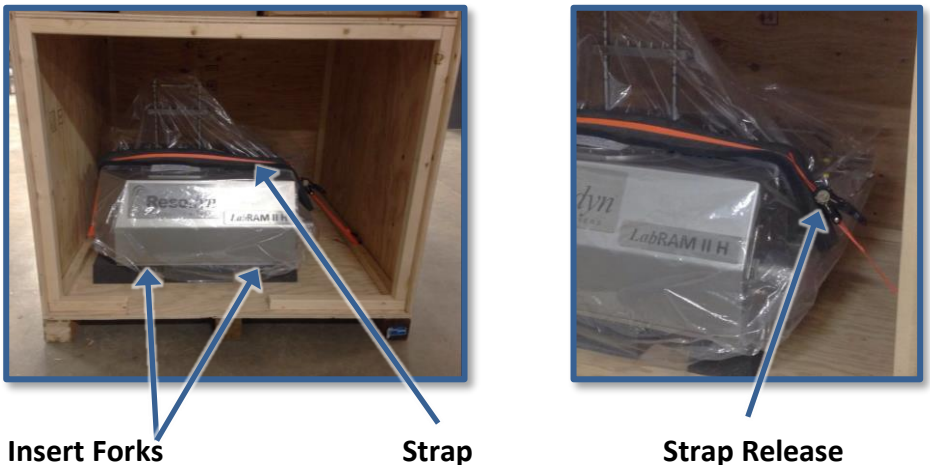
Upon receipt of the LabRAM II H, do not unpack or remove any of the packaging materials until positioned as close to the installation location as possible. When in position, carefully follow the instructions in the section below.

Retain all packaging for 1 year should machine movement or unexpected warranty service be necessary. Original packaging will be required for service shipment during the warranty period and is highly recommended for any shipment performed during the entire life of the product.

- The LabRAM II H should only be handled by multiple, experienced material handling or rigging personnel.
- DO NOT use lifting accessories around or attached to parts that may be damaged or fail during lifting.
- DO NOT use lifting accessories around sharp edges that may damage the item and cause the machine to fall.
- DO exercise caution when lifting and moving the equipment to avoid striking other objects.

The LabRAM II H mixer is 350 lbs. with no additional options. The mixer should be lifted using a forklift. The LabRAM II H was packaged in a wooden crate and should be removed from the crate by performing the following instructions:

1. Release the shipping strap and remove along with the protective foam under the shipping strap.

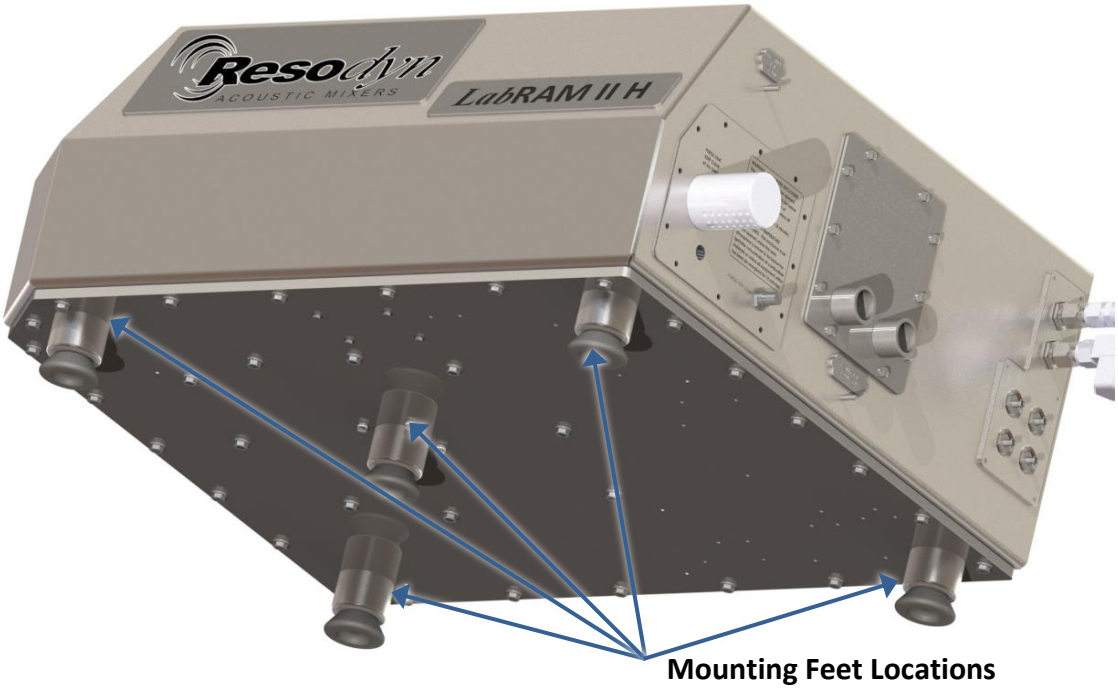


2. Lift the LabRAM II H, by using the forklift forks in the fork locations shown below. The LabRAM II H machine can now be placed on an appropriate mounting surface.

All non-permanent options, such as the vessel holder fixture, fiber cable, remote control enclosure, remote disconnect enclosure, jacketed vessel, etc., have been shipped in separate boxes and are placed on the top tier of the wooden crate, as shown.

3.8 Mounting

The LabRAM II H should be installed on a stable rigid surface capable of supporting the weight of the mixer. The LabRAM II H should be mounted on top of a table, making sure that all 5 support feet illustrated below are present.



Mounting Feet Locations

⚠	Do not attempt to lift or carry the LabRAM II H with a single person or multiple people. Only lift the equipment with proper lifting equipment and methods.

3.9 Guards and Safety Devices

Ensure all safety devices (limit switches, etc.) are functioning correctly, and regularly check their operation.

3.10 Technical Support for Mixer Operation:

The LabRAM II H system should only be operated when it is in good working condition. If the system shows any signs of visible damage or fails to operate as outlined in this manual, the system should not be operated.

For operational errors and troubleshooting, refer to Troubleshooting, Section 15, Page 71.

If necessary, contact your Resodyn Acoustic Mixers customer service representative for questions or the contacts provided below for additional technical support.

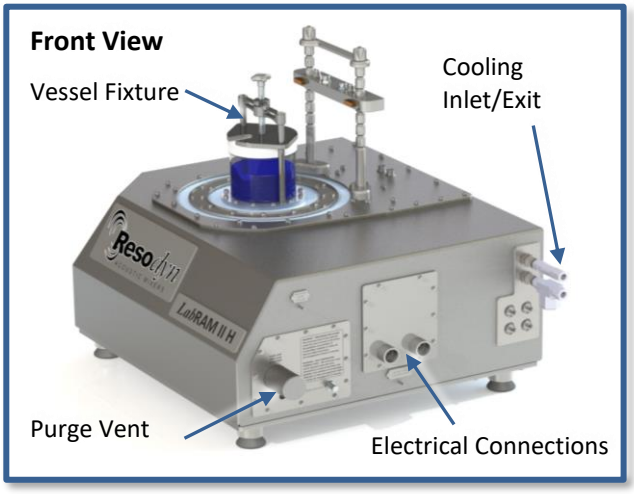
Technical Support for Mixer Operation:

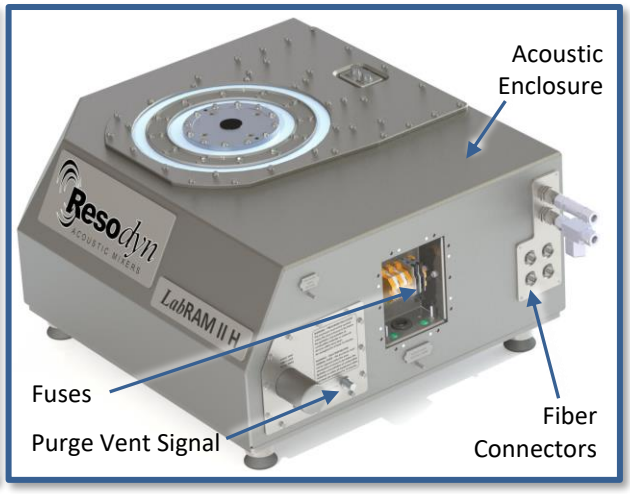
Phone : (406) 497-5333 Fax : (406) 497-5206 E-mail : service@resodynmixers.com	Resodyn Acoustic Mixers 130 North Main, Suite 630 Butte, Montana 59701

4 System Overview

The LabRAM II H is specifically designed and manufactured for use in mixing up to 2.2 lbs. (1 kg) of materials. The LabRAM II H is a highly versatile mixing system that is designed for hazardous area laboratory and production environments. The LabRAM II H system is equipped with proprietary mixing control circuitry, a vessel holder, machine safety interlocks, purge system, and a stainless-steel acoustic enclosure. The LabRAM II H external features include the Acoustic Enclosure, Remote Purge Controller, Remote Control with Touch Screen Human Machine Interface (HMI), Electrical Connectors and Fuse Access Panel, and Internal Liquid Cooled Heat Exchanger. For more information see Appendix B.

The Remote Control, Remote Disconnect, Remote Vacuum Starter, Vessel Heater Cooler, and Machine Chiller are not designed or rated to be operated in a hazardous area. These devices cannot be installed in the Hazardous Area.





⚠	The Remote Control, Remote Disconnect, Remote Vacuum Starter, Vessel Heater Cooler, and Machine Chiller are not designed or rated to be operated in a hazardous area. These devices shall not be installed in the Hazardous Area.

The Remote Control is connected to the LabRAM II H machine through both the Emergency-Stop cable and fiber optic communication cables for HMI Touch Screen control and USB interface.

Additional options for the LabRAM II H are heating and cooling plumbing for a jacketed vessel, vacuum control, remote USB access and temperature monitoring, as well as custom vessel fixtures, and other custom options.

4.1 ResonantAcoustic® Mixing Platform

The LabRAM II H delivers energy to the material being mixed by accelerating the platform up to 100 *g* of acceleration, as well as the sound energy created by that motion.

4.2 Acoustic Enclosure

The acoustic enclosure surrounds the patented resonator system. The enclosure reduces the sound emitted by the LabRAM II H but does not cover the upper resonator plates and gaskets. Because the moving parts on top of the resonator are not contained in the acoustic enclosure, the movement of these plates could pose a risk to operators and generate sound above 80 dB at the machine.

⚠	During operation the Payload Plate, Driver Plate, Fixture, and Vessel are accelerating up to 100 *g* of acceleration at nominally sixty times per second (60 Hz). Serious bodily injury is possible if one comes into contact with these moving surfaces.

4.3 Remote Panel and Touch Screen Human Machine Interface (HMI)

The remote panel HMI is the primary user interface on the LabRAM II H. The LabRAM II H is digitally controlled through the HMI. All data entry and operations are provided through software keypads and buttons on the screen. The touch screen and operating system is described below in more detail in Section 8 HMI (Human Machine Interface) – Overview

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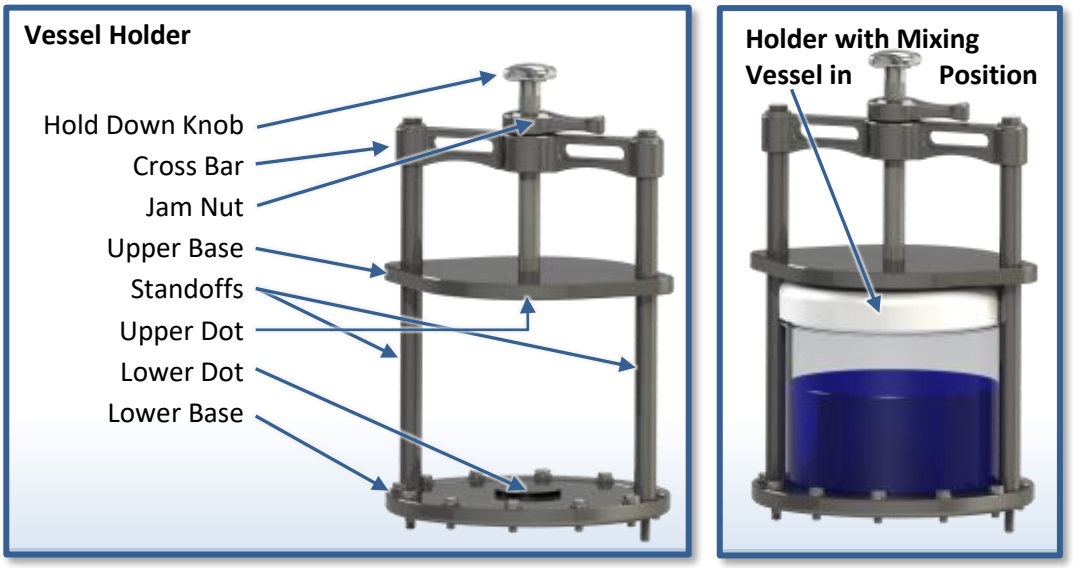
4.4 Standard Vessel Fixture and Vessels

A variety of vessel sizes and types, along with the appropriate hold-down fixtures are available for the LabRAM II H. The standard and supplied vessel hold-down fixture is a 5” diameter vessel holder that accommodates vessels between the heights of 4.5” and 7”. For vessels shorter than 4.5”, spacers can be purchased from Resodyn Acoustic Mixers as well as shorter standoffs and bolts that will accommodate vessel heights between 2.5” and 5.25”. Many applications call for specialized, custom hold-down fixtures. Resodyn can provide virtually any shape of vessel a particular mixing application requires. Please contact your Resodyn Acoustic Mixer sales representative to learn more. (406) 497-5333



The LabRAM II H hold-down fixture is made of several key components. All components are made from electrically conductive or static dissipative materials. These are the hold-down knob, jam nut, cross bar, bolts, standoffs, upper base, lower base, and upper and lower dots shown above in sequence and described in more detail below.

Hold-down Knob. Turning the Hold-down Knob clockwise clamps the vessel in place. The knob is coupled to specialized thread designed for strength and accuracy. The thread is connected to the **Upper Base**. Turning the knob raises and lowers the **Upper Base**.

Jam Nut. The Jam Nut is used to lock the vessel in place. When tightened against the top of the **Cross Bar**, the **Jam Nut** locks the **Hold-down Knob** from loosening during operation. The **Jam Nut** is set after the mixing vessel is tightened down using the **Hold-down Knob**.

Vessel Spacer Vessel Spacers (not shown) accommodate smaller vessel heights in the standard height vessel holder. Shorter vessels may require one or more spacers stacked together. Any mixing vessel must be securely positioned within the upper and lower bases of the hold-down fixture by RAM Vessel Spacers only. If the mixing vessel is not secure in the vessel holder, damage may occur to the machine, vessel, and the mixing material. If you require vessel spacers, please contact your Resodyn Acoustic Mixers sales representative. (405) 497-5333.

5 System Specifications

The LabRAM II H is equipped with the following external connectors: 1) Hazardous rated connections for the Inlet power, Emergency-Stop, and Key Controller, 2) USB Option rated for hazardous environments 3) Fuse Access Cover, 4) Machine Cooling Fluid Connectors, 5) Panel for Vacuum Option, and 6) Fiber Communication Connectors. All external connections are found on the stainless acoustic enclosure of the LabRAM II H machine. See Section 4, System Overview, Page 11 for detailed illustrations.

The LabRAM II H overall system specifications are provided in Table 5-1.

Table 5-1. LabRAM II H System Specifications

Maximum Payload Capacity	2.2 lb. (1 kg)
Sealed Enclosure	Yes (Standard)
Sound Emitted	<70 dB at 3 feet (0.9 m) at 100 g with an empty vessel
Vessel Temperature Monitoring	Up to 2 RTDs monitored and recorded (Optional)
Automatic Programmable Vacuum	Yes (Optional)
Data Logging	Yes (Standard)
Remote Operation	Yes (Standard)
Computerized Operator Interface	Yes (Standard)
Weight	350 lbs. / 400 lbs. with acoustic enclosure (159 kg / 182 kg with acoustic enclosure)
Overall Dimensions (Clearance)	
LabRAM II H Machine (width x depth x height)	35” x 27” x 28” (0.89 m x 0.69 m x 0.71 m) including RTD Vacuum Line Bridge
LabRAM II H Remote Box (width x depth x height)	13.5” x 12” x 8” (0.35 m x 0.31 m x 0.21 m)
Purge & Pressure Control Unit	9” x 6.5” x 14.5” (0.23 m x 0.16 m x 0.37 m)
Electrical @ 50/60 Hz, CE Certified	100-120 VAC / 200-240 VAC
Purge Air	20-120 psi (1.4-8.3 bar) at 12 SCFM (240 l/min)
Cooling Fluid	0.5 gpm (2 l/min) at 60°F (15.5°C) at 0-15 psi (0-1 bar)

	**NOTE:** The LabRAM II H system weighs a minimum of 350 lbs. Follow the lifting procedures are described in Section 3.7 Handling/Lifting. The system should be located on a sturdy table or bench that will hold the mixer and any auxiliary equipment, supplies or loads.

5.1 Voltage Level

The LabRAM II H is designed to utilize single phase 100-120 or 200-240 VAC 50Hz/60Hz supply voltages for use worldwide. Systems are configured for either 100-120 VAC or 200-240 VAC 50Hz/60Hz supply from the factory.

5.2 Power Consumption

The mixer is designed to be very efficient by operating at a resonant condition. Depending on the operating set point, vessel selection, and vessel contents, the LabRAM II H will draw between 80 and 1200 Watts.

6 Installation

6.1 Unpacking, Lifting, and Placing LabRAM II H

Upon receipt of the LabRAM II H, do not unpack or remove any packaging materials until positioned as close to the installation location as possible. When in position, remove all wrapping and strapping, and retain shipping paperwork for your records. Retain all packaging material for 1 year should machine movement or unexpected warranty service be necessary. Original packaging will be required for return shipment if service requires it.

- Open the indicated side of the wooden crate and remove any packing materials, bubble wrap, shipping straps as outlined in Section 3.7 on page 8.
- Make sure to remove any loose packaging material from the area before attempting to move or install the LabRAM II H
- Following the lifting and moving procedures outlined in Section 3.7 on page 8, move and install the LabRAM II H machine to the installation location.
- When placing the LabRAM II H at its location, allow enough room around the machine to complete the installation, route wires and conduit, and allow for future working space, etc.

6.2 Mounting

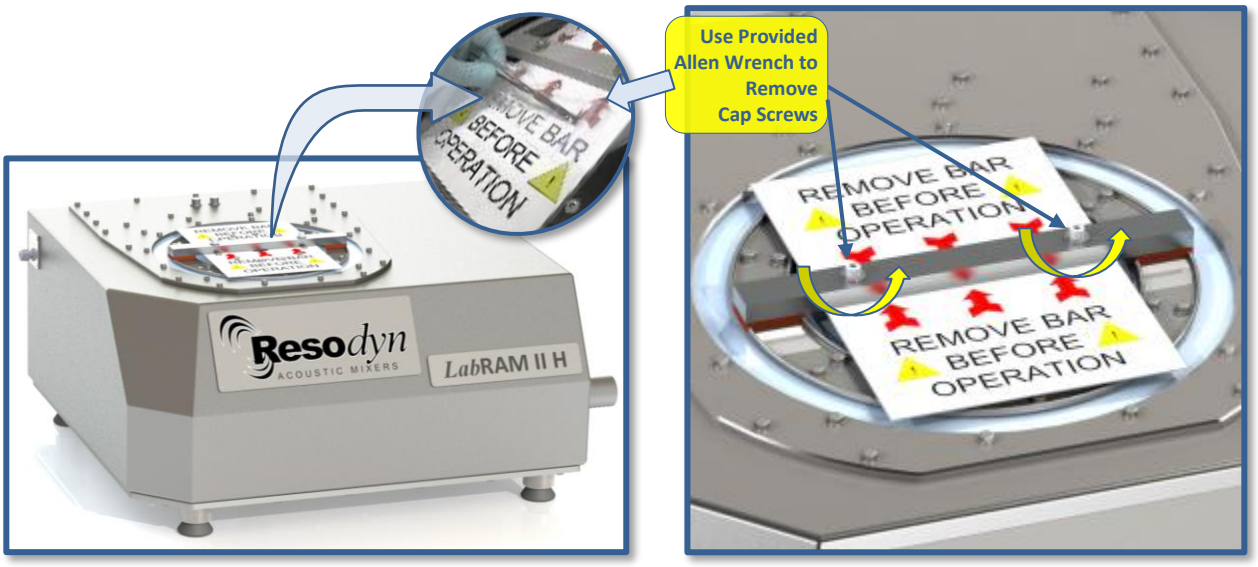
The LabRAM II H should be installed on a stable, rigid surface capable of supporting the machine weight. If other equipment or materials are to be placed or used on the same surface, a higher weight rating should be used as appropriate.

ResonantAcoustic® Mixing (RAM) technology imparts minimal forces to the surface on which it is mounted. Careful placement and leveling by a qualified technician is recommended, as is periodic inspection of the positioning and condition of the surface. Surrounding instruments, accessories, and mixing conditions should be considered in an overall placement plan.

6.3 Remove the Shipping Lock Bar

The LabRAM II H is shipped with a Lock Bar to secure the resonator during transportation. The Lock Bar **MUST** be removed before proceeding with installation or attempting to operate the LabRAM II H.

Remove the 3/16" Allen wrench from its shipping bag attached to the Warning Label. Using the provided Allen Wrench, remove the two ¼-20 socket head cap screws securing the lock bar across the mixing platform. Remove the Lock Bar by lifting it from the platform and retain it along with screws for future re-positioning or transport of mixer. A Resodyn case is provided for your documentation, manuals, and other materials like this hardware.



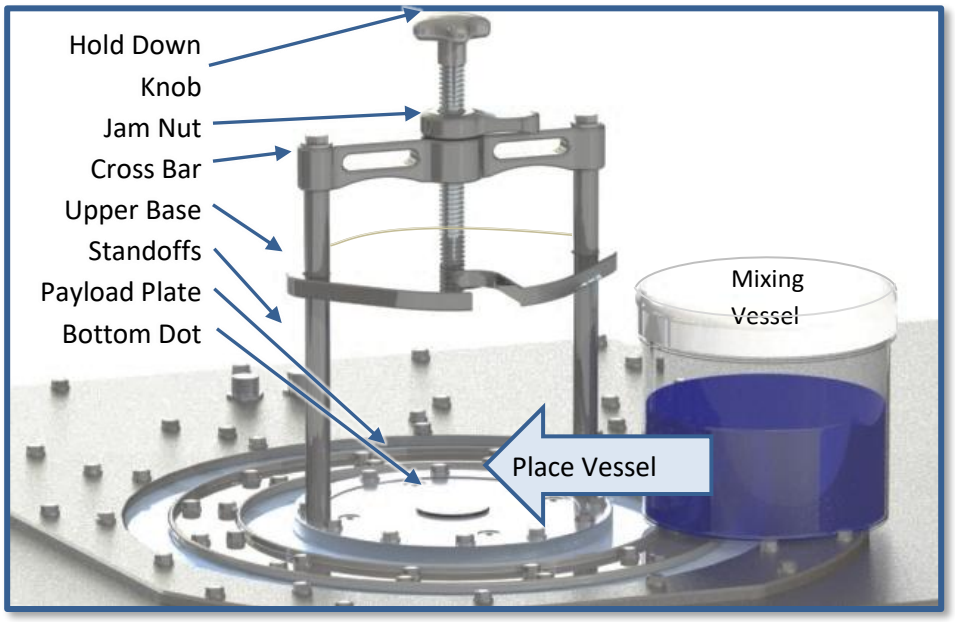
Once the shipping bracket has been removed, the vessel holder assembly can now be installed using the instructions that follow.

6.4 Vessel Holder Assembly

Remove the Vessel Holder Assembly from the accessory box accompanying the shipment.

NOTE: The Hold-Down Fixture is shipped with nuts fastened to the bottom of the ¼-20 socket head cap screws. These nuts hold the fixture together during shipment. Remove these two nuts and store them with other hardware. Be careful NOT to remove or change the orientation of the components until familiar with the parts and the assembly.

The Vessel Holder is loosely assembled. Follow the positioning and sequence shown for installation, or if reassembly or fixture movement is needed in the future.



Make sure the long, ¼-20 socket head cap screws are positioned properly throughout the overall Vessel Holder assembly. The cap screws must pass through the Cross Bar, Upper Base, Standoffs, and Lower Base as shown. Thread the two ¼-20 socket head cap screws into the Top Plate loosely, alternating between screws. When fully seated, torque each cap screw to 8 ft-lbs. using a 3/16" Allen head tool.

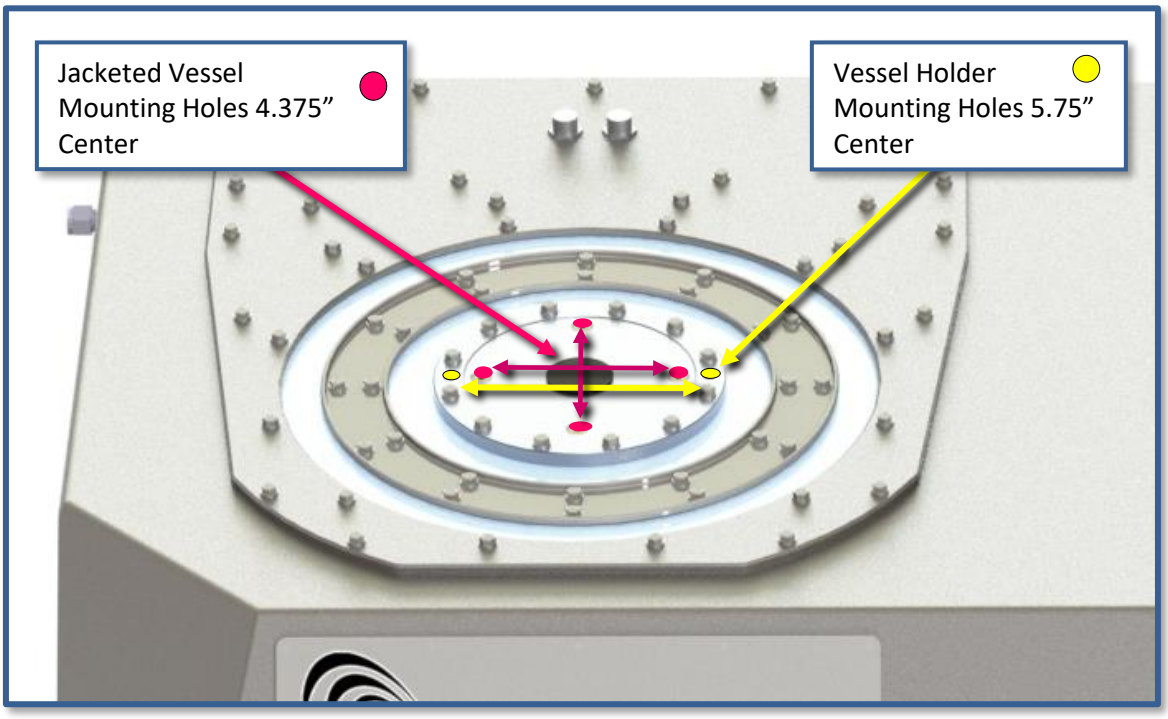
⚠	On the highest setting, the LabRAM II H mixer payload operates at 100g of acceleration, where 1 g equals the acceleration of gravity on the surface of the earth. Care should be taken to tightly secure the screws with the tool provided to avoid the Fixture and Vessel from loosening during operation. 8 ft-lbs. is the recommended torque setting. No audible sound should be heard from any of the Vessel Holder Components

All Vessel Holder assemblies, standard or custom, will match a hole pattern in the Top Plate. Mounting hole pattern for the standard 5" vessel holder is ¼-20 threads measuring 5.75" center-to-center.

The mounting plate that comes standard with the LabRAM II H also has mounting holes to accept fixtures and vessels from the original LabRAM. The fastener holes are four ¼-20 threads measuring 4.375" center-to-center.

See the detailed illustration on the next page for the position of these mounting holes.

⚠	Note: When the LabRAM Mounting holes are not in use, brass set screws should be installed to seal the purge gas from excessively leaking through the open fastener holes. Silicone may be added to the outside of the setscrews to create an airtight seal. However, a LabRAM II H mounting plate is available without the LabRAM Mounting holes (Resodyn Part Number 102786).



6.5 Purge System

The LabRAM II H uses a remotely mounted Purge and Pressurization System. The purge control unit should be mounted near the LabRAM II H. Please refer to the Pepperl+Fuchs 6000 Series Purge/Pressurization System manual for guidance on mounting the purge control unit. The unit has three electrical connections: incoming power, power going to the LabRAM II H, and an intrinsically safe cable that connects to the purge vent (the included cable is 16.4 ft (5m) long). It also has two pneumatic connections: incoming supply, and purge air going to the LabRAM II H. The purge air must be clean and dry; see Table 6-1 for the exact requirements. Instructions for wiring, plumbing and operating the purge control unit can be found in the unit’s manual. All wiring shall be rated for the hazardous location and installed by a qualified electrician. The electrical source and fuses should be rated for the supply power for your area. The ratings for both voltage ranges are as follows: 8 Amps for 100-120 VAC and 6.3 Amps for 200-240 VAC.

Table 6-1. Purge System Air Supply Requirements

Pressure	20 psig to 120 psig (1.4 bar to 8.3 bar)
Flow Rate	5 SCFM to 12 SCFM (141 l/min to 340 l/min)
ISO 8573-1 Grade	Class I
Additional Requirements	Oil and Water Free

If required, the purge control unit can be operated in "Bypass Mode" which maintains power to the LabRAM II H if the purge pressure is lost. The unit’s manual provides directions to activate this setting. Activate the Bypass Mode for startup and maintenance purposes. **When the**

Bypass Mode is active, the safety power shut off function is disabled! Do not activate the Bypass Mode position unless it is absolutely necessary, and the area is known to be nonhazardous. As soon as maintenance or service is complete, deactivate the Bypass Mode.

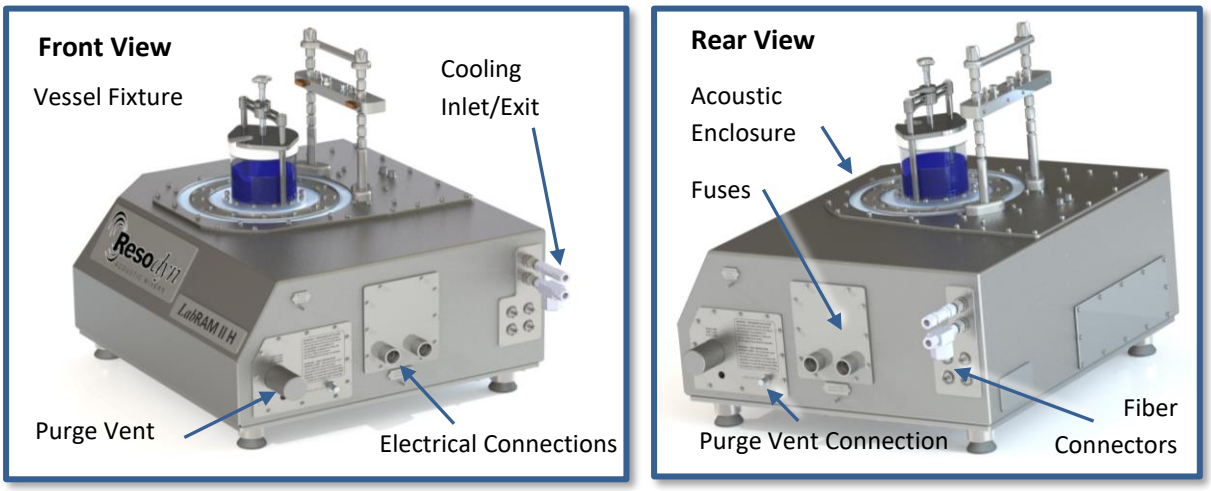
⚠	When the Bypass Mode is activated, the safety power shut off function is disabled! Do not activate the Bypass Mode unless it is absolutely necessary, and the area is known to be nonhazardous. As soon as maintenance or service is complete, deactivate the Bypass Mode. Please contact Resodyn Acoustic Mixers for the Bypass Mode password.

6.6 Electrical Installation

6.6.1 Electrical Connections, North America

The electrical power and Emergency-Stop connections are on the removable fuse cover plate. Machines shipping to a location in North America will have a conduit seal attached to the cover plate. Hazardous rated 22" flexible conduit will be attached to the conduit seal which has a ¾" NPT on the end of it that can be attached to the customer-supplied rigid metal conduit. For installation instructions and wiring schematics refer to Appendix A. Conduit seals or sealed cable glands shall be installed and sealed per manufacturer's recommendation and within 18" of the enclosure.

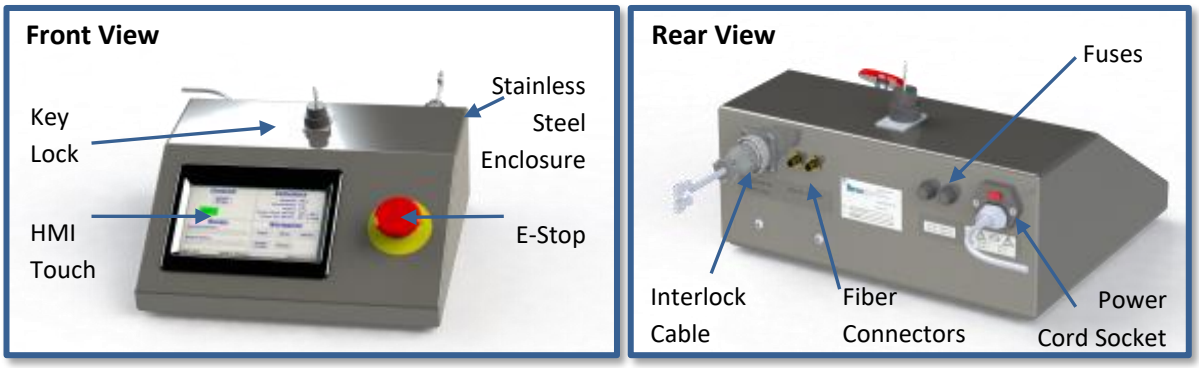
LabRAM II H Machine



6.6.2 Electrical Connections, International

For units being shipped to a location outside of North America, ½" NPT hazardous rated sealed cable glands and 100' of cable for each connection will be provided. The power cable and Emergency-Stop cable shall use these sealed cable glands on the LabRAM II H end of the connection. The cable glands must be installed and sealed per manufacturer's instructions. For installation instructions and wiring schematics refer to Appendix A.

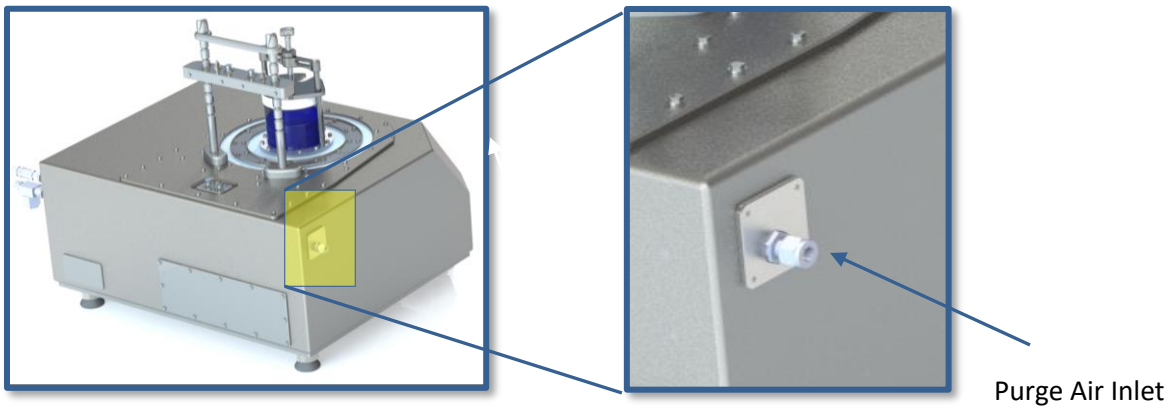
LabRAM II H Remote Control



The **Remote-Control** panel requires separate power from the LabRAM II H machine, which is connected in the power cord socket, see the "rear view" shown below.

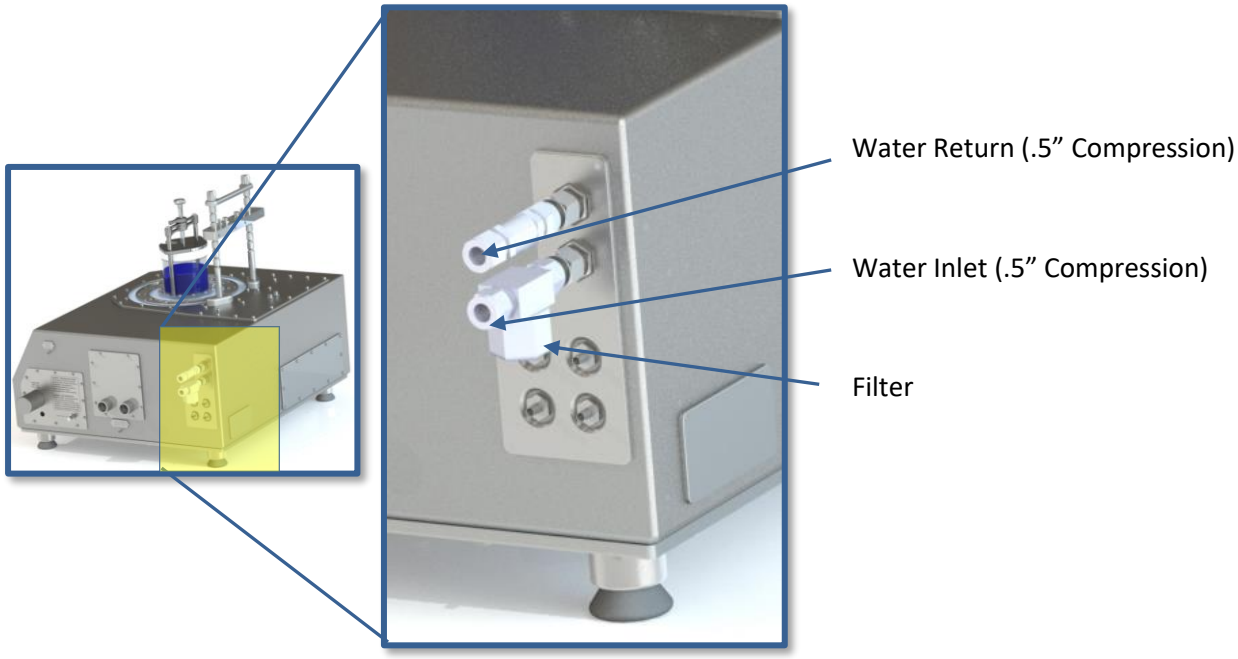
6.7 Purge Air Connections

The purge control unit controls the airflow going to the LabRAM II H. A 3/8" outer diameter stainless steel tube needs to be run from the purge control unit to the LabRAM II H. The tubing length and the number of bends should be limited to minimize the pressure drop in the line.



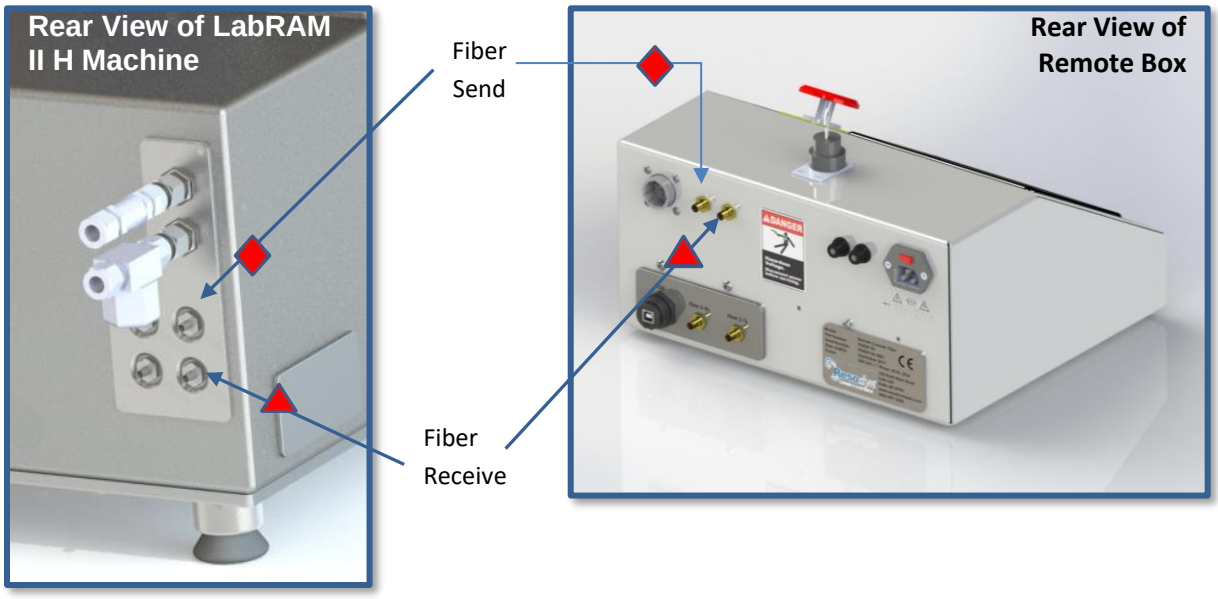
6.8 Machine Cooling Connections

The LabRAM II H cooling fitting connections are ½" compression tube fitting connections. The connections are located on the back-right corner of the machine (when facing the rear of the machine). The inlet cooling fluid pressure up to 15 psi for (1 bar) providing 0.5 gallons per minute (gpm) (2 liters/min) of 60°F (15.5°C) cooling water. An internal pressure regulator is preset at 15 psi (1 bar).



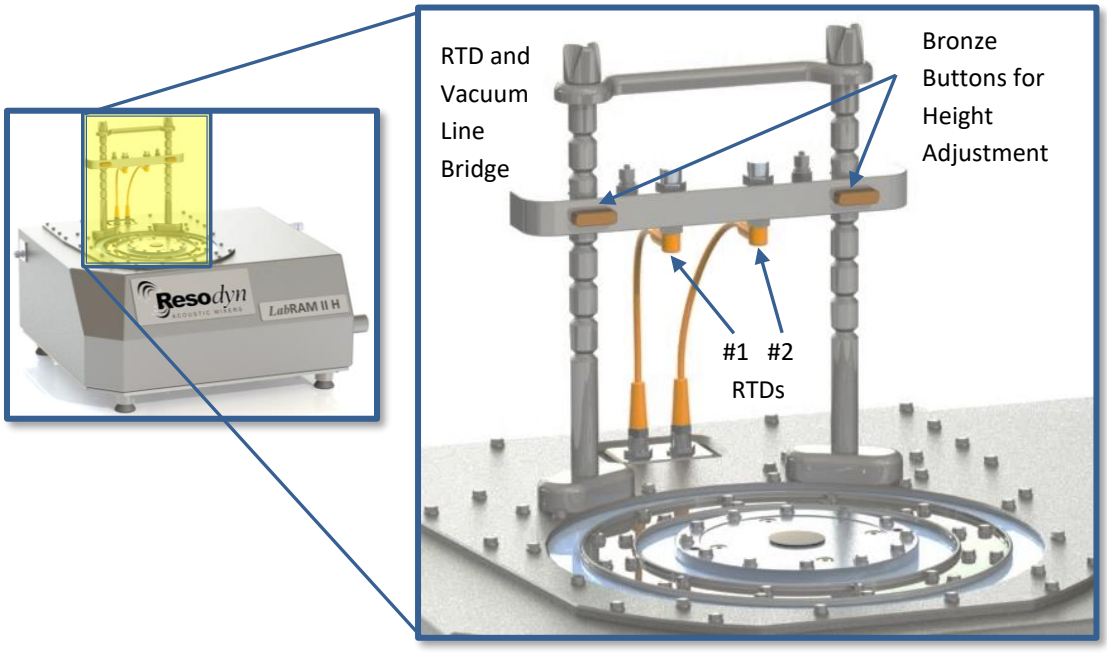
6.9 Fiber Optic Communication

The LabRAM II H is controlled remotely by the HMI on the Remote-Control panel. The communication between the remote panel and the LabRAM II H machine is over the fiber optic cables. Two ST-type fiber optic connectors are provided for transmit and receive connections, shown below. An armored fiber optic cable (50' or 100' as specified) has been provided with the system for connection between remote panel and the LabRAM II H machine. The fiber send on the LabRAM II H machine will be connected to the fiber receive on the Remote Control, connectors shown with diamonds in the figure below. Similarly, the fiber receive on the LabRAM II H machine will connect with the fiber send on the remote-control box, connectors shown with triangles in the figure below.



6.10 Temperature Measurement and RTD and Vacuum Line Holder Option

The Temperature Measurement option includes the internal wiring and software programming that enables up to two RTDs (resistance temperature detectors) to monitor temperatures during the mixing process. A height adjustable RTD and vacuum line bridge is permanently mounted to the LabRAM II H. The line holder allows for user adjustability of the height of the RTD connectors. Connector cables between the connectors on the acoustic enclosure and the connectors on the RTD and vacuum line holder are provided below. RTD #1 is displayed during



operation at the home screen. Both RTD temperatures are recorded for every run. To view the temperature of RTD #2 during a mix, the viewer must be used.

6.11 Jacketed Vessel and Jacketed Vessel Plumbing (Option)

The jacketed vessel and jacketed vessel plumbing option include the following:

1) jacketed vessel housing (PN: 900663),

2) 16 fl. oz. stainless steel mix container (PN:102760),

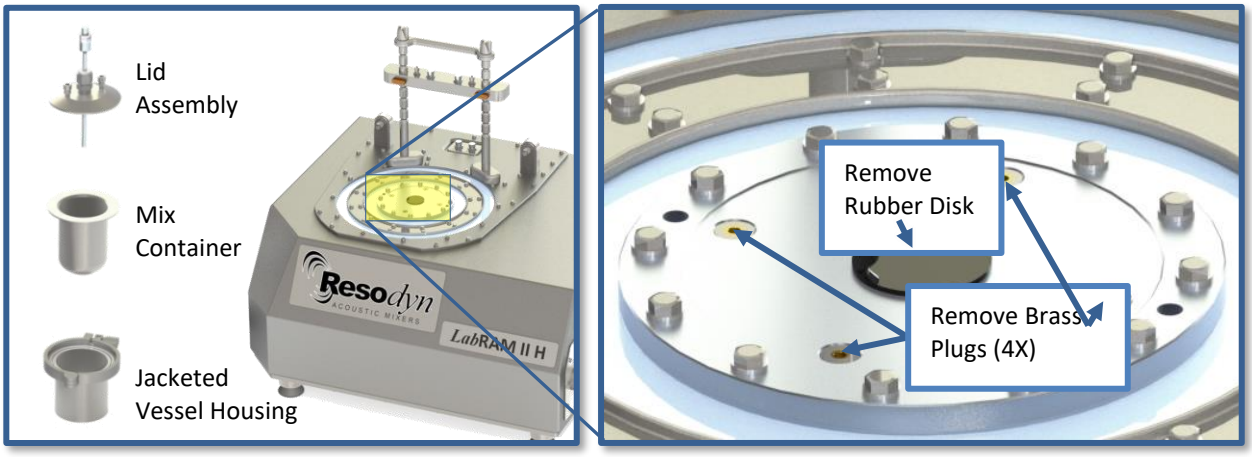
3) vacuum lid with two (2) 6mm vacuum line ports with 1/4" RTD port, cable and RTD with 6 mm anti-static vacuum and vacuum sense lines (PN: 900683),

4) heating/cooling line mounts with 1/8” Anti-static stainless-steel braided lines (PN: 903019),

5) RTD/Vacuum Line Holder (PN: 903017)

6). RTD Wiring that includes two (2) bulkhead m12 fittings on the enclosure with all internal wiring (PN: 903033).

The jacketed vessel is designed to circulate a maximum of 50 psi steam or fluid to heat or cool the mixing container. The vessel assembly provided does not have a pressure relief valve installed. The system has ¼” Female NPT ports to hook to the user’s facility heating or cooling system.



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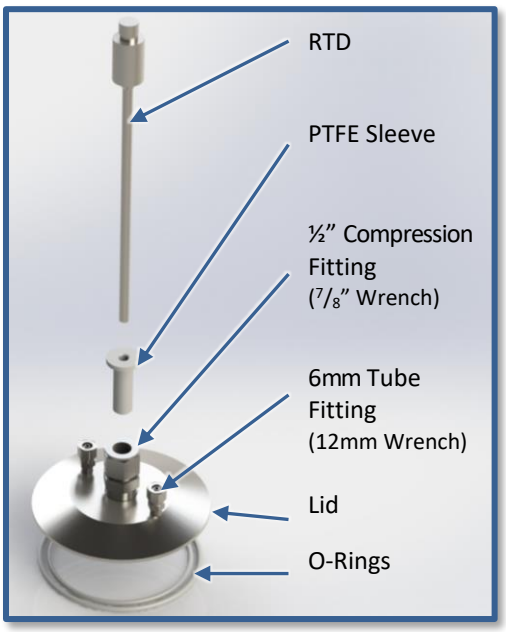
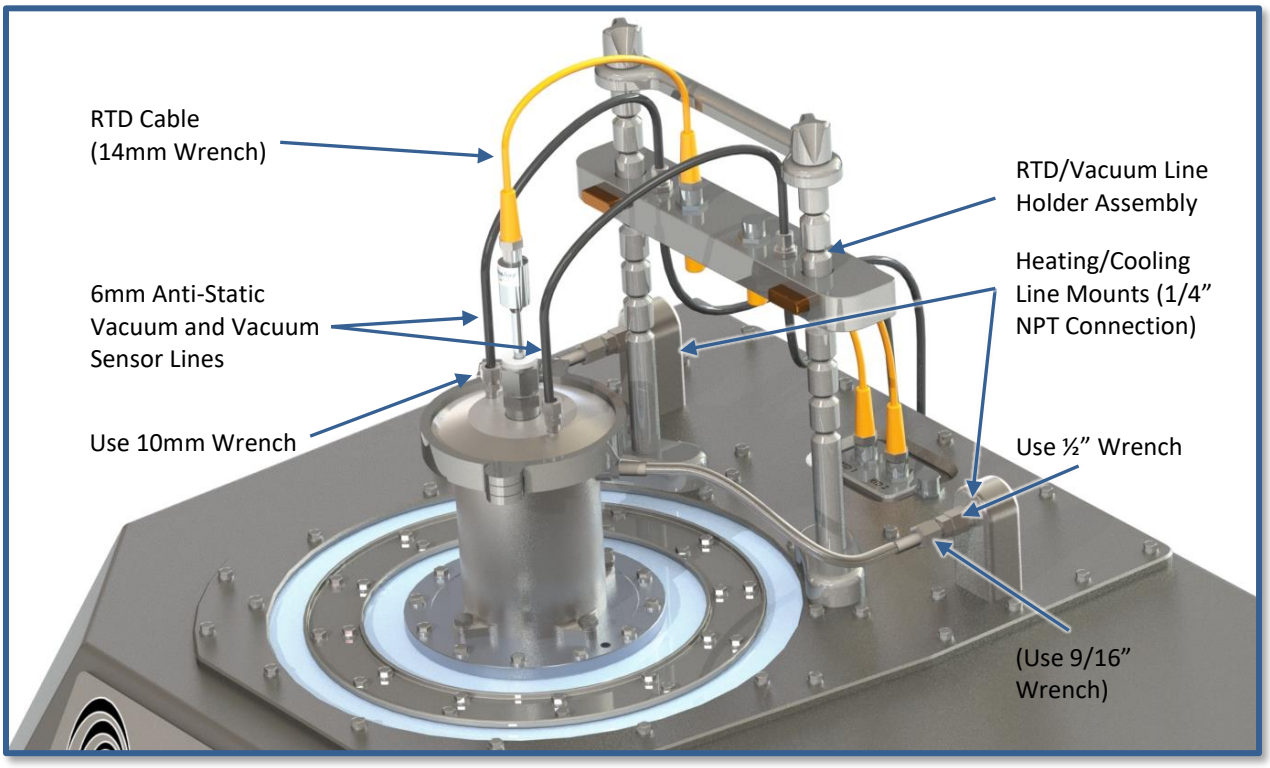
Jacketed Vessel Installation:

1. Using a 1/8” hex key, remove the four ¼-20 brass plugs and rubber disk from the resonator plate as shown above
2. ¼”-20 hex bolts and washers
3. With the provided O-rings in the O-ring grooves of the lid of the jacketed vessel assembly, carefully place the lid assembly on the jacketed vessel housing, making sure to keep the O-rings in position. Install the mix container and
4. With the RTD at the desired depth, secure in place using a 7/8” wrench
5. With a 14mm wrench, connect the RTD cables as shown in the image below
6. With a 12mm wrench, connect the vacuum lines as shown in the image below
7. Connect the jacketed vessel to the line mounts using the anti-static, stainless steel braided hoses



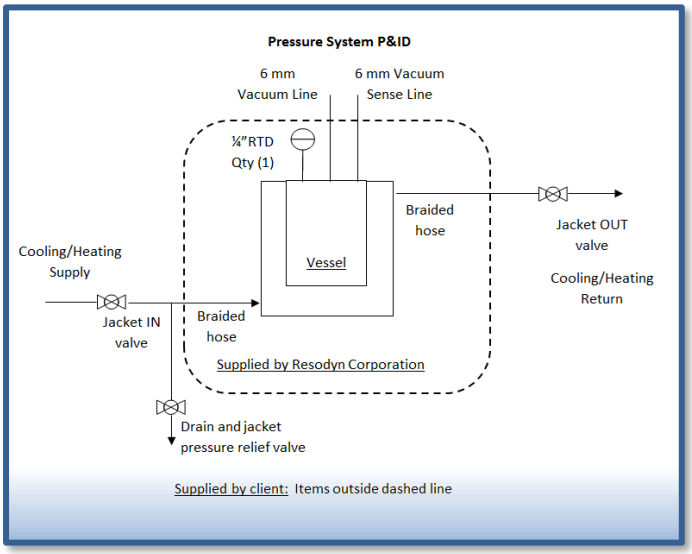


Jacketed Vessel Operation:

The jacketed vessel system schematic is shown to the right. The items outside the dotted line are to be provided by the client.

The cooling/heating fluid may be under pressure and must be turned off and the pressure relieved before opening the jacketed vessel.

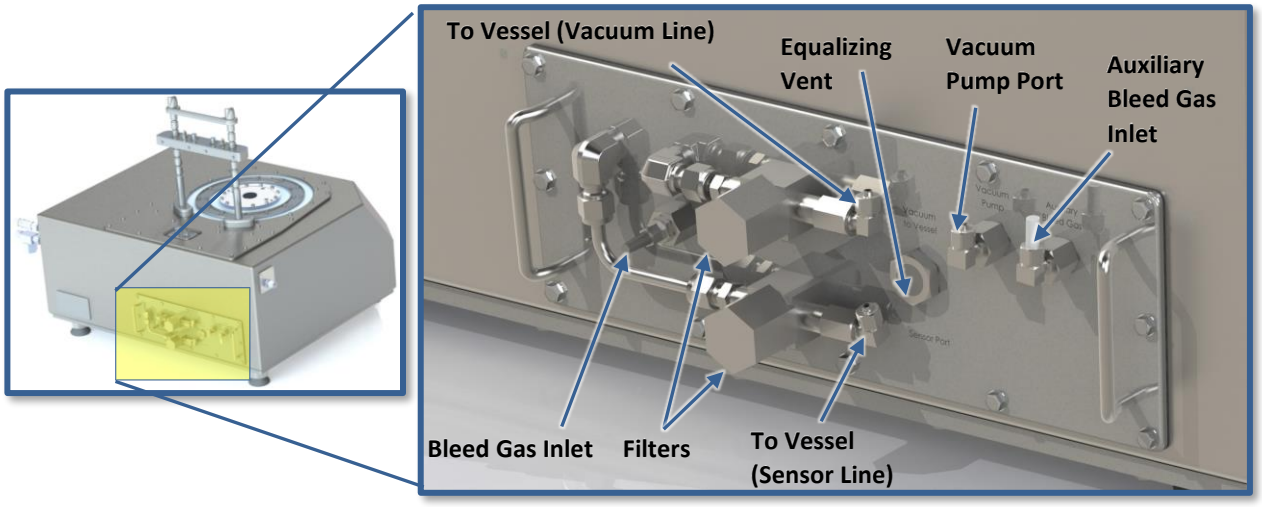
⚠	The cooling/heating fluid may be under pressure and must be turned off and the pressure relieved before opening the jacketed vessel.

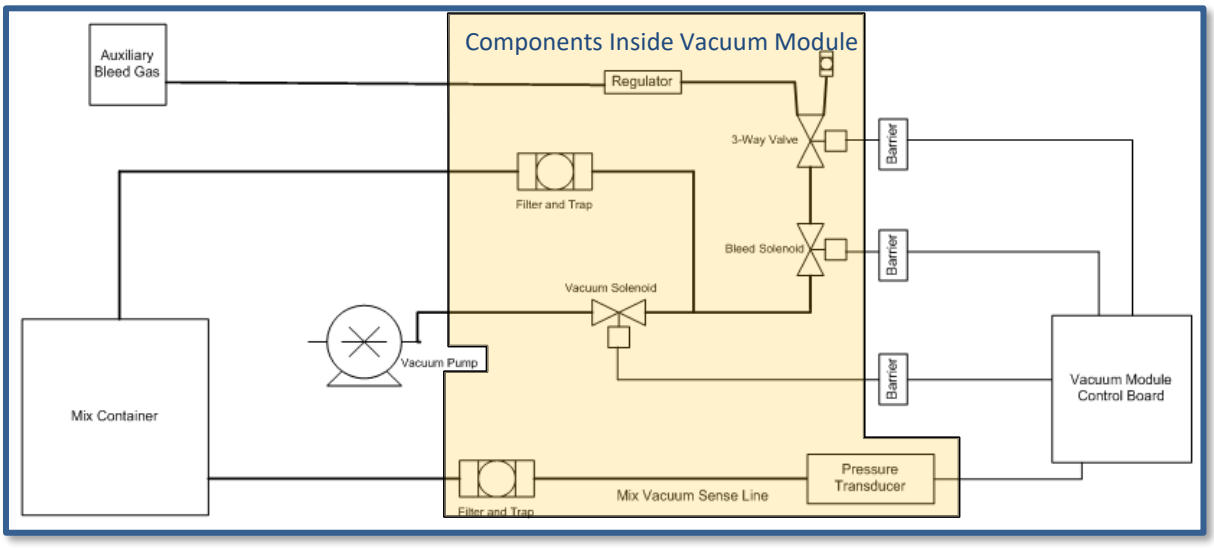


6.12 Vacuum Control System (Option)

The vacuum control system option includes:	1) internal vacuum control wiring and control	
	2) filter and trap for vacuum sense and vacuum lines	
	3) RTD/Vacuum line holder	
The wetted parts in the system include:	PH 15-7 Mo	Hastelloy
	316 & 316L SS	Buna-N
	PTFE	Anti-static PTFE tubing

The vacuum control system is designed to control, sense, and record the vacuum of the mixing vessel. The vacuum is measured and controlled to absolute pressure in “torr”. The vacuum and sense lines are connected to the RTD/Vacuum line holder assembly and to the 6mm Tube fittings as shown below. The bleed gas is configured to be from the ambient environment or can be hooked up to pressurized source, such as a dry nitrogen cylinder. The maximum inlet pressure to the auxiliary bleed gas inlet is 250 psi.

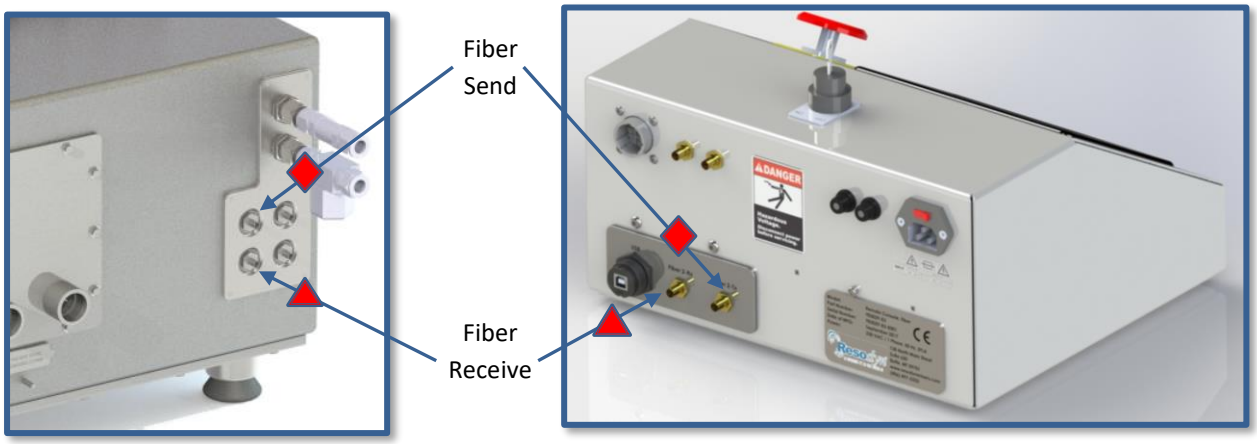




6.13 Remote USB Connection (Option)

The USB type B connection on the back of the LabRAM II H remote box is used for data download and firmware upgrades. To download the machine data and/or update the firmware a computer with RAM Tools software installed. The RAM Tools software Installation and Usage Guide should be consulted on to download data and update the machine firmware.

Two ST-type fiber optic connectors are provided for transmit and receive connections, shown below. An armored fiber optic cable is provided (select from 50’ or 100’) with the system for connection between remote panel and the LabRAM II H machine. The fiber send on the LabRAM II H machine will be connected to the fiber receive on the remote-control box, connectors shown with diamonds in the below. Similarly, the fiber receive on the LabRAM II H machine will connect with the fiber send on the remote-control box, connectors shown with triangles in the figure below.



7 Quick Start

This section defines the minimum steps required to operate the LabRAM II H. All instructions and guidelines in Section 6 must be completed before attempting a Quick Start or operation of the LabRAM II H.

7.1 Setup

To first set up the LabRAM II H mixer, the mixing vessel must be installed. The fixture must have a vessel installed before operating the mixer. (See Section 6.4)

7.1.1 Securing Container in the Vessel Holder

Place the mixing vessel centered on the Lower Base, ensuring to align over the bottom dot, as described in Section 6.4 Vessel Holder Assembly. If missing, please call Resodyn Customer Service at 406-497-5333. Turn the Hold-Down Knob clockwise at the top of the fixture until snug, to fasten the Mixing Vessel in place. Tighten the Jam Nut to lock the Vessel Holder assembly together. The mixing vessel should not feel loose if grabbed and moved while fastened in the holder. If the vessel feels loose, loosen the Jam Nut, and tighten the Hold-Down Knob further. Vessel spacers may also be used under the mixing vessel when mixing in short vessels.

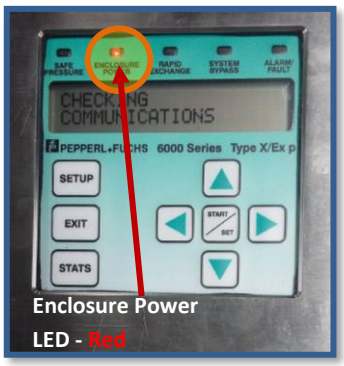
7.2 Power-Up

Shift the power switch (located on the rear of the Remote Disconnect) to the on, or “I”, position to enable power to the Purge and Pressurization Controller. Make sure the key is on the “I” position and the Emergency-Stop button is pulled out.

Power to the LabRAM II H system power is provided through the Purge and Pressurization Controller. The Purge and Pressurization Controller must execute a purge cycle before the LabRAM II H can be operated. Purging takes nominally 5 minutes to perform, depending on air supply.

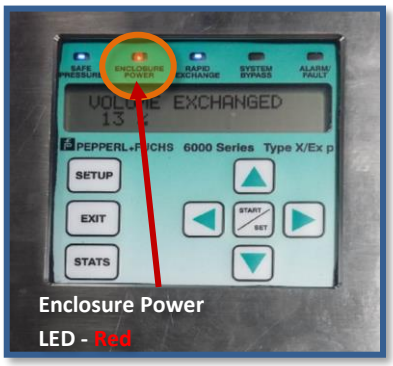
7.2.1 Purging the LabRAM II H *(See the manufacturer's manual for Detailed Information)*

Upon application of power, the Purge Controller screen should read, "Pepperl+Fuchs XPurge 6000" then "CHECKING COMMUNICATIONS" followed by "CLEAN ENCLOSURE PRESS START/SET"



Press START/SET button, the screen will read SEMI-AUTO MODE PRESS START/SET. Press the START/SET button once again and after a brief delay, the purge process will begin and the screen will read INIT PURGING – PLEASE WAIT

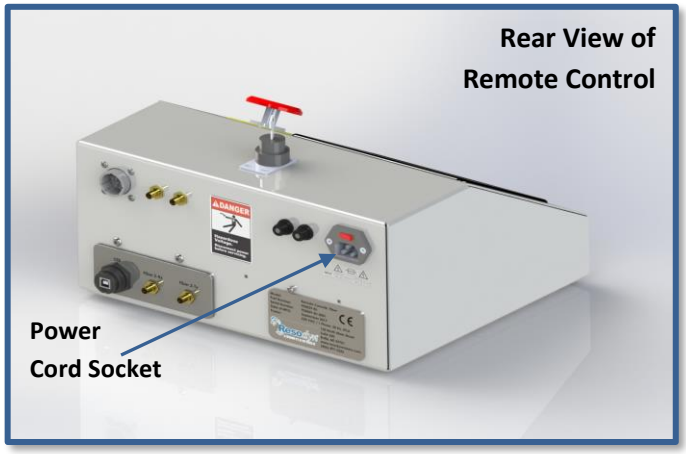
When purging initiates, the screen will read, "VOLUME EXCHANGED XX%" increasing in percentage as the purge proceeds.



When purging is complete, the LabRAM II H will receive power and the Enclosure Power LED will turn green.

7.2.2 Remote Control

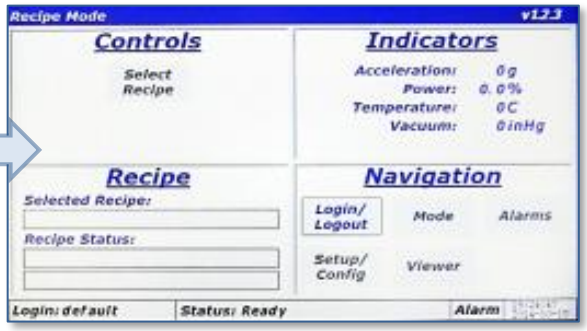
Make sure the power cord is plugged into the power cord socket of the Remote Control panel. Turn the switch above the cord socket to the on, or "I" position.



The Resodyn Acoustic Mixers logo screen is displayed on the HMI screen. When ready for operation, the second screen shown below to the lower right will be displayed. This screen, shown after the boot-up is complete, displays "Recipe Mode" in the title bar, and will be referred to as the "Main Screen" throughout this Manual.

RAM Logo: Power Applied

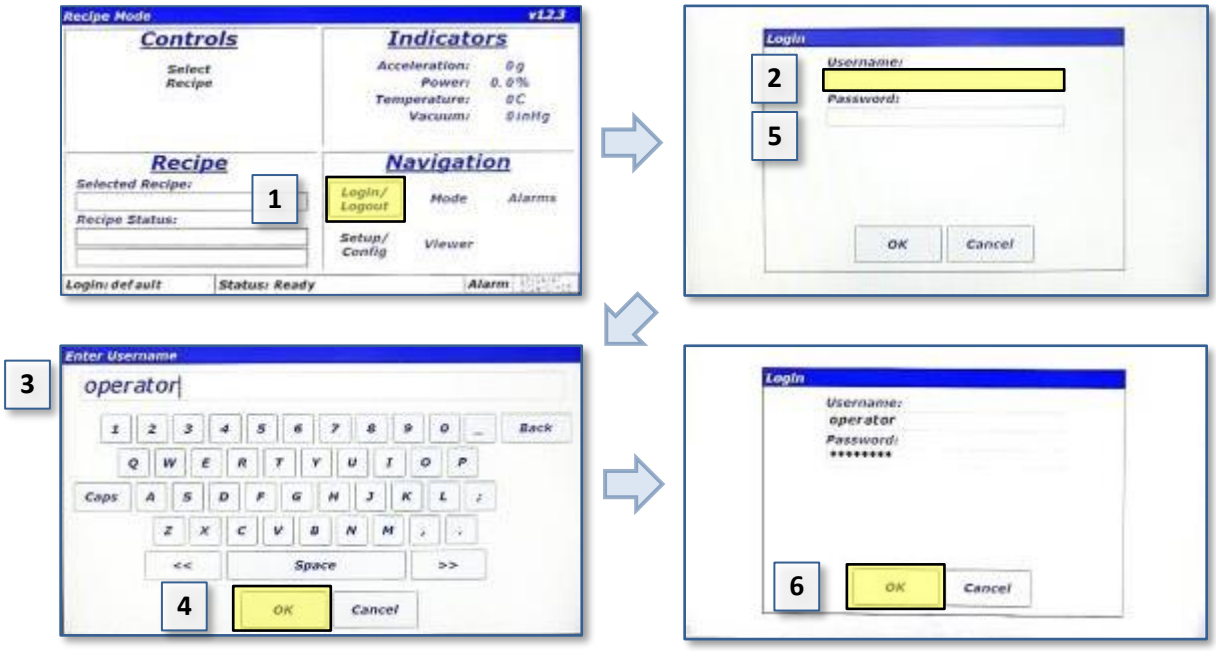
Main Screen: Ready for Operation



7.3 Login

Before running the LabRAM II H, a user login is required. For quick start, the lowest level login will be used. Both the username and password are “operator”.

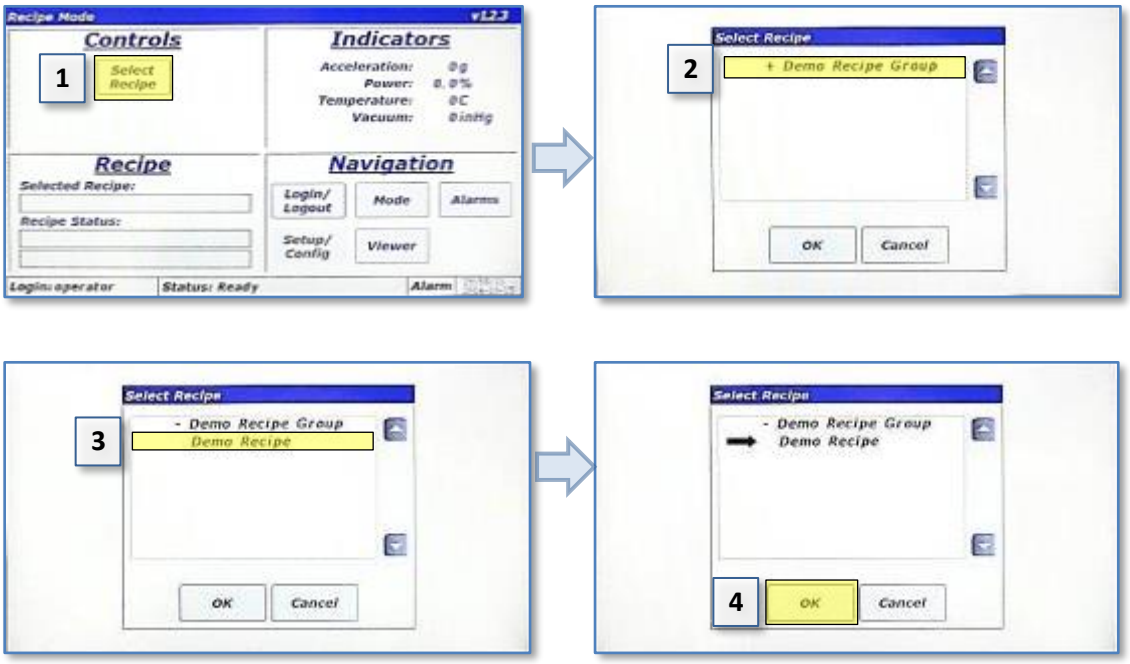
1. Touch the <Login/Logout> button.
2. Touch the <Username:> text box. This will launch the “Enter Username” alpha-numeric keypad.
3. Using the keypad, enter the “operator” username.
4. Touch <OK> button after entering username.
5. Repeat steps 1-3 for entering “operator” for the password.
6. When both username and password are entered, touch the <OK> button on the “Login” screen. The Main Screen will be redisplayed with more buttons enabled.



7.4 Select the Recipe

The LabRAM II H is provided with a demonstration recipe to use as a reference and guideline. The following demonstrates how to select a recipe for mixing using that demonstration recipe.

1. Touch the <Select Recipe> button. The “Select Recipe” screen is displayed.
2. Touch the line that displays “+ Demo Recipe Group”. This will expand the Demo Recipe Group and show the recipe(s) contained in that group. The demonstration recipe supplied with the LabRAM II H is called “Demo Recipe.”
3. Touch the line that displays “Demo Recipe.” A black arrow will appear to the left of the recipe selected. This black arrow indicates that the recipe has been selected.
4. Touch the <OK> button to return to the Main Screen.

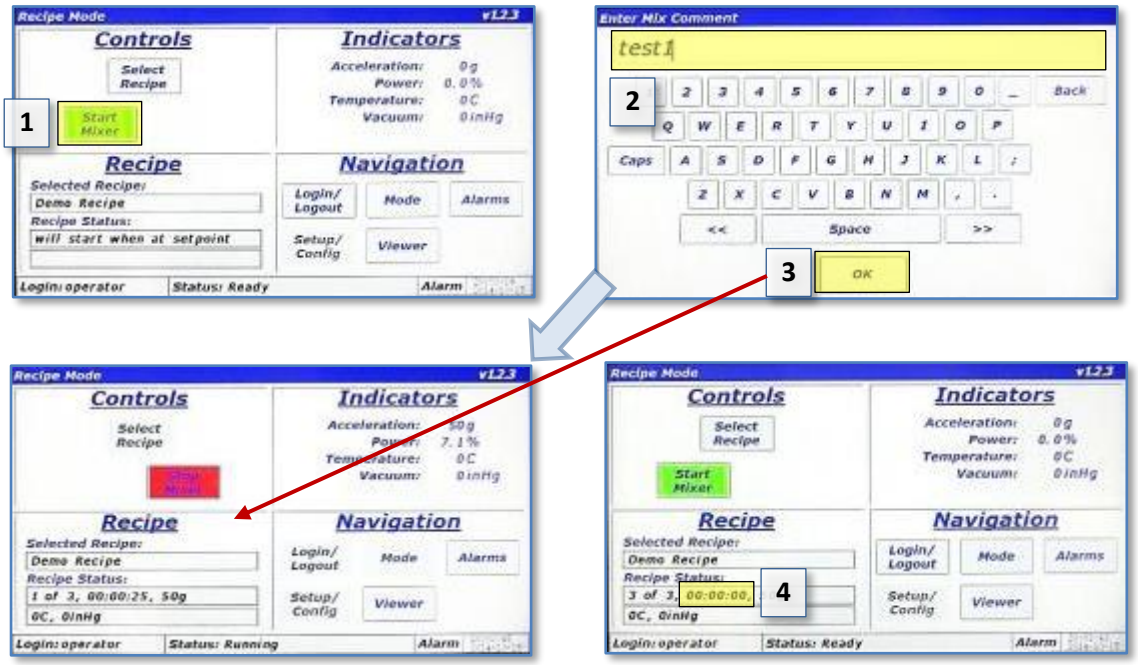


5. The Main Screen will display the name of selected recipe in the “Recipe” pane, and the green <Start Mixer> button will also appear. Touch the <Start Mixer> button to initiate a mix cycle.

7.5 Run the Recipe

A recipe is a pre-defined mixing routine that runs the mixer at specific acceleration, vacuum, and temperature settings for defined periods of time.

1. Press the <Start Mixer> button to begin the mix cycle.
2. The “Enter Mix Comment” screen will appear. Use the keypad to enter a description or comment about the process to be performed, i.e., Batch #123, or Test #1.
3. Touch the <OK> button on the “Enter Mix Comment” pane to start mixing and begin and the Main Screen will be displayed again. The <Start Mixer> button will change to a red <Stop Mixer> button. The “Recipe” pane below displays current recipe segment, total segments, current segment timer, acceleration, temperature, and vacuum settings with their measured values will be displayed in the Indicators Pane.
4. When the final recipe’s timer counts down to 00:00:00, the mixer will stop. The <Stop Mixer> button will change to the <Start Mixer> button. This completes the recipe execution. Repeat the Demo Mix recipe for familiarization if necessary or required.



7.6 Completion

When the middle section of the Recipe Status Bar reads “Status: Ready”, the LabRAM II H’s doors can be opened, and the mix container can be removed.

1. Open the door
2. Remove the mixing container.
3. If no further mixes are required, turn the power switch to the off position.

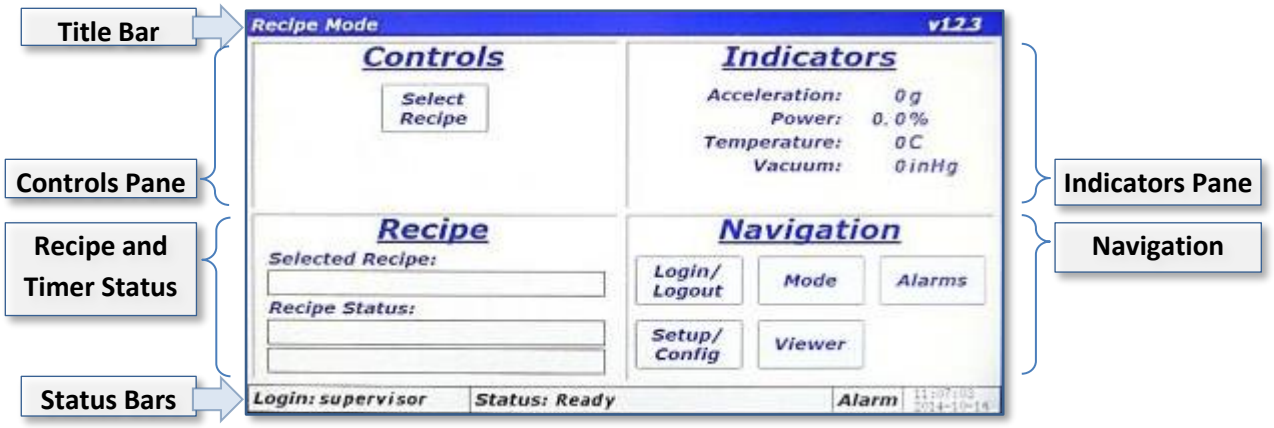
8 HMI (Human Machine Interface) – Overview

The HMI is the primary user interface on the LabRAM II H. The LabRAM II H is digitally controlled through the HMI. All data entry and operations are achieved through software keypads and buttons on the HMI screen.

This section will cover the top-level features of the HMI operation, and the details of these topics will be described in subsequent sections.

8.1 Main Screen

The Main Screen allows control of the LabRAM II H. Its appearance will vary depending on operating mode (Recipe or Auto), and machine operation status. The basic sections of the Main Screen are illustrated and described below.



- Title Bar – Displays mode and the firmware version.
- Controls Pane – User selects, Starts, and Stops recipes in Recipe Mode, or enters setpoints (Acceleration, Temperature, and Vacuum) in Auto Mode.
- Indicators Pane – Displays the value of measured parameters.
- Recipe and Timer Status Pane – Displays recipe and auto mode timer status.
- Navigation Pane – Buttons for screen navigation.
- Status Bar – Displays current username, machine status message, alarm status, and date/time.

8.2 Login

As illustrated in the Quick Start section, to operate the LabRAM II H, user authentication (login) is required. Four different login levels are provided to control access to machine features. The LabRAM II H is delivered with pre-configured users at each level of login for demonstration purposes. These logins are tabulated below. It is recommended to delete these users or change the passwords upon familiarization and establish new ones.

Level	Username	Password
0	operator	operator
1	technician	technician
2	calibration	calibration
3	supervisor	supervisor

Begin at the <Login/Logout> button in the “Navigation Pane.” Refer to the Quick Start section for screen procedures to log in. Detailed descriptions of available login levels can be found in Section 9 Operational Modes (Recipe and Auto).

The LabRAM II H is controlled using two operating modes: Auto and Recipe. Recipe Mode is primarily used by operators, while Auto Mode is for advanced users to characterize a mixing process for eventual recipe programming and access through Recipe Mode. Level 0 (operator level) can be locked out of Auto mode.

The <Mode> button in the “Navigation Pane” allows switching between operational modes. Note that operational modes cannot be changed while the LabRAM II H is accelerating/mixing.

8.3 Alarming

Operational parameters are monitored by the LabRAM II H to protect the user and system. If the safe bounds of any of these parameters are exceeded, or the equipment is operated incorrectly, an Alarm will be triggered, and the mixer will stop. The Status Bar’s “Alarm” field will turn red for a shutdown alarm or yellow for a warning alarm. The <Alarms> button in the “Navigation Pane” allows viewing of alarms in a tabular format for review and acknowledging alarms to clear them.

8.4 Setup and Configuration Screens

The Setup and Configuration screens are accessed with the <Setup/Config> button to access customizable options, view machine parameters, manage data, recipe creation, and calibration.

The Level 0 (operator) login level does not have any access to the Setup and Configurations screen set, while other levels have varying access to features. The breakdown of feature access is defined in Section 9.1 Login Levels and Privileges.

8.5 Viewer

All measured parameters including acceleration, power, frequency, temperature, and vacuum are plotted in a time-history format in the Viewer screen. The Viewer screen is accessed via the <Viewer> button in the “Navigation Pane”.

9 HMI Operation – Security and Login

To protect the LabRAM II H from unauthorized use and to maintain a record of which users operated the mixer, the system uses a user authentication system. Users are required to enter a username and password before operating the mixer. If the machine is not running and no user interaction with the HMI is detected for 10 minutes, then the current user will be automatically logged out.

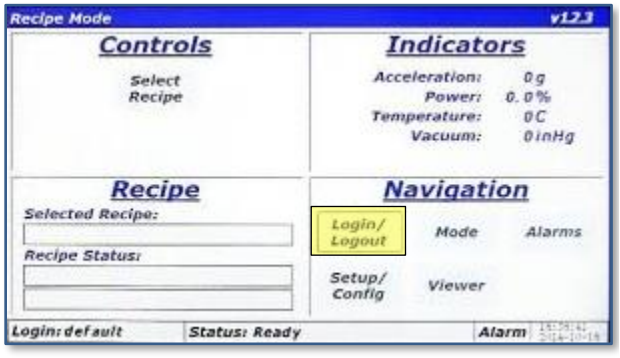
9.1 Login Levels and Privileges

The following table summarizes the different login levels and their associated privileges.

Privilege Description	NAME: "supervisor" LEVEL: 3	Privilege Description	NAME: "calibration" LEVEL: 2
	Highest level of access		Instrument calibration
	Instrument calibration		Viewing troubleshooting status
	Viewing troubleshooting status		Viewing troubleshooting status
	User creation/maintenance		Auto Mode operation
	Date/time setting		**NAME: "technician" LEVEL 1**
	Recipe creation		Status viewing for troubleshooting
	Optional feature configuration		Recipe Mode operation
	Data file management		Auto Mode operation
	Recipe Mode operation		**NAME" "operator" LEVEL 0**
	Auto Mode operation		Lowest level of access
			Recipe Mode operation
			Optional Auto Mode operation

9.2 Screen Operations - Logging In/Out

The following outlines the steps for logging in using the pre-configured supervisor login.



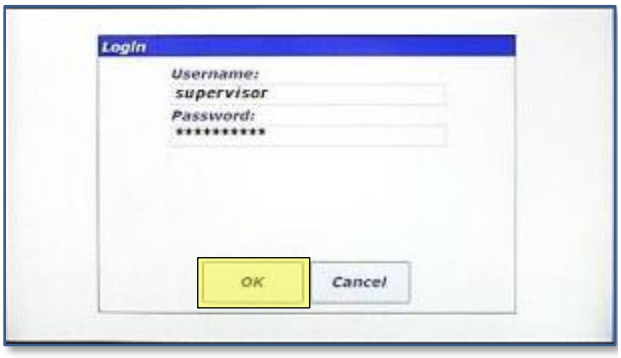
1. Touch the <Login/Logout> button

2. The “Login” screen will appear. Touch the textbox beneath “Username:”.

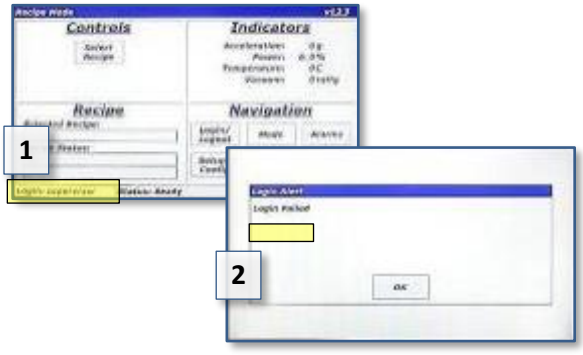
3. Using the keypad, enter “supervisor” for the username. Touch the <OK> button when finished.

4. The “Login” screen will reappear, and “supervisor” will be visible in the “Username:” textbox. Touch the “Password:” textbox to enter the password.

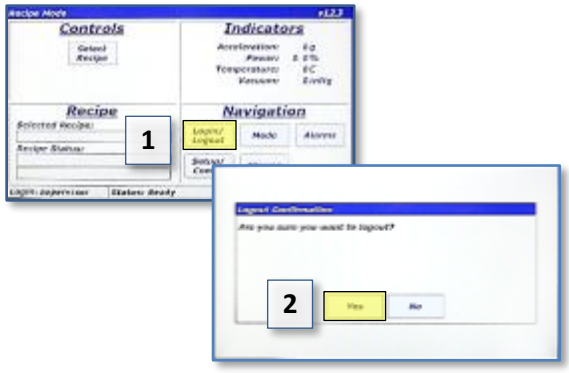
5. Using the keypad, enter “supervisor” for the password. Touch the <OK> button when finished.



6. The “Login” screen will reappear, and “supervisor” will be visible in the “Username:” textbox and the asterisk masked password will also be visible. Touch OK to login.



7. If the login attempt is successful, image 1 above will be displayed and the “supervisor” username will be displayed in the lower right corner. If login is unsuccessful, a dialog will be displayed notifying the user (image 2 above).



8. To logout, simply touch the <Login/Logout> button again. A confirmation dialog box will appear. Touching yes on that dialog will log the current user out.

9.3 Log Files

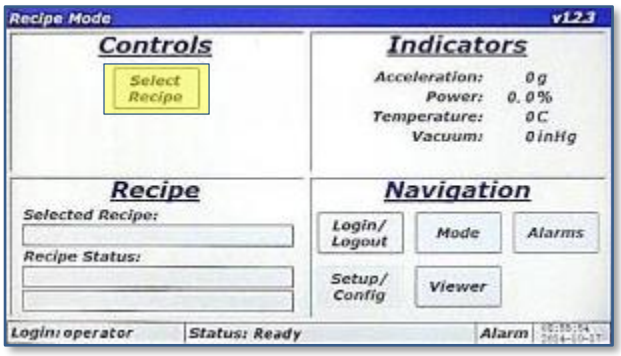
Every login attempt, successful or not, is logged to data files in the LabRAM II H’s memory. These files can be uploaded to a PC via USB for data archiving. See Section 13.8 Data Tab.

10 HMI Operation – Modes of Operation

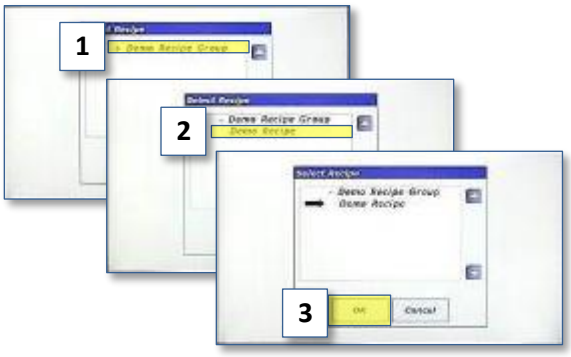
As previously noted, the LabRAM II H is controlled in one of two operating modes, which are referred to as Auto Mode and Recipe Mode. Recipe Mode is the primary mode used by operators, while Auto Mode is used by higher levels to characterize a mixing process for eventual recipe programming. This section covers the details of the LabRAM II H in Recipe Mode and Auto Mode.

10.1 Screen Operations - Recipe Mode

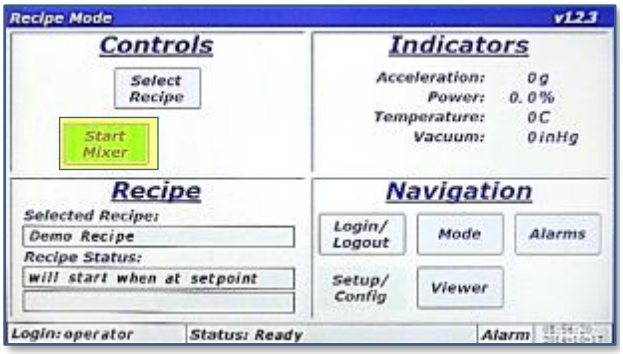
The following table details the steps for operating the LabRAM II H in Recipe Mode. Note that this sequence assumes the user has already logged in to the system.



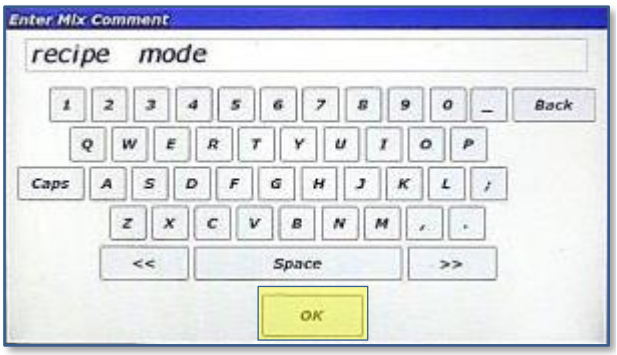
1. Touch the <Select Recipe> button.



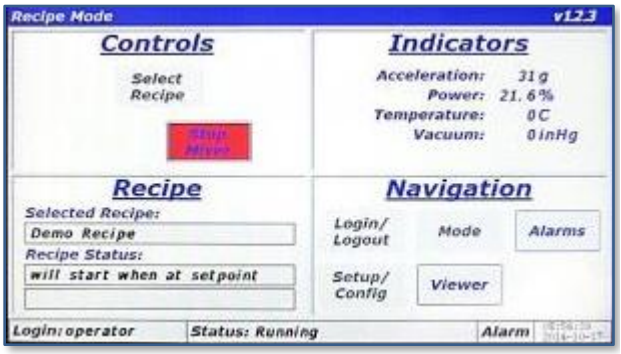
2. Touch “Demo Recipe Group” (item 1) to expand the group. Touch “Demo Recipe” to select it (item 2). A black arrow will appear next to the recipe. Touch <OK> to load the recipe (item 3).



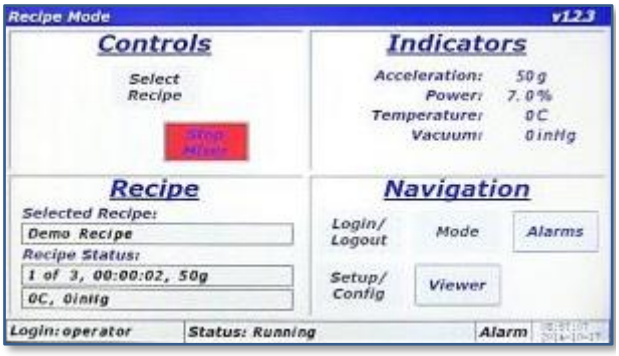
3. The main screen is displayed, and the <Start Mixer> button will be visible while the Recipe pane will display the name of the recipe just selected. Touch the <Start Mixer> button to begin the recipe mixing cycle.



4. The “Enter Mix Comment” screen will appear. Enter a fitting description of the current mix being executed. The text entered in this screen is stored in a log file in the LabRAM II H’s memory. Touch <OK> when finished.

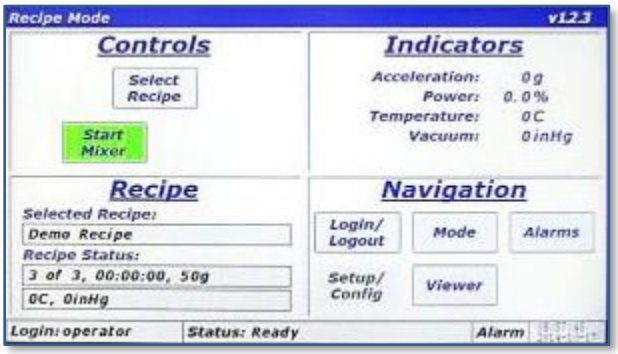


5. The Main Screen is again displayed, and the LabRAM II H will begin accelerating/mixing. The <Start Mixer> button changes to the <Stop Mixer> button. The recipe pane content will not update until the measured acceleration reaches the programmed setpoint. E.g., if the recipe calls for 60*g* of acceleration, updates will not start until acceleration reaches that 60*g*.

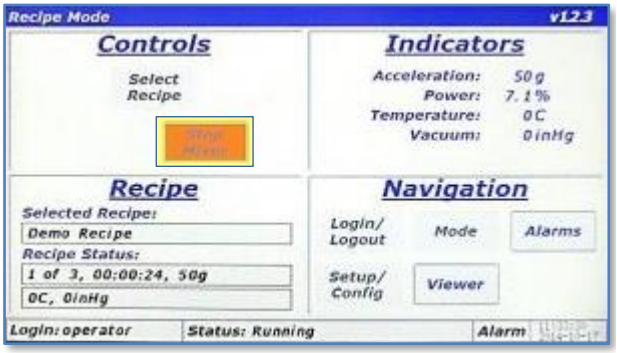


6. When acceleration reaches setpoint, the Recipe pane will update and display the currently executing segment, total segments, and remaining time on current segment, acceleration setpoint, temperature setpoint, and vacuum setpoint.

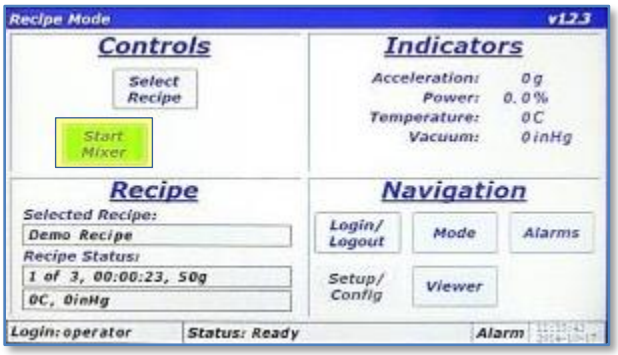
NOTE: If not equipped with temperature or vacuum control, the setpoints for these parameters will read 0C and 0inHg, respectively.



7. When the timer of the final segment expires, the mixer will stop. The <Stop Mixer> button changes to and the <Start Mixer> button. This completes a complete recipe mixing cycle.

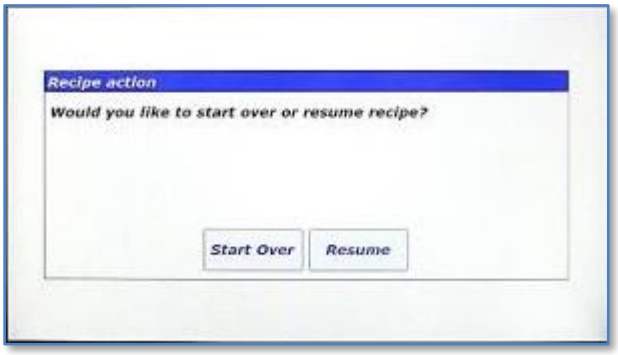


8. The LabRAM II H can be stopped by touching the <Stop Mixer> button during a recipe mix. Normally, this is only done if a user forgot to add an ingredient. Upon stopping the recipe, the timer will pause. To stop the mixer while running in Recipe Mode, simply touch the <Stop Mixer> button.



9. When the machine is stopped, ingredients can be added (or the cause for stoppage can be corrected). The LabRAM II H can then be restarted by touching the <Start Mixer> button.

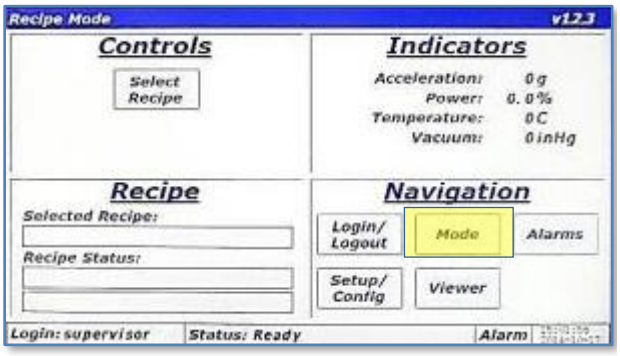
10. The “Enter Mix Comment” screen will appear again Enter a fitting description. Touch <OK> when finished.



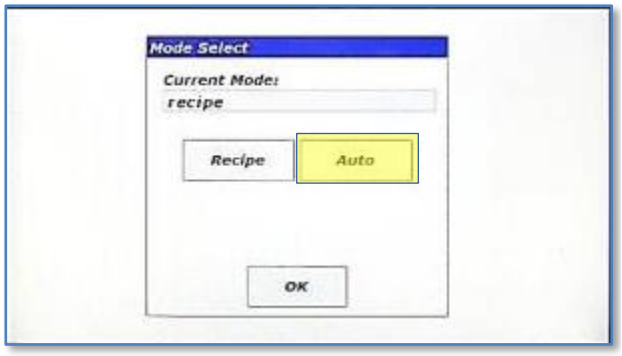
11. The LabRAM II H will give the option of starting from the beginning of the recipe by touching the <Start Over> button or continuing from the point the mixer was stopped by touching the <Resume> button.

Screen Operations - Auto Mode

The following table details the steps for operating the LabRAM II H in Auto Mode. Note that this sequence assumes the user has already logged in to the system with authorized login credentials to operate in Auto Mode.

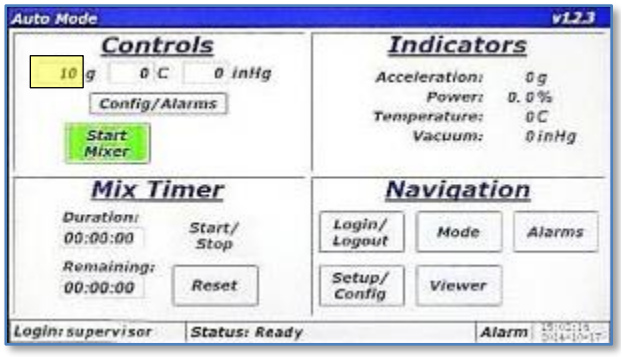


1. Touch the <Mode> button.



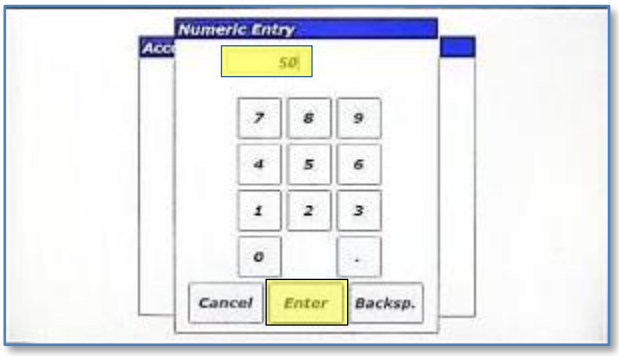
2. The “Mode Select” dialog is displayed. Touch the <Auto> button to change from Recipe to Auto Mode.

3. Touch the <OK> button to close the “Mode Select” dialog.

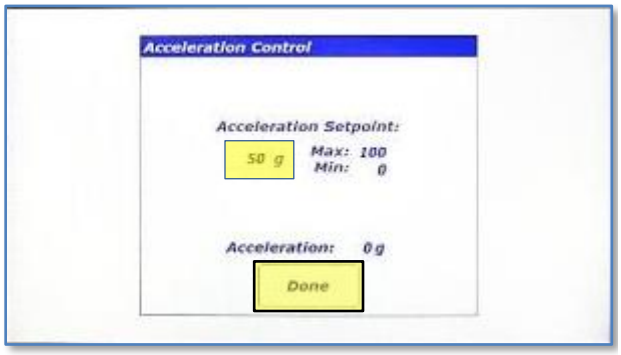


4. The Main Screen will appear but will look different in Auto Mode than it did in Recipe Mode. The Controls Pane now has three textboxes that are used to enter setpoints for acceleration (in *g*), temperature (in C or F as selected), and vacuum (in inHg or mm as selected). The <Config/Alarms> button is used for entering user limits for certain parameters and will be discussed later. The <Start Mixer> and <Stop Mixer> buttons operate the same as Recipe Mode. The lower left pane is now titled “Mix Timer” instead of “Recipe.” The “Mix Timer” is used to enter and operate the timer for Auto Mode. To update the acceleration setpoint, touch the textbox next to “*g.*”

5. The “Acceleration Control’ dialog will appear. The acceleration setpoint can be entered in this dialog. The entered value for acceleration must lie between these maximum and minimum values or the entry will not be accepted. To change the acceleration setpoint, touch the textbox next to “g.”

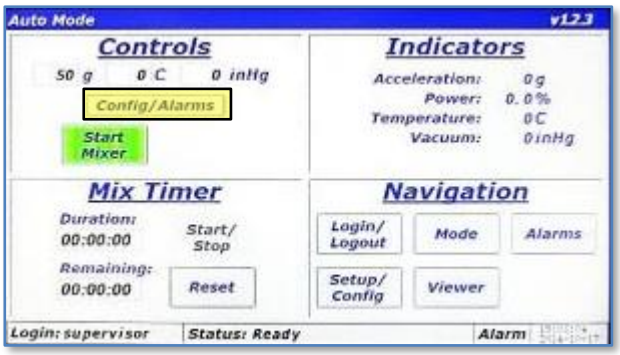


6. A numeric keypad will appear. Enter the new setpoint value and touch the <Enter> button to close the keypad.

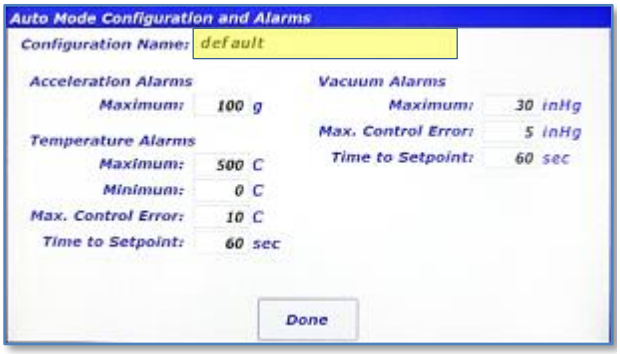


7. The newly entered setpoint will now appear in the textbox. Touch <Done> to close the “Acceleration Control” dialog.

NOTE: If the LabRAM II H is mixing or in acceleration, the setpoint would be used as soon as a valid setpoint was entered. The LabRAM II H does not wait for you to touch <Done>.

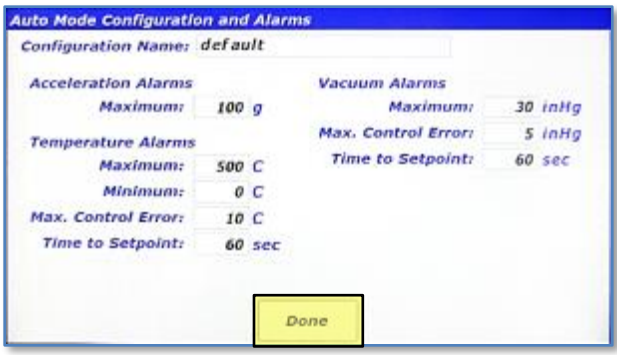


8. The new setpoint will now be updated in the Main Screen. To enter user-defined limitations and select a Configuration, touch the <Config/Alarms> button.

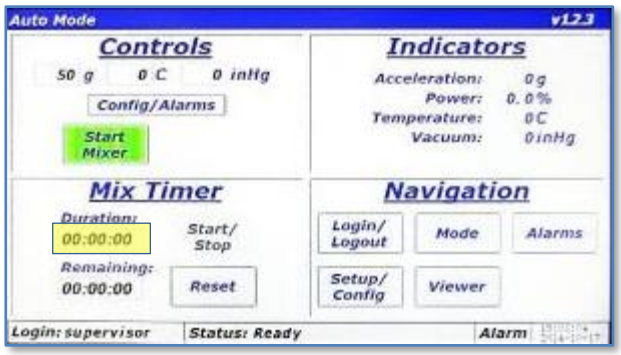


9. The “Auto Mode Configuration and Alarms” screen is displayed. This screen allows a user to enter limitations that will shut the machine down (and limit setpoint entry) if they are exceeded. If, for example, the material being mixed by the LabRAM II H was acceleration sensitive, the Maximum Acceleration could be limited in this screen. The Configuration for Auto Mode is selected by touching the textbox next to “Configuration Name:”.

10. The “Select Configuration” dialog will appear, and the Configuration can be selected from the list (only one configuration is defined in the image). Touch <OK> after the configuration has been selected.

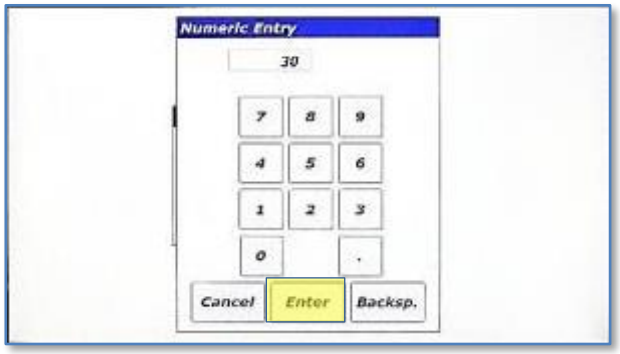


11. The “Auto Mode Configuration and Alarms” screen will be displayed again. To close the dialog touch <Done>.



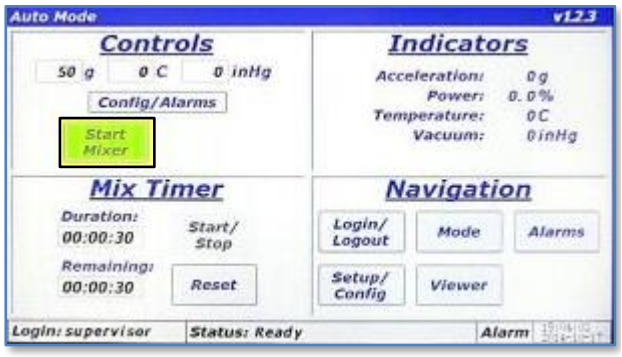
12. To enter a timer duration, touch the textbox under “Duration:” in the Mix Timer Pane.

13. The “Timer Entry” dialog appears. The dialog has three textboxes, which are, going from left-to-right hours:minutes:seconds. Touch the right textbox to enter seconds.



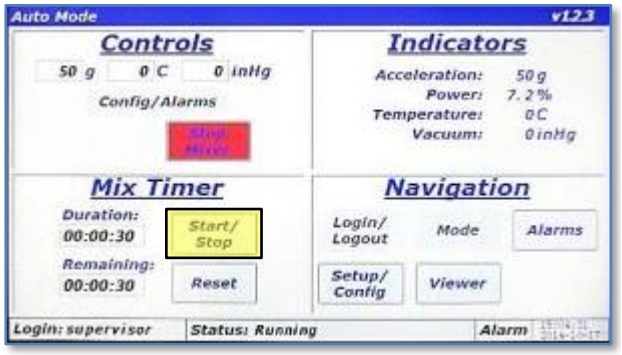
14. The “Numeric Entry” dialog will popup. Using the numeric keypad, enter 30 (for 30 seconds). Touch <Enter> when complete.

15. The entry from the previous step is displayed in the “Timer Entry” dialog. To edit hours and minutes, simply repeat the previous steps using the other textboxes. When complete, touch the <OK> button.

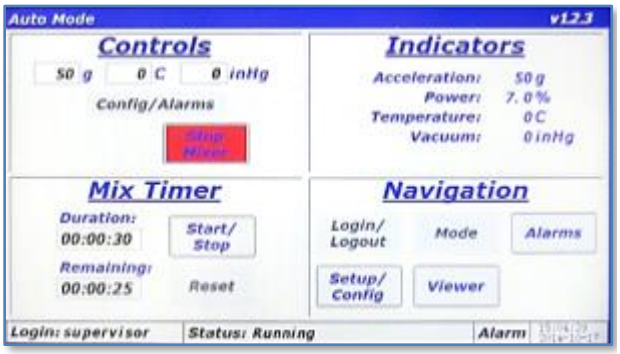


16. The timer value, 30 seconds in this case, will appear in the Mix Timer pane in the textboxes under “Duration:” and “Remaining:”. Touch the <Start Mixer> button to begin a mix cycle in Auto Mode.

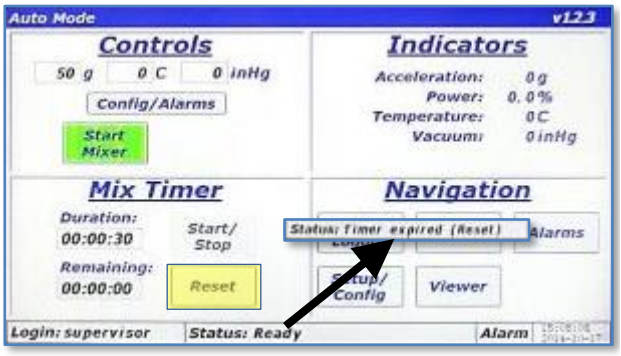
17. The “Enter Mix Comment” screen will appear. Enter a fitting description of the current mix. The text entered in this screen is stored in a log file in the LabRAM II H’s memory. Touch <OK> when finished.



18. The Main Screen is again displayed and the LabRAM II H will begin accelerating/mixing. The <Start Mixer> button changes to the <Stop Mixer> button. Depending on Auto Mode Timer mode configured, the timer may start immediately, it may start when the mixer is at acceleration setpoint, or not at all (manual). The factory default for this option is manual mode where the user must touch the <Start/Stop> to start the timer. Touch <Start/Stop> in the Mix Timer pane.



19. When the timer is actually running the <Reset> button will be disabled. Also, the timer duration cannot be changed when the timer is running. Pressing the <Start/Stop> button will pause/stop the timer, which will re-enable the <Reset> button. If the <Reset> button is pressed, it will reload the timer to the initial value.



20. When timer expires, the LabRAM II H will stop accelerating/mixing. If the Auto Mode timer is set to the manual option, the middle portion of the Status Bar will read “Status: Ready”. If the Auto Mode timer is set to the immediate or at-setpoint option, the middle portion of the Status Bar will read “Status: Timer expired (Reset)”. If this message is visible, the <Start Mixer> button should be hidden. The user must press the <Reset> button or load a new duration in for the Auto Mode mix timer.

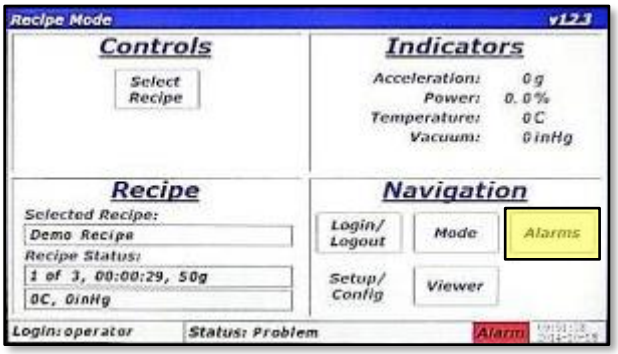
11 HMI Operation – Alarming

The LabRAM II H protects itself and the user by monitoring parameters that could cause damage or injury. When any of these parameters are violated, the mixer will stop accelerating/mixing. Whenever one of these situations arises, the user is notified at the Main Screen by changing the color of the Alarm section of the Status Bar to red or yellow. Red means a shutdown error is present, and yellow means a warning is active.

The Alarm screen is accessed by touching the <Alarms> button from the Main Screen in the Navigation Pane. The Alarms screen is laid out in a tabular format that shows when an alarm is posted, its message, when it recovered, when the alarm was acknowledged, and the alarm ID.

Whenever an alarm is triggered, acknowledged, or recovered, a log file stored in the LabRAM II H’s memory is updated. The alarm logs can be uploaded to a computer through USB.

11.1 Screen Operations - Alarms



The following table details the steps for viewing and managing alarms.

1. When an alarm is active, the “Alarm” section of the Status Bar will turn red for a shutdown alarm and yellow for a warning. To view the alarm, touch the <Alarms> button.

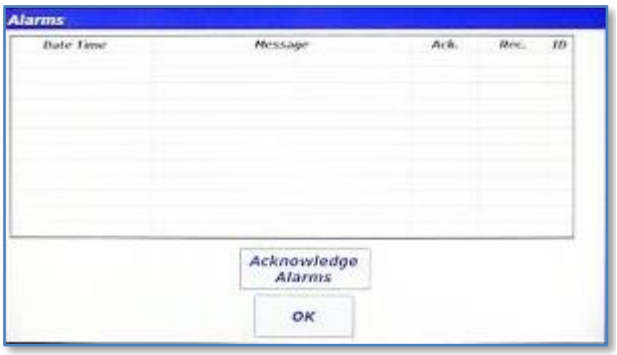
1. The “Alarms” screen is displayed with the alarm message on the first line of the table. In this case, the “Door Opened During Operation” alarm has been triggered. This alarm is triggered if the LabRAM II H is mixing and the door is opened. Note - when an alarm is active but not acknowledged the alarm message will be red. The columns of the table are as follows:
   - Date Time: the date and time of alarm activation
   - Message: the alarm description
   - Ack.: the time that the alarm was acknowledged
   - Rec.: the time that the alarm was recovered
   - ID: alarm identification number

   Touch the <Acknowledge Alarms> to acknowledge the alarm.

2. The alarm font turns blue and a time is inserted into the “Ack.” Column. The blue color indicates an alarm that is still active but has been acknowledged. If the door is physically closed, the alarm will recover, and the message will disappear from the alarm table.

3. The alarm message disappears when an acknowledged alarm recovers.

4. If the alarm is recreated but the door closed (alarm recovered) before acknowledgment, the above alarm message will be displayed. This time, the alarm message is green and the “Rec.” column is populated with a time. If the <Acknowledge Alarms> is touched, the alarm message will disappear because it will be recovered and acknowledged.



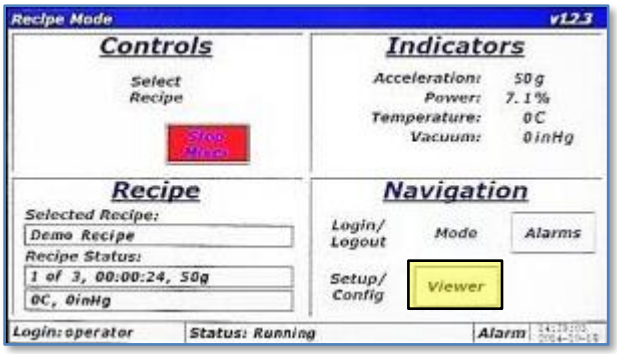
5. The alarm message disappears when an acknowledged alarm recovers.

12 HMI Operation – Viewer

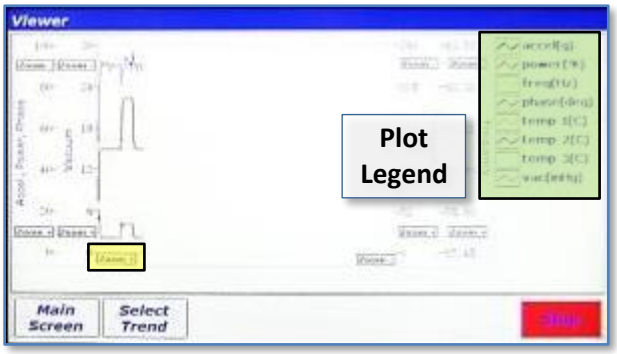
The LabRAM II H measures several parameters important to mixing efficiency. These measure parameters can be viewed in real-time as a time-history plot. To view real-time plots, touch the <Viewer> button in the Navigation Pane of the Main Screen.

12.1 Screen Operations - Viewer

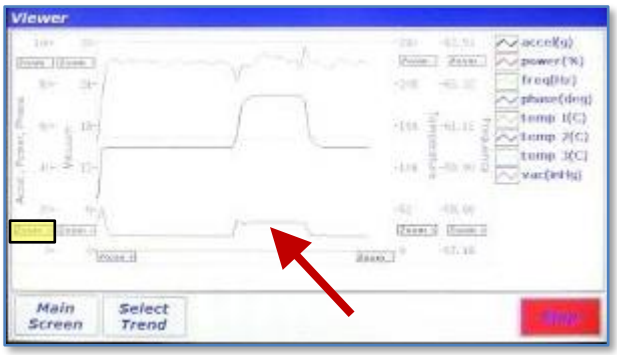
The following table details the steps for viewing real-time measured parameters.



1. With the LabRAM II H mixing/accelerating in either Recipe or Auto Mode, touch the <Viewer> button in the Navigation Pane.

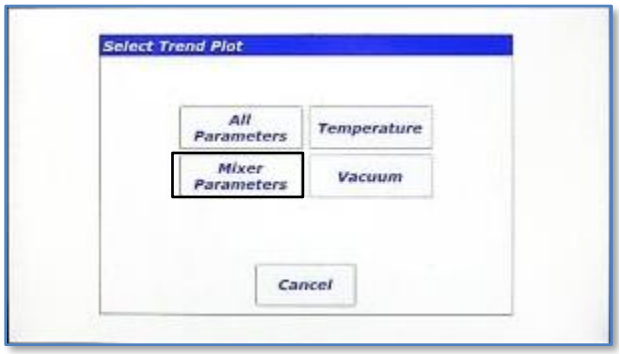


2. The “Viewer” screen will appear. This screen is a time-history plot of a maximum of eight parameters. The plot colors and names are in the Plot Legend. Four Y-Axes have independent zooming capabilities. All plots share a single X-Axis zoom. To Zoom in on the X-Axis, touch and hold the <Zoom +> button on the X-Axis.

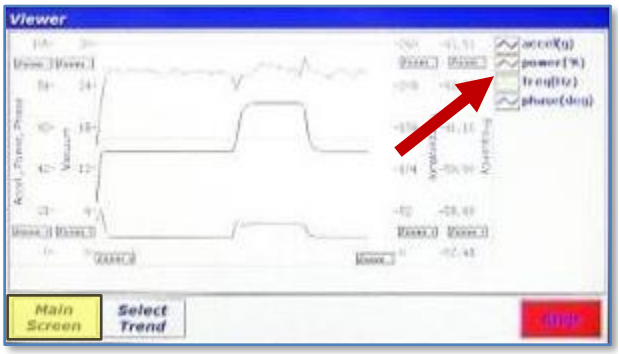


3. The visible plots will now have a shorter overall time and will be “zoomed in”. Touching the <Zoom -> button will have the opposite effect. Zooming on the vertical Y-Axes uses the same method. To zoom in on the smaller “power (%)” plot, touch and hold the <Zoom +> button on the “Accel., Power, Phase” Y-Axis.

4. The smaller “power (%)” can now be examined more closely. Sometimes it is difficult to see a parameter of interest with all parameters plotted in the graph. To pare down visible parameters, touch the <Select Trend> button.



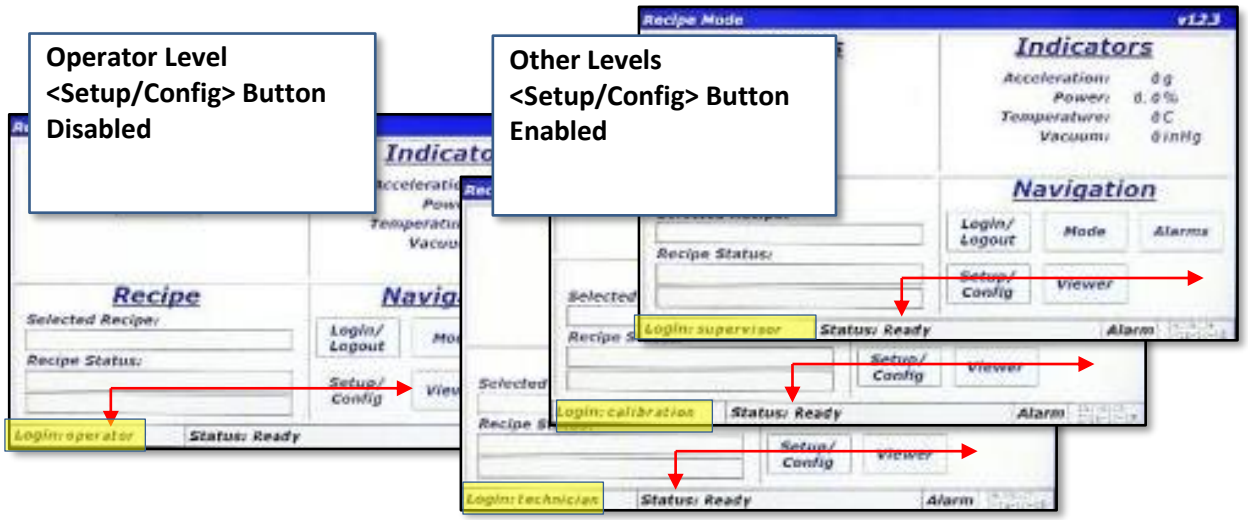
5. The “Select Trend Plot” dialog will appear. This dialog allows displaying the parameters of interest. The buttons on this dialog will display different versions of the graph displaying plots according to the button labels. Touching the <Mixer Parameters> displays only four parameters.



6. With only the four mixer parameters displayed in the plot as indicated by the contents of the Plot Legend a clearer picture may emerge. To return to the Main Screen, touch the <Select Trend>.

13 HMI Operation – Setup and Configuration

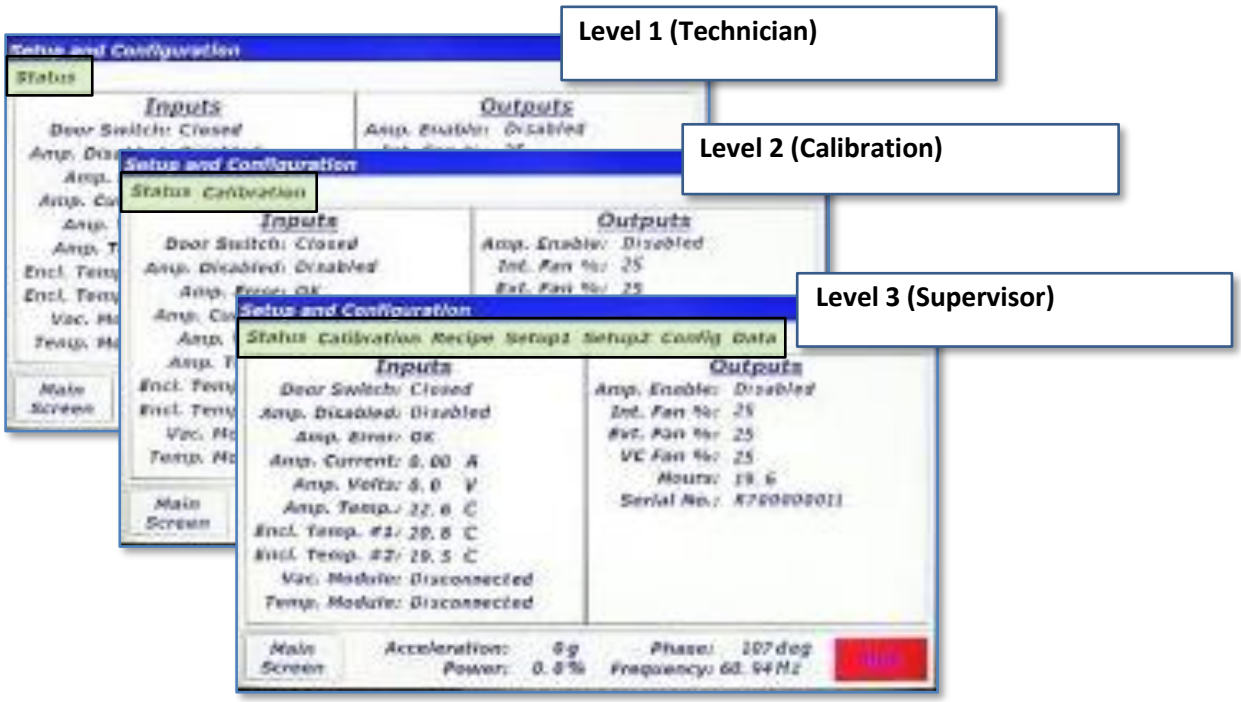
The LabRAM II H offers the user extensive customization and flexibility. The Setup and Configuration screen provides user control of optional features, and manages the configuration of the LabRAM II H. The Setup and Configuration screen is accessed by touching the <Setup/Config> button from the Main Screen. If logged in at Level 0 (operator), this button is displayed, and the button is enabled for all other login levels (refer to image), but the content of the Setup and Configuration screen is adjusted based on the user’s login level.



The Setup and Configuration screen is laid out in a tabbed format, like many modern web browsers. Touching a tab title will switch between tabs. Tabs are added/removed based on the user's login level. The following table identifies the tabs and login level required to access those tabs. The associated image illustrates how the Setup and Configuration screen changes appearance based on login level.

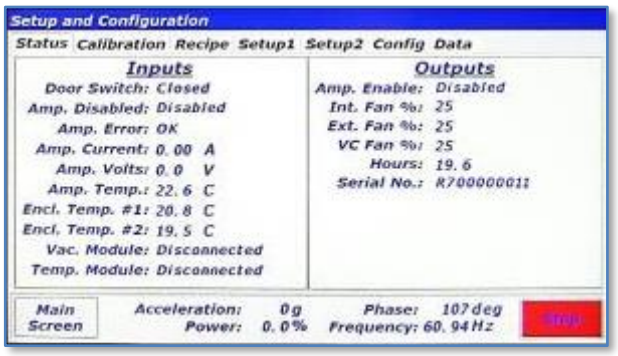
Tab Name	Login Level Required		
Status	Supervisor	Calibration	Technician
Calibration	Supervisor	Calibration	
Recipe	Supervisor		
Setup 1	Supervisor		
Setup 2	Supervisor		
Config	Supervisor		
Data	Supervisor		

The subsequent coverage of the Setup and Configuration screen will be performed using a Level 3 (Supervisor) login.



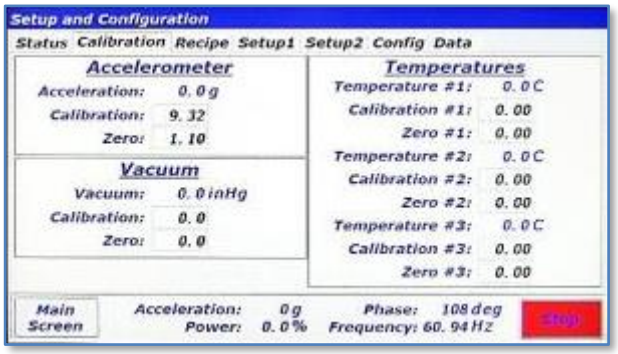
13.1 Status Tab

The Status Tab is used to examine machine parameters and perform diagnostics, if needed. The left portion of the tab is dedicated to machine inputs which include switch and amplifier status, amplifier voltage/current, enclosure temperatures, and vacuum/temperature module communication status. The right portion of the tab is dedicated to machine outputs including amplifier enable command, fan speeds, machine hours and serial number.



13.2 Calibration Tab

The Calibration Tab is used to verify calibrations and to adjust calibration coefficients. Resodyn Acoustic Mixers provides calibration standards to calibrate the accelerometer. Calibration Procedures are provided with the kit. Accelerometer calibration should be performed annually. Vacuum and temperature can be calibrated with any standard systems used for that purpose.

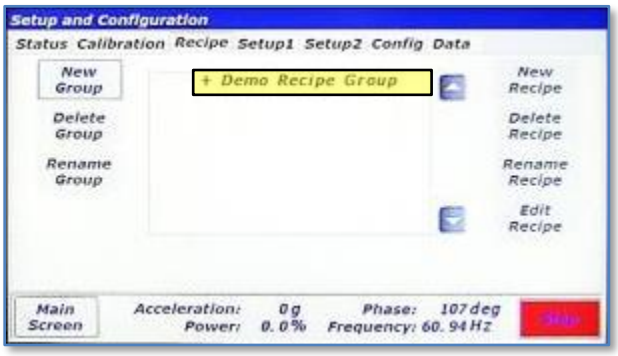


13.3 Recipe Tab

The Recipe Tab is used to create and edit recipes and recipe groups. The LabRAM II H has the capability to store 10 recipe groups with 10 recipes per group, for a total of 100 recipes. Recipe groups can be thought of “folders” on a computer and recipes are analogous to “files” on a computer. Recipe groups can be created, renamed, and deleted in the recipe tab. Recipes can be created, renamed, deleted, and edited from the recipe tab. The remainder of this section provides a walk-through on all the recipe operations.

13.3.1 Screen Operations – Edit an Existing Recipe

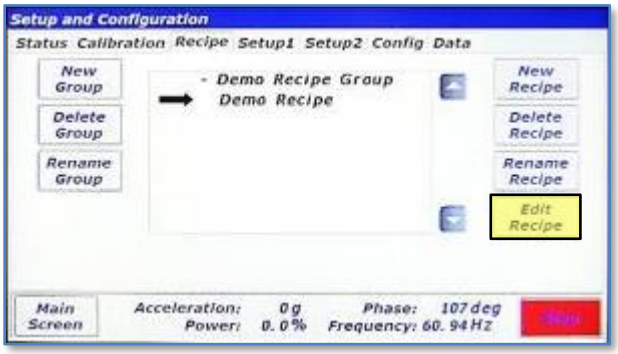
The following walk-through covers how to edit an existing recipe. The LabRAM II H is shipped with a demonstration recipe and group, and that recipe will be edited.



1. While in the Recipe Tab of the Setup and Configuration screen, touch the "+ Demo Recipe Group" line. This will expand the recipe group.

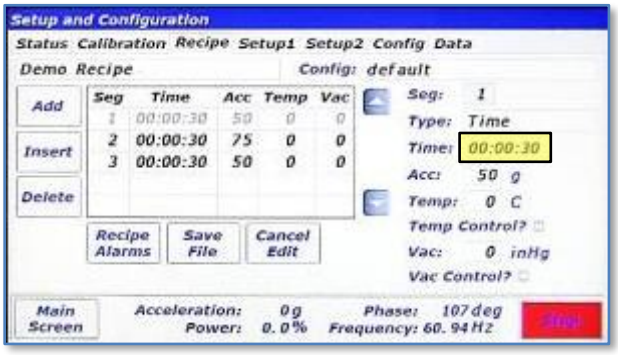
NOTE: The buttons on the left side of this tab are used for recipe group management and the buttons on the right are used for recipe management. The buttons on both sides will change enabled/disabled state based on selection of recipe groups and recipes. In the image above, all the buttons on the right are disabled because no recipe group or recipe is selected in the list. Only the <New Group> button is enabled on the left. That is because no recipe group has been selected yet.

2. After expanding the "Demo Recipe Group", the "+" next to the group name changes to a "-" and the recipes in that group are listed. In this case, there is only one recipe listed named "Demo Recipe". Touch the line with the recipe.



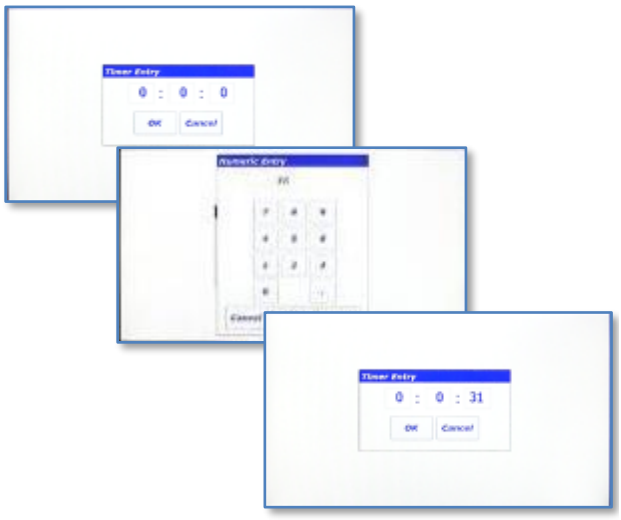
3. After touching the recipe name, an arrow will appear indicating that the recipe has been selected. To view/edit the contents of this recipe touch the <Edit Recipe> button.

NOTE: The buttons on both sides are now enabled because a recipe group and recipe are expanded and selected, respectively.

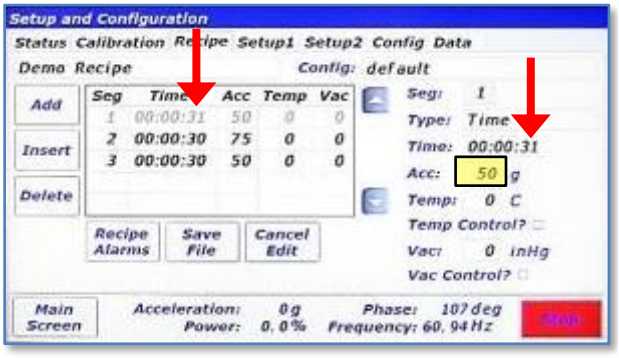


4. The recipe contents will be read from the LabRAM II H's memory and displayed in the screen shown above. The recipe name is displayed in the top-left textbox. The Configuration associated with this recipe is displayed in the top-right textbox. The <Add>, <Insert>, and <Delete> buttons on the left side of the screen are used to add or remove segments to the recipe. The table in the middle of the screen shows defined segments. The controls on the right side of the screen are used to change settings for time, acceleration, temperature, and vacuum. To demonstrate usage of these controls, the time for segment 1 will be changed from 30 seconds to 31 seconds, and the acceleration setpoint will be changed from 50g to 51g. Touch the textbox next to "Time:".

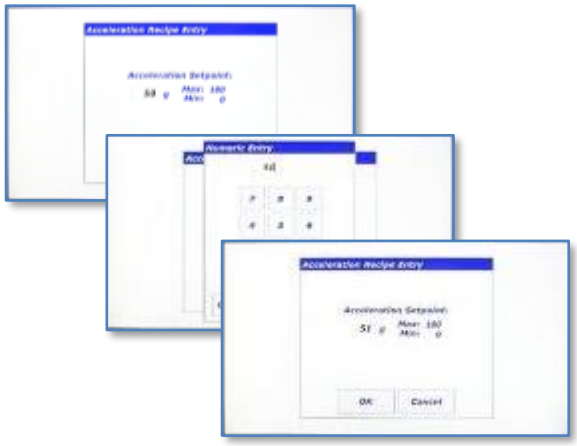
NOTE: Segments are time steps of the recipe. In the screen above, each row in the table is a segment.



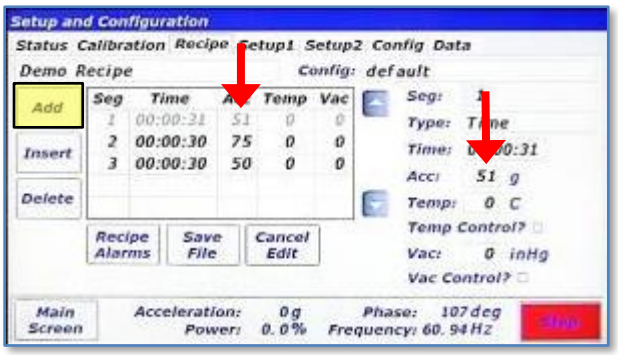
5. The timer entry for recipe editing is the same as in Auto Mode. Touch the seconds textbox, enter 31 using the "Numeric Entry" dialog and then touch the <Enter> button. Touch OK in the "Timer Entry" dialog when complete.



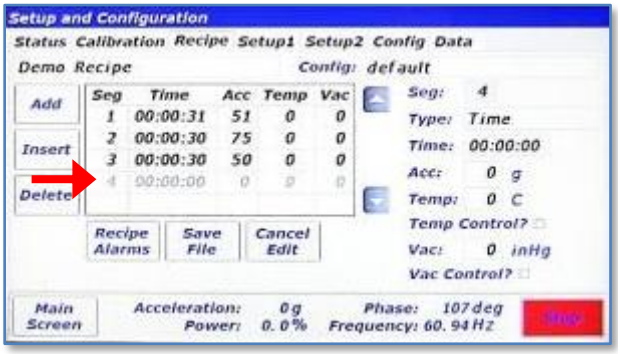
6. The time for segment 1 is now 31 seconds. Now, update the acceleration setpoint from 50g to 51g. Touch textbox next to "Acc:".



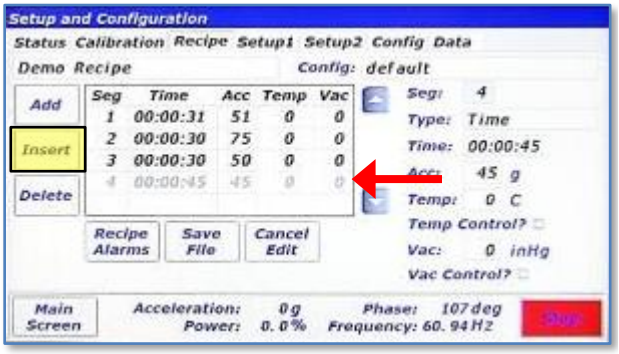
7. The "Acceleration Recipe Entry" dialog will appear. Again, this dialog is used the same as the Auto Mode acceleration entry. Touch the textbox and enter 51 using the "Numeric Entry" dialog and then touch the <Enter> button. When complete, touch the <OK> button.



8. The new setpoint of 51g now appears in the table and in the control on the right-side. Temperature and vacuum setpoints are entered in the same fashion, assuming these options are equipped on the LabRAM II H. Touch the <Add> button on the left-side of the screen to append a segment to the end of this recipe.

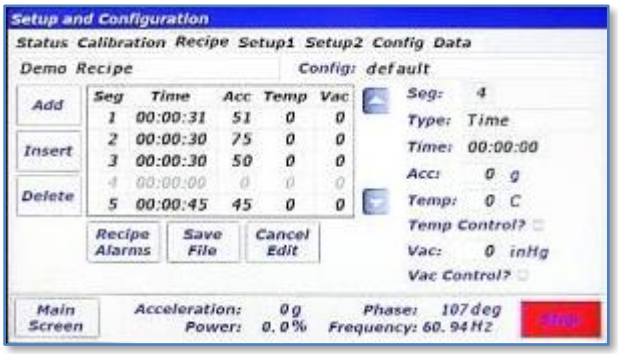


9. A new segment, segment 4, is now added to the end of the this recipe. Using the methods previously described, this segment will be edited to have a time duration of 45 seconds and an acceleration setpoint of 45g.

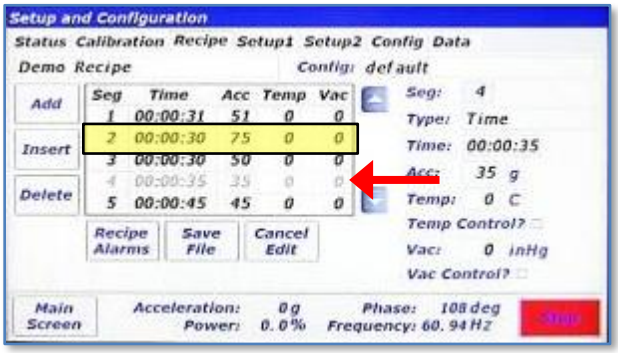


10. Now, another segment will be added to the recipe, except the <Insert> button will be used this time. Touch the <Insert> button to add another segment ahead of the selected segment. Since segment 4 is selected (light grey color), the new segment will become segment 4 and the old segment 4 will become segment 5.

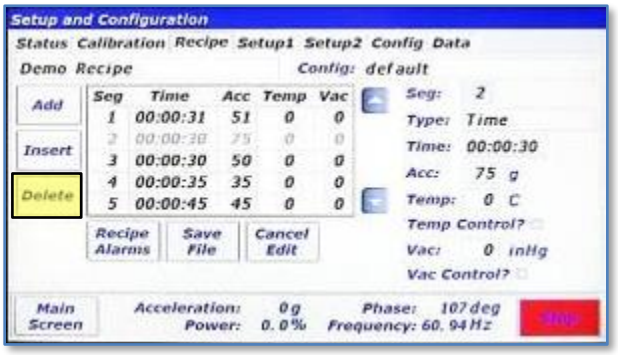
NOTE: The selected segment is a lighter grey color than the other segments. To select a different segment, touch the desired segment in the table control.



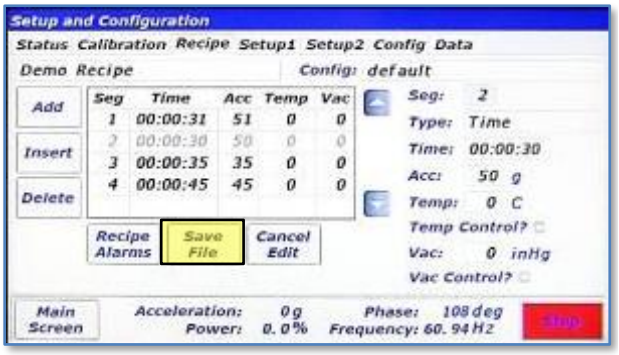
11. Now, the n ew segment 4 will have its contents edited. Using the methods previously described, this segment will be edited to have a time duration of 35 seconds and an acceleration setpoint of 35g.



12. The new segment 4 now has updated time and acceleration setpoint. Segment 2 will now be deleted. Touch the line that contains segment 2.



13. Segment 2 is now highlighted (light grey). Touch the <Delete> button on the left to delete segment 2.



14. The previous segment 2 is now deleted and the previous segments 3,4, and 5 are shifted up one. To complete this recipe edit, touch the <Save File> button.

15. A confirmation dialog will appear. Touch <Yes> to save.

13.3.2 Screen Operations – Create New, Rename, and Delete

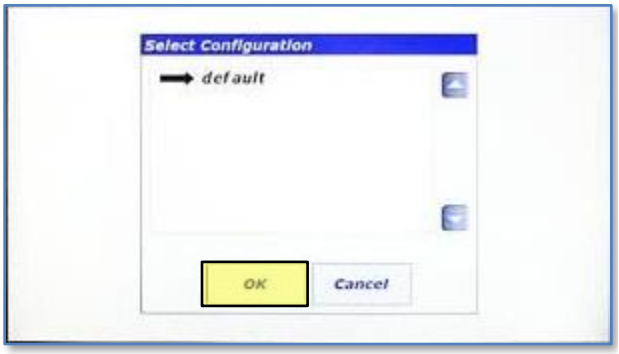
The following walk-through covers how to create a new recipe group and then add a new recipe to that group.

1. To create a new recipe group, touch the <New Group> button.

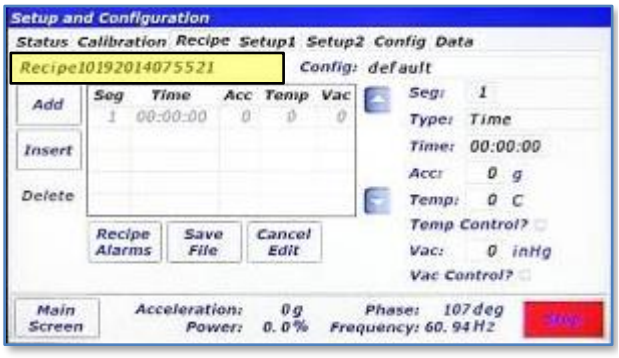
2. Using the keypad enter the new group's name. Then touch <OK>.

3. The new group will appear in the list. To add a recipe to this group, the group must be selected first. Touch the line "+ new group"

4. The <New Recipe> button will now be enabled. Touch it to create a new recipe.

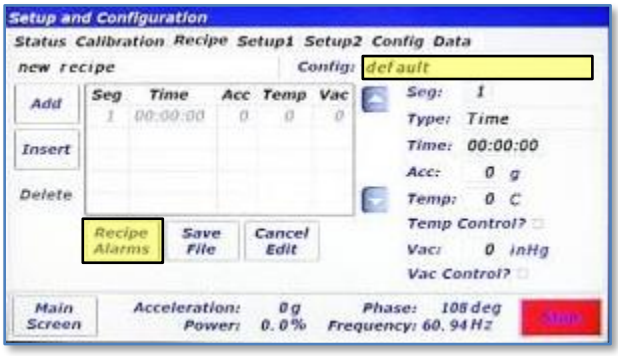


5. The “Select Configuration” dialog will appear. Configurations will be discussed in a later section. Touch <OK>.

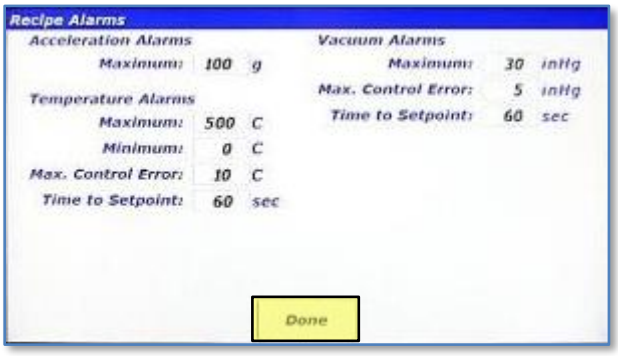


6. When a new recipe is created, a default name is given to the recipe. Also, a blank segment 1 is automatically added. To change the name, touch the textbox in the top-lefthand corner.

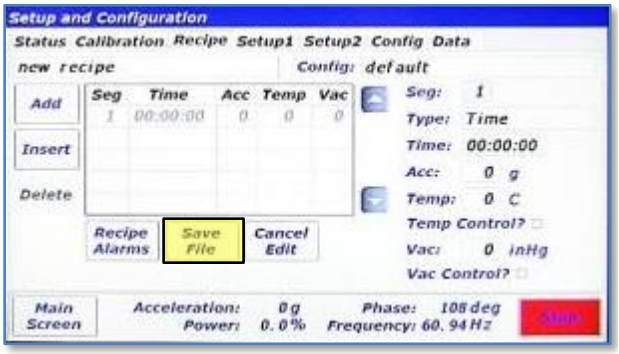
7. Rename the recipe and touch <OK>.



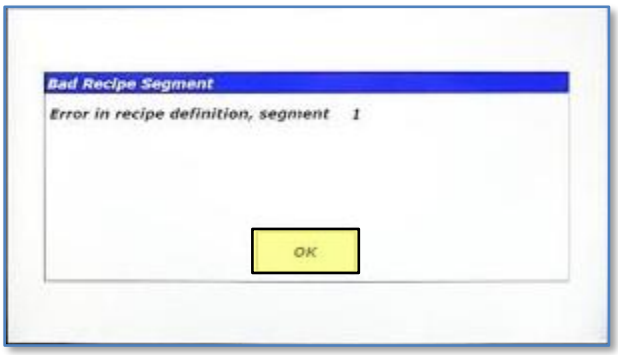
8. If the configuration ever needs to be changed, touch the textbox next to “Config:”. This will launch the “Select Configuration” dialog as seen in step 5. The “Type:” textbox is used for selecting the segment type. Currently Time segments are the only option. This feature will be expanded in future firmware revisions of the LabRAM II H. Touch the <Recipe Alarms> button.



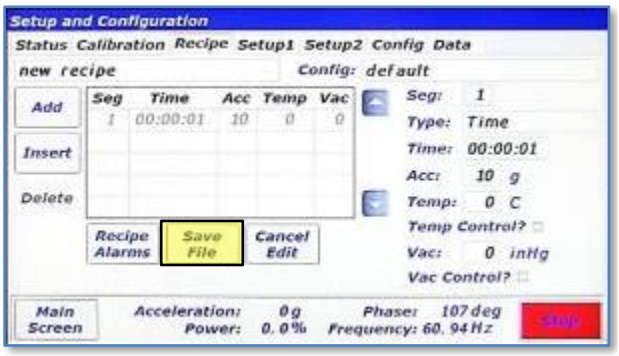
9. The “Recipe Alarms” screen will appear. This screen does the exact same thing as the “Auto Mode Configuration and Alarms” but for Recipe Mode. This screen allows the user to enter limitations for the recipe. If for example, the material that will be mixed with this recipe was temperature sensitive, the Maximum temperature is set here to protect the material from overheating. Touch <Done> when done entering alarm limits.



10. To demonstrate the error checking functionality, touch the <Save File> button without editing the empty segment 1.



11. The “Bad Recipe Segment” dialog will appear identifying that something is wrong with the definition of segment 1. The time for segment 1 is 00:00:00, which is not allowed. Acceleration, temperature, and vacuum setpoints all need to lie between values entered in the “Recipe Alarms” as well as in the recipe segments to pass the error checking. Additionally, the setpoints are checked against fixture limits. Fixtures are discussed in a subsequent section. Touch <OK> to return to the editing screen.

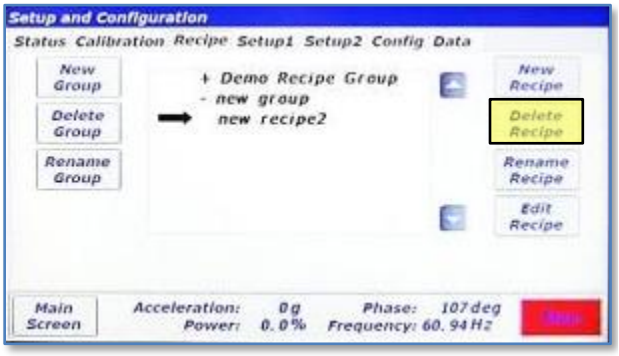


12. Correcting the contents of the recipe allows saving. Touch <Save File>.

13. Now that the recipe is correct, the “Recipe Save” dialog appears. Touch <Yes>.

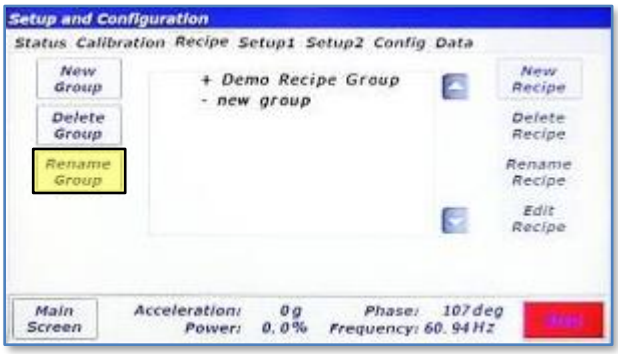
14. After expanding “new group”, “new recipe” is visible. Select “new recipe” by touching its line in the box. Recipes can also be renamed from this screen. Touch the <Rename Recipe> button on the right.

15. Rename the recipe and touch <OK>.



16. Recipes are also deleted from this screen. Select the renamed recipe and Touch the <Delete Recipe> button.

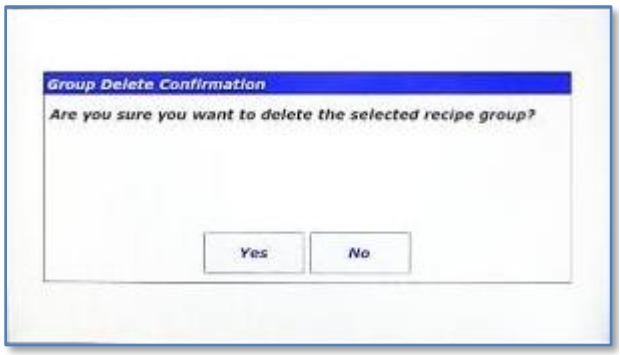
17. Touch <Yes> on the “Recipe Delete Confirmation” dialog to delete the recipe.



18. Selecting “new group” again will reveal that the recipe has indeed been deleted. Recipe Groups are also renamed and deleted from this screen. The process for this is identical to recipe renaming and deleting. With “new group” selected (“-“ next to it), touch the <Rename Group> button.

19. Rename the recipe group and touch <OK>.

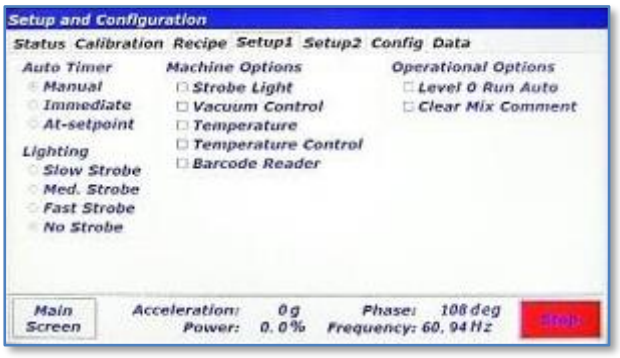
20. The group has been renamed. To delete the new group, select it and touch the <Delete Group> button.



21. Confirm delete by touching <Yes> in the “Group Delete Confirmation” dialog.

22. The group has been deleted.

13.4 Setup1 Tab



The Setup1 Tab is used to configure optional features and enable machine options.

13.4.1 Auto Timer Group Box

This group box allows setting of the auto mode timer's behavior:

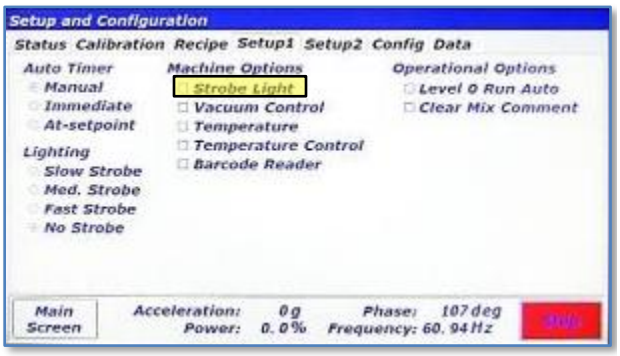
- **Manual:** Auto Mode timer starts only when user presses <Start/Stop>.
- **Immediate:** Auto Mode timer starts as soon as LabRAM II H starts mixing/accelerating.
- **At-setpoint:** Auto Mode timer starts as soon as LabRAM II H acceleration reaches initial setpoint.

13.4.2 Lighting Group Box

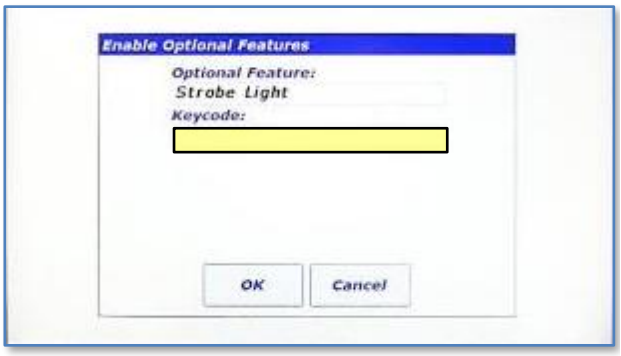
The lighting group box is not applicable to the LabRAM II H.

13.4.3 Machine Options Group Box

If a LabRAM II H user decides to enable features after initial purchase, a keycode will need to be entered to turn those features on. The Machine Options Group Box allows the user to enable optional features by entering a keycode. Additionally, this box communicates enabled features because if a feature is enabled, it will be checked. The following illustrates the process of enabling an optional feature.

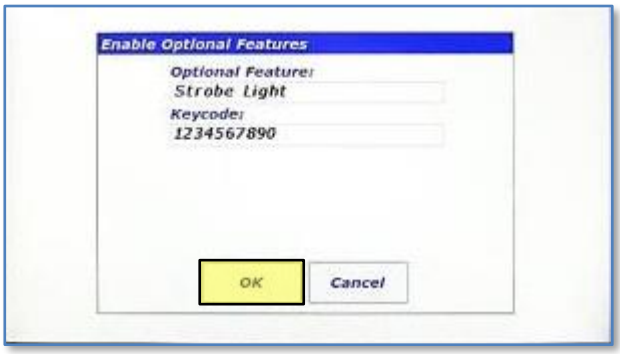


1. To enable the strobe light feature, touch the strobe light check box.

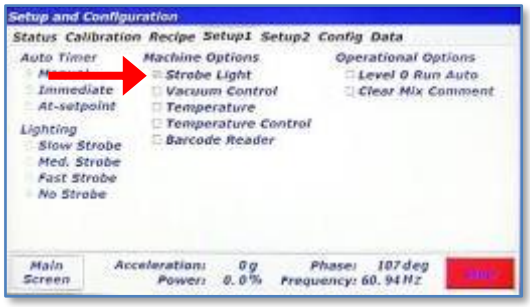


2. The "Enable Optional Features" dialog will appear. Touch the textbox under "Keycode:".

3. Enter the keycode provided by Resodyn Acoustic Mixers. Touch <OK> when complete.



4. Touch OK to attempt activation.



5. If activation is successful, then a checkbox will appear in front of the option. Otherwise, a failure dialog will appear.

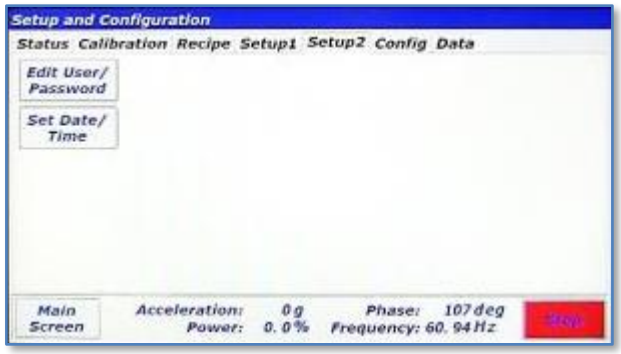
13.4.4 Operational Options Group Box

User preference options are in the Operational Options Group Box. Currently, there are only two options:

- **Level 0 Run Auto:** If this checkbox is checked, Level 0 (Operator) can operate the LabRAM II H in Auto Mode.
- **Clear Mix Comment:** By default, the previous Mix Log Comment is retentive between LabRAM II H starts. Checking this option will clear the Mix Log Comment between starts and force the user to re-type the mix comment.

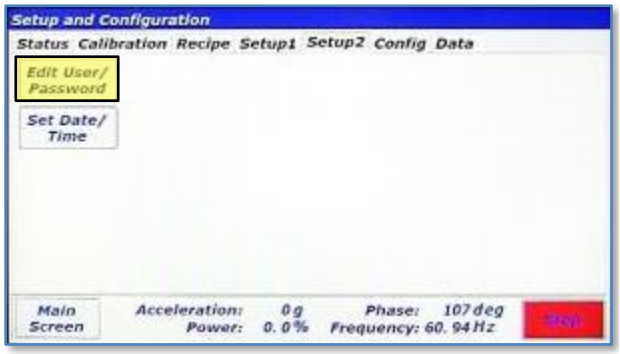
13.5 Setup2 Tab

Currently, only two buttons are present on the Setup2 Tab. The top button, <Edit User/Password> provides a user management utility to create new users, change passwords, and delete users. The <Set Date/Time> button is used to adjust those system parameters.



13.5.1 Screen Operations – User Management

This walk-through describes how to create a new Level 2 (Calibration) user login.



1. Touch the <Edit User/Password> button.

2. The “User Management” dialog appears. Touch the <Add User> button.

3. The “New User” dialog appears. Touch the “Username:” textbox to enter a new username.

4. Enter the new username and password using the same method as initial login and set the login level number according to the description in the dialog. In this case, a Level 2 (Calibration) login will be created. Touch <OK> to create the new user.

5. The new user has been created. To change the password, touch the <Change Password> button.

6. The “Change password” dialog will appear. Enter the old password and new password and then touch <OK>.

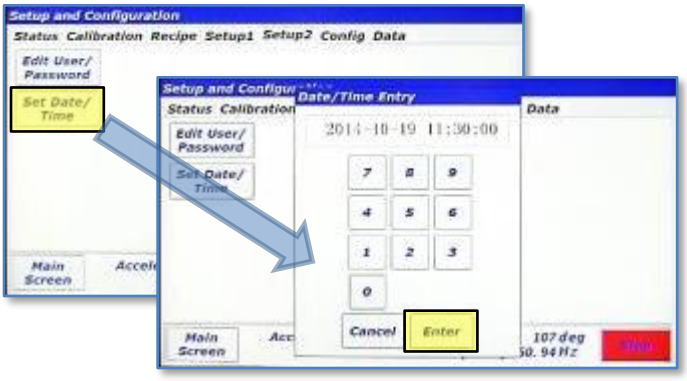
7. The password has been changed when the “User Management” dialog reappears. Otherwise, a failure dialog will notify the user of failed password change. To delete a user, select it, and touch the <Remove User>.

8. Confirm user delete by touching the <Yes> button in the “User Delete Confirmation” dialog.

9. The user has been deleted.

13.6 Setting Date and Time

Touch <Set Date/Time> on the Setup2 tab to set the system date and time. The entire date and time must be set for the update to work correctly. Date is entered in YYYY-MM-DD format and time is entered in 24-hour format, i.e., HH:MM: SS. Touch <Enter> when complete.



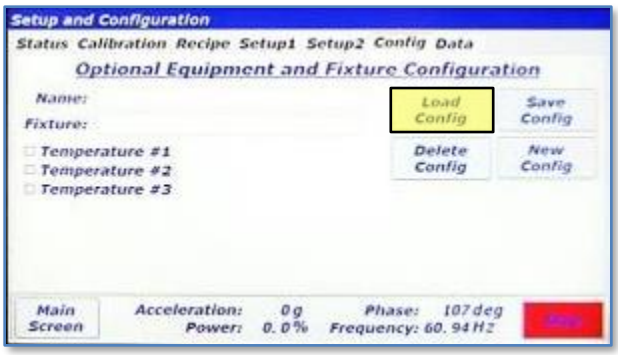
13.7 Config Tab

The Config Tab provides a method of enabling/disabling certain features of the machine. Temperature measurement can be de/activated as necessary to avoid alarm conditions that are not applicable to a mix setup. If a temperature sensor is not being used, its alarming functions need to be shut off.

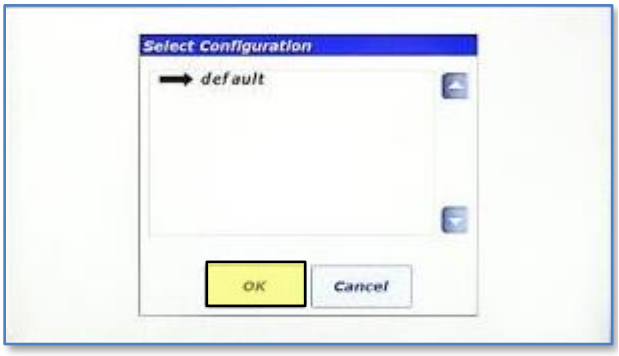
This tab also allows selection of configured fixtures (mix container and mix container holders) that provide necessary operating parameters and limitations of different fixtures.

13.7.1 Screen Operations – Edit a Configuration

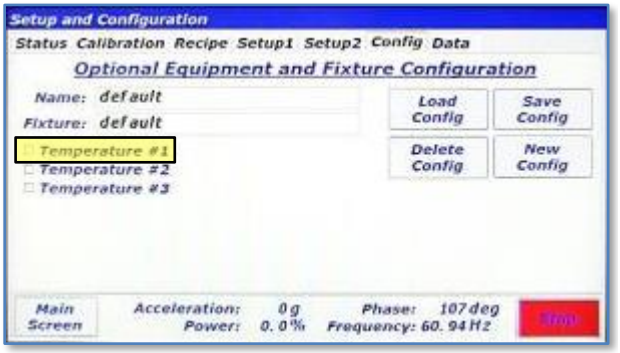
The following walk-through modifies the configuration provided with the LabRAM II H called "default." This sequence assumes that temperature measurement option is equipped, and that temperature #1 was not used initially.



1. In the Config tab, touch the <Load Config> button.

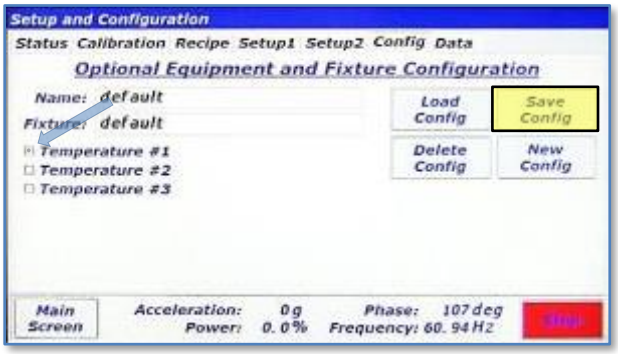


2. In the "Select Configuration" dialog, there is only one configuration defined. It is already selected. Touch <OK>.



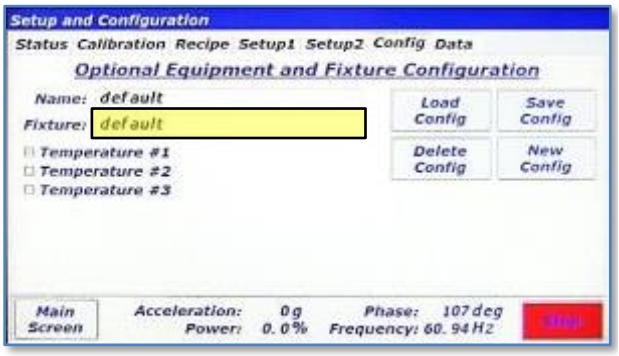
3. The "default" configuration is now loaded. Notice that none of the temperature checkboxes are checked. This means that in its current state, no temperature alarming would be active, and all temperatures would read "0". Turn on temperature #1 by touching it.

NOTE: The default configuration cannot be deleted, but it can be modified.



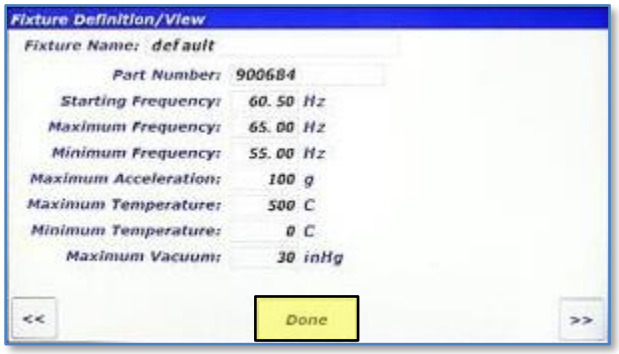
4. Temperature #1 is now checked. Touch the <Save Config> button to commit changes.

5. Touch <Yes> on the "Configuration Save Confirmation" dialog box.



6. With temperature #1 checked and default configuration saved, temperature #1 input will be monitored and displayed. Additionally, all fixture and user temperature alarm limits will be active. The name given to the original fixture shipped with the LabRAM II H is also referred to as "default". Touch the textbox next to "Fixture:".

NOTE: A fixture contains operational parameters associated with a mix container holder and mix container. Fixture files define these parameters, and fixture files are created by Resodyn Acoustic Mixers and cannot be modified. But, they are viewable.

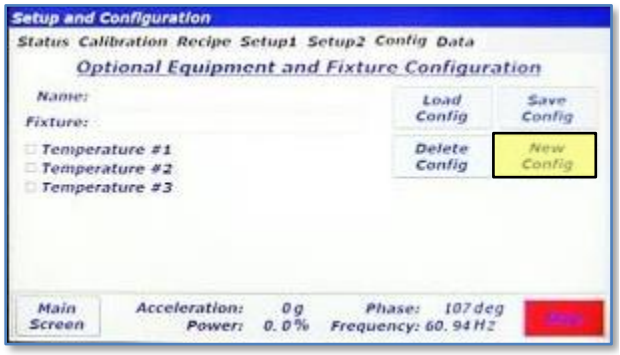


7. The "Fixture Definition/View" screen will appear. The parameters for the selected fixture are displayed. If the system has more than one fixture defined, the "<<" and ">>" buttons scroll through all of the fixture files. Touch <Done>.

NOTE: These values are read-only and are created by Resodyn Acoustic Mixers. When new fixtures are ordered, fixture files will need to be installed on the mixer using the procedure

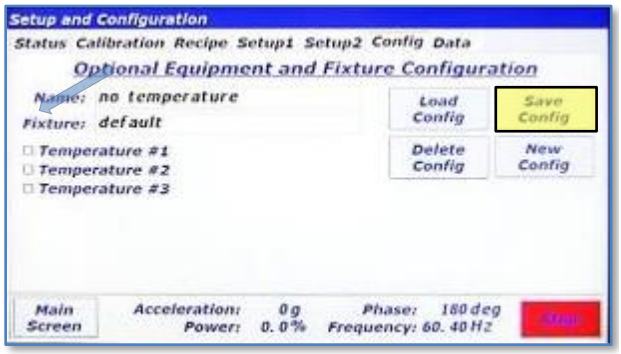
13.7.2 Screen Operations – Create a Configuration

The following walk-through creates a new configuration to use *without* temperature monitoring now that the newly edited default configuration *includes* temperature monitoring.

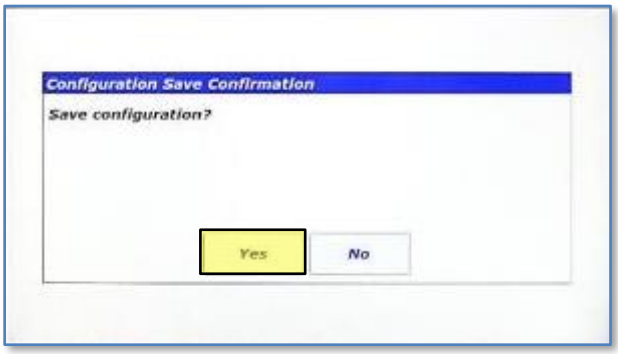


1. Touch the <New Config> button.

2. Enter a name for the configuration and touch <OK>.



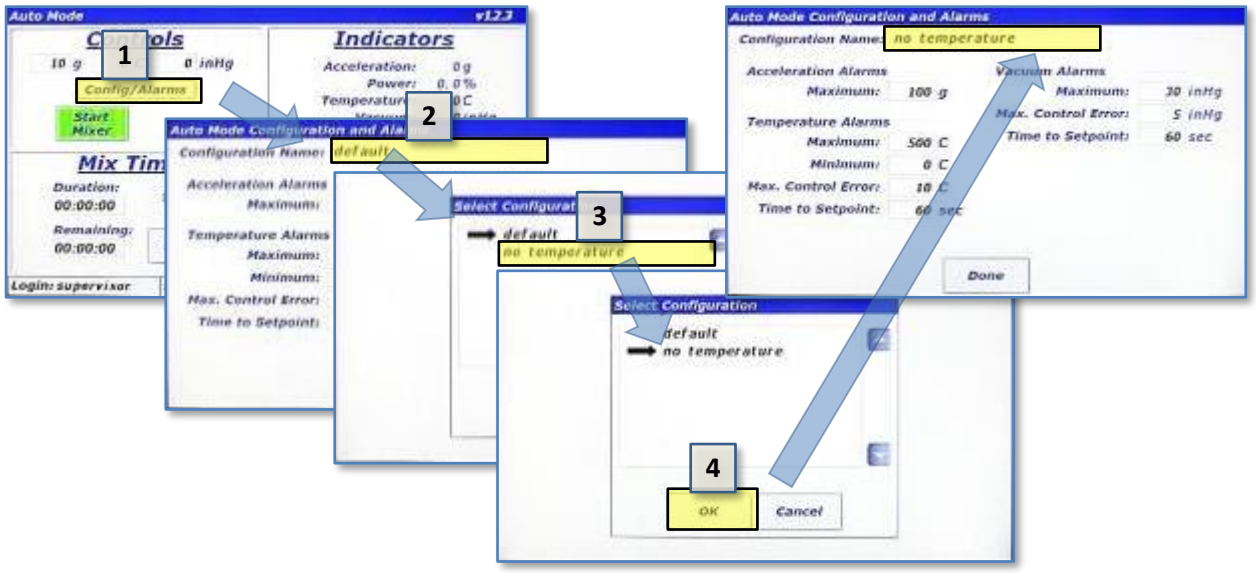
3. Deselect temperature #1. Touch <Save Config> to save this configuration that does *not* use temperature monitoring.



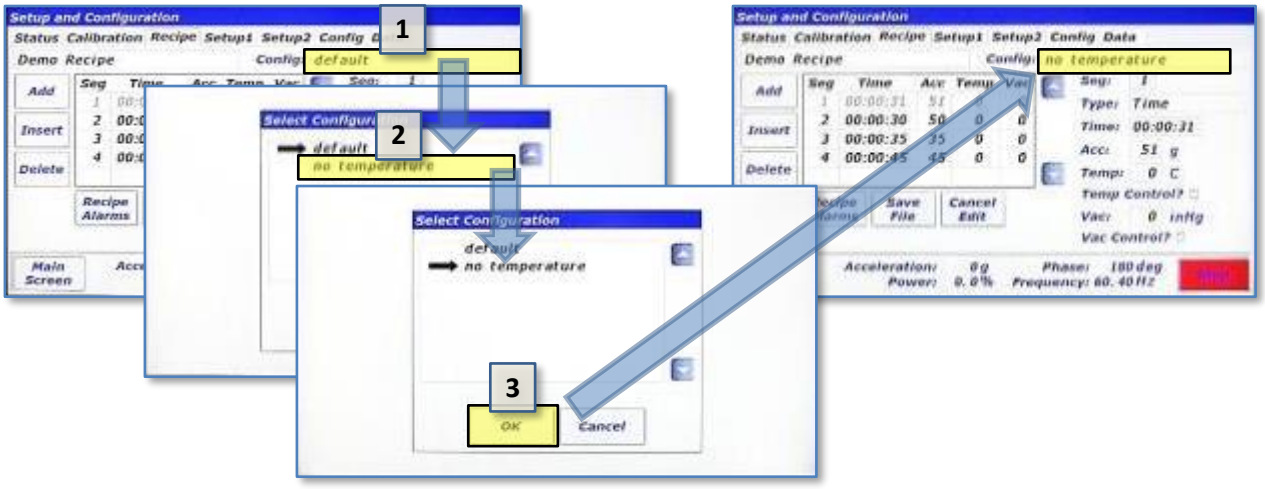
4. Touch <Yes> on the "Configuration Save Confirmation" dialog box.

13.7.3 Configuration Usage

This section will provide a refresher of how Configurations are used. Configurations are used for both Recipe and Auto Mode. In Auto Mode the Configuration is selected by first touching the <Config/Alarms> button in the Controls pane and then selecting the configuration in the "Auto Mode Configuration and Alarms" screen. As illustrated on the next page.



In Recipe Mode, the Configuration is selected as soon as a new recipe is created or by touching the textbox next to "Config:" Refer to the following sequence illustration.



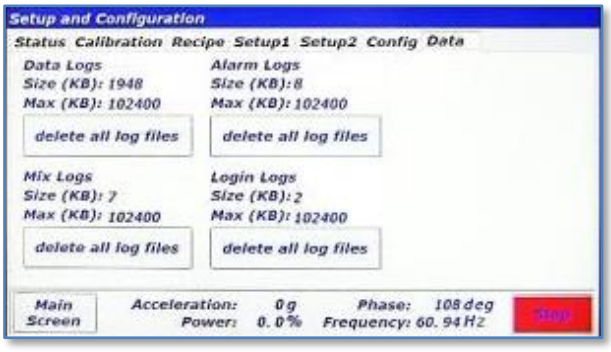
Data Tab

The LabRAM II H stores log files for a variety of purposes. The list below summarizes the files that are captured on the LabRAM II H.

- **Data Logs:** Measured parameters are captured and written to data log files when the LabRAM II H is mixing/accelerating. Measured parameters include acceleration, power, temperatures, voltage/current, and vacuum.
- **Alarms Logs:** Every time an alarm is triggered, cleared, or acknowledged, a message is written to an alarm log file.
- **Mix Logs:** Mix Log files are written to whenever a mix cycle starts or stops. The mix log comment, start/stop time, operational mode, recipe name (if in recipe mode) are all written to the Mix Log files.
- **Login Logs:** Every successful and unsuccessful login attempt is written a login log file.

It is the user's responsibility to manage the size of the log file directories and the Data Tab provides the means to clean up the log file directories. Pressing the <delete all log files> button for any of the log file groups will delete all the files in that directory. Warning alarms will be triggered if any of the directories exceed 100MB (102400kB), and files will be automatically deleted on a new day if any of the directories exceed 200MB.

All log files can be synchronized with a computer using the RAMTools application developed by Resodyn Acoustic Mixers. Contact your Resodyn Acoustic Mixers Customer Service (406-497-5333) to obtain a copy of RAMTools free of charge.



14 Care and Maintenance

Resodyn Acoustic Mixers are manufactured in the US, under a strict quality manual and embedded corporate culture of building world class equipment that is built to last.

To help ensure long life and effective maintenance, it is important to participate in general cleaning and care as indicated below.

14.1 Preventive Maintenance

The bellows can prematurely wear and become damaged if materials can be free in the resonator area. Cleaning of the upper resonator and bellows ensures a long life of the bellows. Clean with a soft, non-abrasive cloth and water.

14.2 Cleaning Procedures

Clean with a soft, non-abrasive cloth and water with slight additives of neutral washing agents (pH 5 – 8). Greasy or oily substances may be removed by rubbing with a cloth wetted with isopropyl alcohol (IPA) or white spirit free of aromatic compounds.

14.3 Accelerometer Calibration

The LabRAM II H acceleration should be calibrated once a year or per the end users specified preventative maintenance schedule or whenever the accelerometer is replaced.

The calibration kit can be purchased or rented from Resodyn Acoustic Mixers.

14.4 Maintenance

The LabRAM II H is designed with few serviceable replaceable parts.

14.4.1 Major Repairs

All repairs inside the enclosure, unless otherwise stated in this manual, should be diagnosed and repaired by Resodyn Acoustic Mixers trained repair personnel only.

All components not listed on the replaceable wear parts or spare parts list should be replaced by Resodyn Acoustic Mixers trained repair personnel only!

	Do NOT attempt to take off the acoustic enclosure because of electrical shock hazards. The high voltage symbol indicates the possibility of electrical shock. Component replacements shall be by OEM parts only and performed only by Qualified Resodyn personnel.

14.4.2 Recommended Maintenance Schedule

The recommended preventative maintenance interval for the LabRAM II H only involves the bellows. The bellows are to be visually inspected weekly and replaced as necessary. Refer to section 14.5.2 Bellows Replacement.

Recommended spare parts to have on hand are listed in Table 14-1 as well as their recommended quantities to have on hand.

Table 14-1. LabRAM II H Spare Parts List.

Description	Part Number	Quantity
Inner Bellows Gasket	102805	1
Outer Bellows Gasket	101899	1
Fuses, 8A, Time Lag (For 100-120 VAC)	002942	2
Fuses, 6.3A, Time Lag (For 200-240 VAC)	004481	2
Cooling Fluid Filter Kit	003277	1

The recommended spare parts list for the temperature measurement option are listed in Table 14-2, as well as their recommended quantities to have on hand.

Table 14-2. LabRAM II H Temperature Measurement Option Spare Parts List.

Description	Part Number	Quantity
RTD Cable	002169	1
6” Length 1/4” Diameter RTD	002899	1
1/4” RTD Ferrule	002996	1

The recommended spare parts list for the vacuum system option are listed in Table 14-3, as well as their recommended quantities to have on hand. Additional vacuum filter sizes are available, please contact your Customer Service (406-497-5333) for more information.

Table 14-3. LabRAM II H Vacuum System Spare Parts List.

Description	Part Number	Quantity
20 meters of 6mm Anti-static Vacuum Line (PTFE)	003285	1
40 µm Vacuum Filter	002825	2
Bleed Gas Vent Filter	002709	1

14.5 Replacement of Serviceable Parts

A few common client serviceable replacement parts are identified. These parts are the fuses, bellows, and accelerometer, and are listed in Table 14-4, as well as their recommended quantities to have on hand, on the following page. The bellows estimated life is greater than 2000 hours and the accelerometer is greater than 2,000 hours.

Table 14-4. Customer Replaceable Parts List

Description	Part Number	Quantity
Accelerometer & Integrated Cable Assembly	102592	1
Inner Bellows Gasket	102805	1
Outer Bellows Gasket	101899	1
Fuses, 8A, Time Lag (For 100-120 VAC)	002942	2
Fuses, 6.3A, Time Lag (For 200-240 VAC)	004481	2
Cooling Fluid Filter Kit	003277	1

14.5.1 Fuse Replacement

The fuses should only be replaced when the machine does not power up, but power is being delivered to the machine.

	Ensure the power to the LabRAM II H is turned off and disconnected before performing any maintenance on the unit.
	Only remove fuse panel if the area is known to be safe/non-hazardous.
	When working on the LabRAM II H system electrical components, a personnel-grounding strap should be affixed to the “Personnel Static Ground” lug located above the purge controller. This will ensure the person working on the LabRAM II H, be of equal potential as the unit.

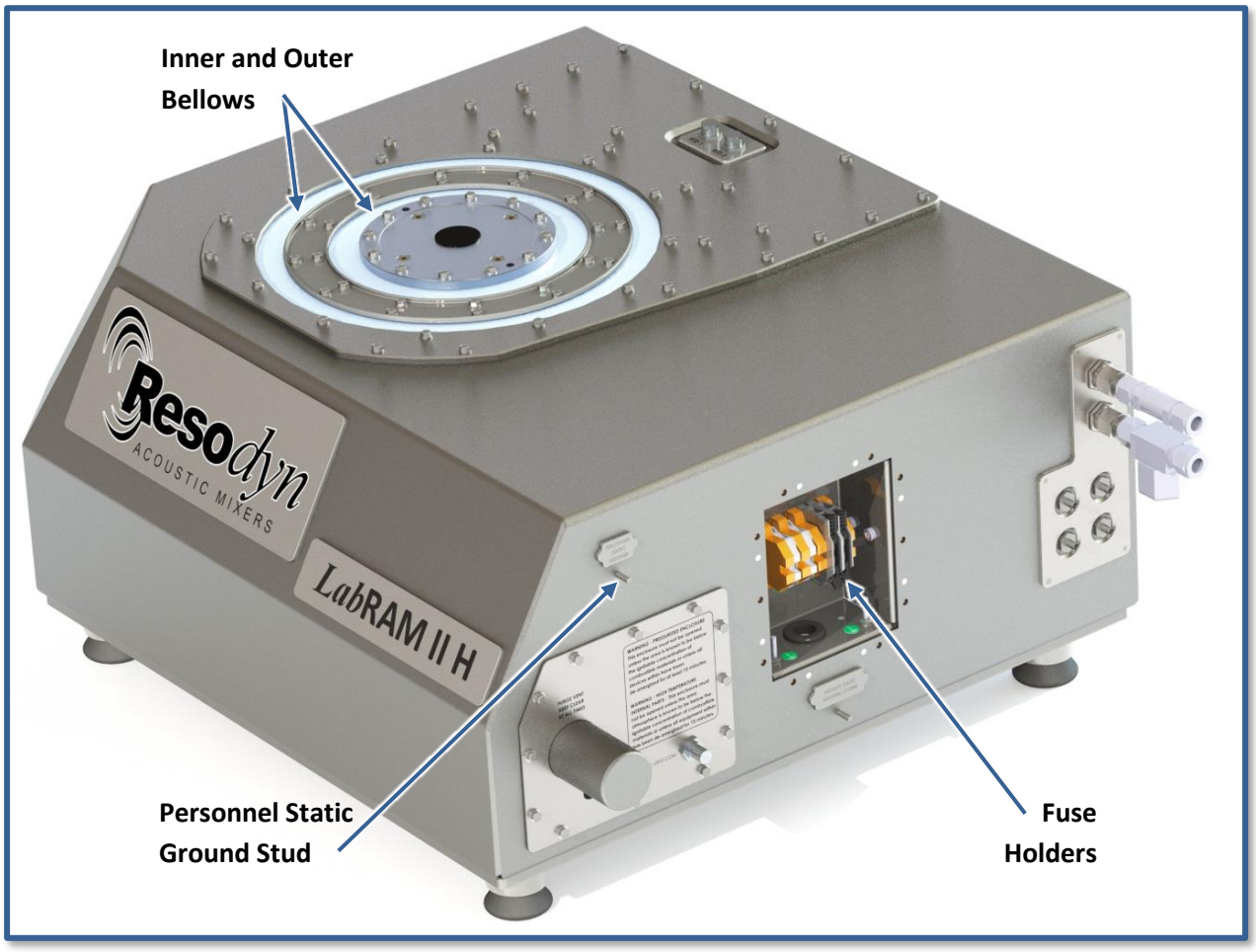
Verify the environment is not hazardous before removing the cover.

The fuses can be replaced by taking off the fuse panel cover by removing ten 10-32 hex bolts using a 5/16” wrench or socket, and then removing the ground wires attached to the fuse panel cover. The fuses can be replaced by pulling out on the fuse holder finger catch, which will rotate the fuse out. Once the fuses are replaced, put the fuse panel back on in the reverse order.

If the machine does not turn on after replacing the fuse, please call Resodyn Acoustic Mixers Customer Service (406-497-5333) immediately.

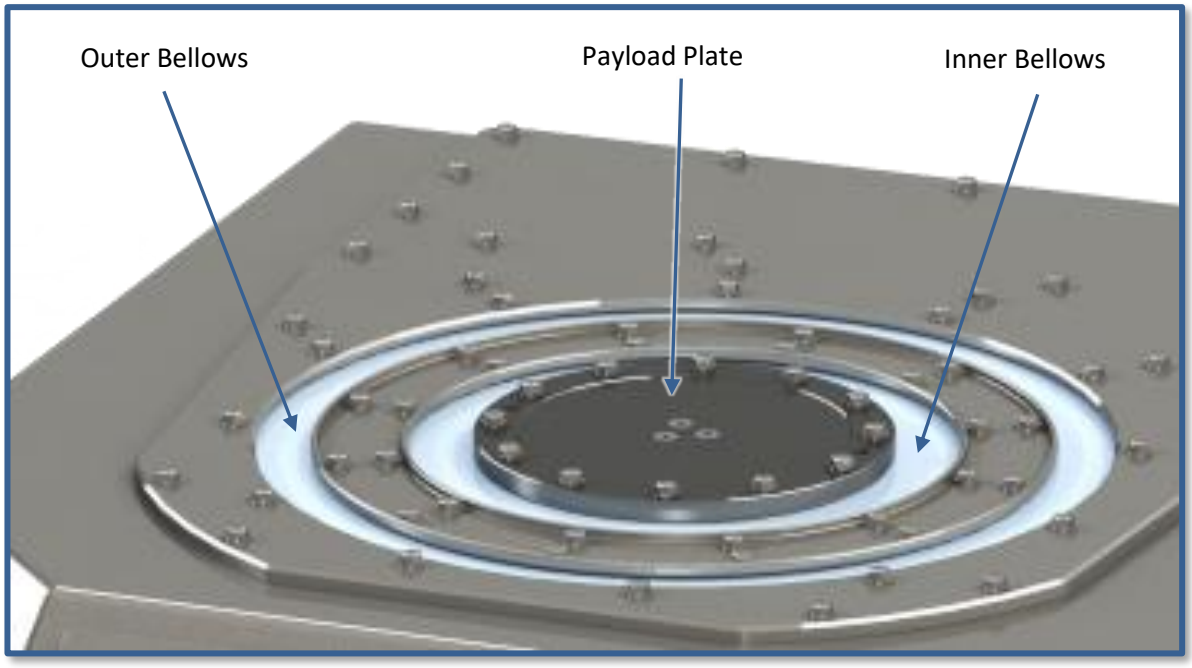
14.5.2 Bellows Replacement

The LabRAM II H is equipped with a sealed inner enclosure that houses the Resonator and Electrical equipment. The interior of the machine is sealed with inner and outer bellows between the moving plates and the enclosure. These bellows are designed for operational life greater than 2,000 hours. Replacement instructions for the bellows are provided separately with the replacement parts when ordered.



14.5.3 Accelerometer Replacement

The LabRAM II H is equipped with an accelerometer that is mounted to the underside of the Payload Plate, shown above. The accelerometer is designed for an operational life greater than 2,000 hours. Replacement instructions for the accelerometer are provided with the replacement part when ordered. When an accelerometer is replaced, the LabRAM II H must be re-calibrated.



Please call Customer Service at 406-4975333 for Accelerometer and Bellows Replacement Installation Kits and Instructions. Note the Serial Number of the machine before calling.

14.5.4 Technical Support for Mixer Operation:

Phone: (406) 497-5333 Fax: (406) 497-5206 e-mail: service@resodynmixers.com	Resodyn Acoustic Mixers 130 North Main, Suite 630 Butte, Montana 59701

15 Troubleshooting and Service

The LabRAM II H systems should only be operated when it is in good working condition. If the system shows any signs of visible damage or fails to operate as outlined in this manual, the system should not be operated.

For operational errors and troubleshooting, refer to the Troubleshooting section.

If necessary, contact your Resodyn Acoustic Mixers customer service representative with questions or additional technical support related to the mixer at 406-497-5333.

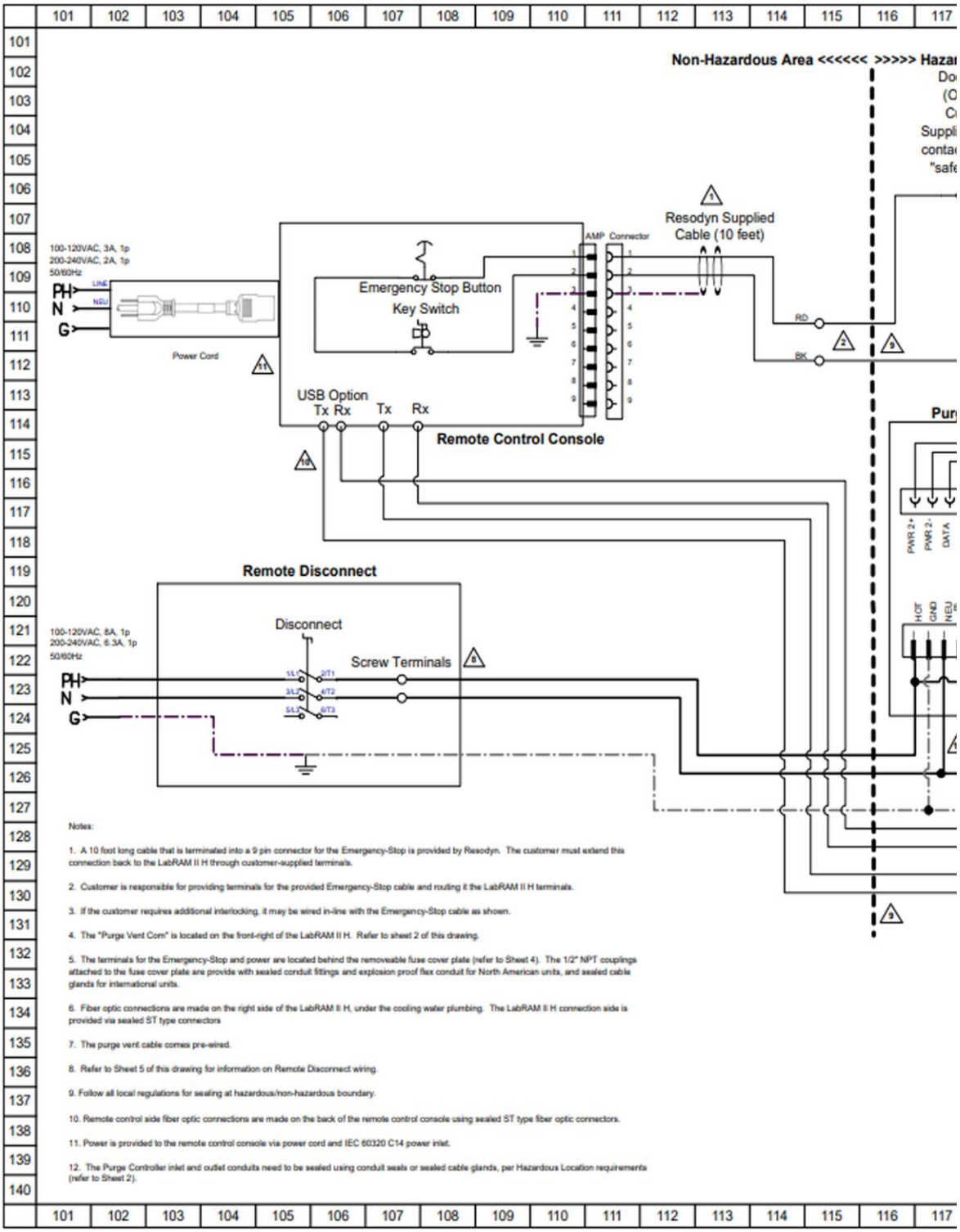
Here are some simple solutions to check before contacting your Resodyn Acoustic Mixers service representative. Use the following chart to resolve common operational events. If the problem persists, contact your customer service representative at the phone number above.

Table 15-1. Troubleshooting Table.

Description of Problem	Potential Problem	Solution
Mixer will not power up	Power turned off	Ensure that the main machine power into the mixer is turned on
	Main fuses blown	Contact Resodyn Acoustic Mixers for replacement fuses
	Remote control power switch off	Ensure that the power switch (located on the back of the remote box above power cord) is in the on position, "**I**"
	Purge controller in error state (red light on purge controller)	Ensure purge air supply is turned on.
	Purge controller is in purge cycle (flashing green light on purge controller)	Wait until purge cycle has completed (solid green light on purge controller)
Broken Accelerometer	Accelerometer cable or accelerometer has failed	Accelerometer and cable assembly must be replaced
Amplifier Over Temperature	Mixer amplifier is too hot	Ensure coolant flow and temperature meet specifications
Enclosure Over Temperature	Mixer enclosure is too hot	Ensure coolant flow and temperature meet specifications
Amplifier Error	Vessel overloaded	Remove mix material until within the maximum specified load limits
	Shorted wire	Contact Resodyn Acoustic Mixers
	Broken wire	Contact Resodyn Acoustic Mixers

Description of Problem	Potential Problem	Solution
Amplifier Over Current	Vessel overloaded	Remove mix material until it is within the maximum specified load limits
	Incorrect fixture file	Ensure that the correct fixture file is being used for the mix
Over Acceleration (g)	Mixer exceeded maximum acceleration	Contact Resodyn Acoustic Mixers
HMI Comms Error	The HMI has ceased to communicate with the main controller	Ensure fiber optic cable is connected to both the LabRAM II H and the Remote Control Box.
	The purge cycle has not completed or is in an error state	Verify that the Purge Controller light is solid green.
Fixture Limit, High Accel. **or** **User Limit, High Accel.**	Accelerometer cable or accelerometer has failed	Accelerometer and cable assembly must be replaced
	Incorrect user limit	Verify user limits are correct
Fixture Limit, High Temp. **or** **Fixture Limit, Low Temp.** **or** **User Limit, High Temp.** **or** **User Limit, Low Temp.**	RTD not plugged in	Verify the RTD is plugged in, or if not in use, ensure Configuration has Temperature #1 unchecked
	Broken RTD or RTD cable	Replace RTD and accelerating portion of RTD cable
	Bad RTD calibration	Verify RTD calibration
	Incorrect user limit	Verify user limits are correct
Fixture Limit, High Vac. **or** **User Limit, High Vac.**	Bad vacuum calibration	Verify vacuum calibration
	Incorrect user limit	Verify user limits are correct
User Limit, Vac. Ctl. Error **or** **User Limit, Vac. Ctl. Time**	Vacuum leak	Check the system for a vacuum leak
	Disconnected vacuum line	Ensure all vacuum lines are connected correctly
Over Accel. at Low Frequ.	Vessel overloaded	Remove mix material until it is within the maximum specified load limits or reduce acceleration
	Incorrect fixture file	Ensure that the correct fixture file is being used for the mix

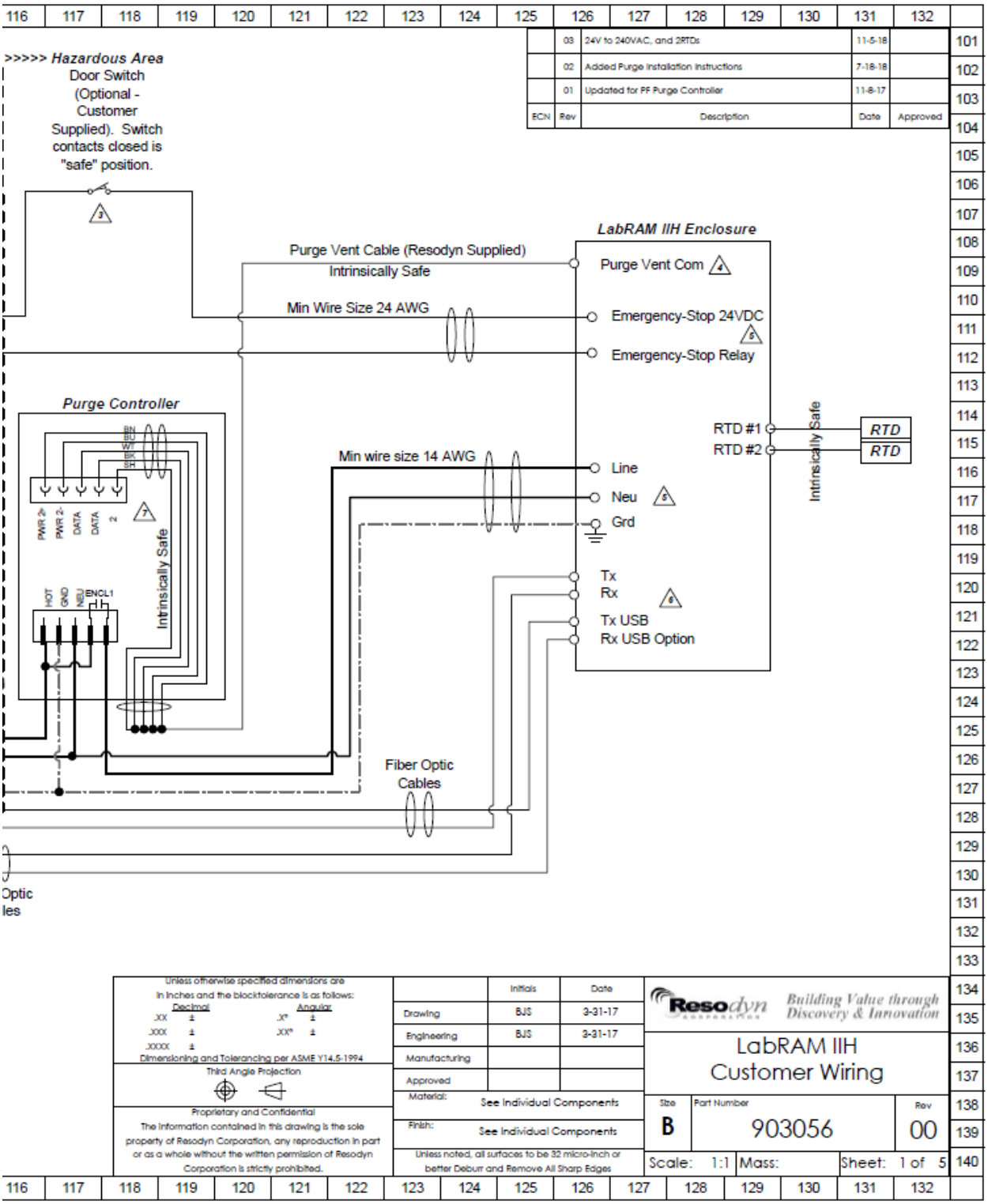
APPENDIX A ELECTRICAL INSTALLATION (NEXT 2 PAGES)



Notes:

1. A 10 foot long cable that is terminated into a 9 pin connector for the Emergency-Stop is provided by Resodyn. The customer must extend this connection back to the LabRAM II H through customer-supplied terminals.
2. Customer is responsible for providing terminals for the provided Emergency-Stop cable and routing it the LabRAM II H terminals.
3. If the customer requires additional interlocking, it may be wired in-line with the Emergency-Stop cable as shown.
4. The "Purge Vent Conn" is located on the front-right of the LabRAM II H. Refer to sheet 2 of this drawing.
5. The terminals for the Emergency-Stop and power are located behind the removeable fuse cover plate (refer to Sheet 4). The 1/2" NPT couplings attached to the fuse cover plate are provide with sealed conduit fittings and explosion proof flex conduit for North American units, and sealed cable glands for international units.
6. Fiber optic connections are made on the right side of the LabRAM II H, under the cooling water plumbing. The LabRAM II H connection side is provided via sealed ST type connectors
7. The purge vent cable comes pre-wired.
8. Refer to Sheet 5 of this drawing for information on Remote Disconnect wiring.
9. Follow all local regulations for sealing at hazardous/non-hazardous boundary.
10. Remote control side fiber optic connections are made on the back of the remote control console using sealed ST type fiber optic connectors.
11. Power is provided to the remote control console via power cord and IEC 60320 C14 power inlet.
12. The Purge Controller inlet and outlet conduits need to be sealed using conduit seals or sealed cable glands, per Hazardous Location requirements (refer to Sheet 2).

(WHITE SPACE EDITED FOR VISUAL CLARITY IN FOLLOWING DRAWINGS)



Step 1:
Remove the six screws from the faceplate of the Purge Controller. Lift the faceplate from the main housing and lay the faceplate to the left of the main housing. Take notice of the ground wire connecting the faceplate to the main housing

Step 2:
Unscrew the explosion proof enclosure cap by turning it counter-clockwise. This will reveal the wiring terminals for incoming and outgoing power.

Step 3:
Install appropriately listed cable/wire seals to both the left and right conduit nipples.

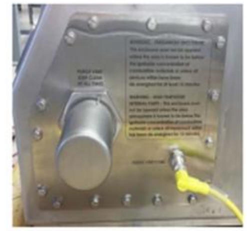
Feed incoming/facility power wiring into one of the conduit nipples and terminate wires per Sheet 1 of this drawing. Torque terminal screws to 5-7 in-lbs (0.6 to 0.8 Nm).

Feed outgoing (to LabRAM II H) power wiring into the other conduit nipple and terminate wires per Sheet 1 of this drawing. Torque terminal screws to 5-7 in-lbs (0.6 to 0.8 Nm).

Replace the explosion proof enclosure cap by tightening it clock-wise.

Step 4:
Re-install the Purge Controller Faceplate. Torque screws to 1 in-lb (0.113 Nm). Failure to do so can leave the unit improperly sealed.

After the system has been validated (in a non-hazardous environment), seal the fittings to ensure compliance with Hazardous Location requirements.



Step 5:
Attach the yellow cable from the Purge Controller to the Purge Vent, mounted on the front-right corner of the LabRAM II H acoustic enclosure.

Unless otherwise specified dimensions are in inches and the block tolerance is as follows:
Decimal: .XX ± / .XXX ± / .XXXX ±
Angular: .X° ± / .XX° ±
Dimensioning and Tolerancing per ASME Y14.5-1994
Third Angle Projection

Proprietary and Confidential
The information contained in this drawing is the sole property of Resodyn Corporation, any reproduction in part or as a whole without the written permission of Resodyn Corporation is strictly prohibited.

	Initials	Date
Drawing	BJS	3-31-17
Engineering	BJS	3-31-17
Manufacturing		
Approved		

Material: See Individual Components
Finish: See Individual Components
Unless noted, all surfaces to be 32 micro-inch or better Deburr and Remove All Sharp Edges

Resodyn Corporation — Building Value through Discovery & Innovation

LabRAM IIH
Purge Contoller

Size: B | Part Number: 903056 | Rev: 07
Scale: 1:1 | Mass: | Sheet: 2 of 5

The Remote Control panel is supplied with a 10 foot cable with flying leads. It is the customer's responsibility to provide terminals for these wires and to route cable/wire between these terminals and the LabRAM II H.

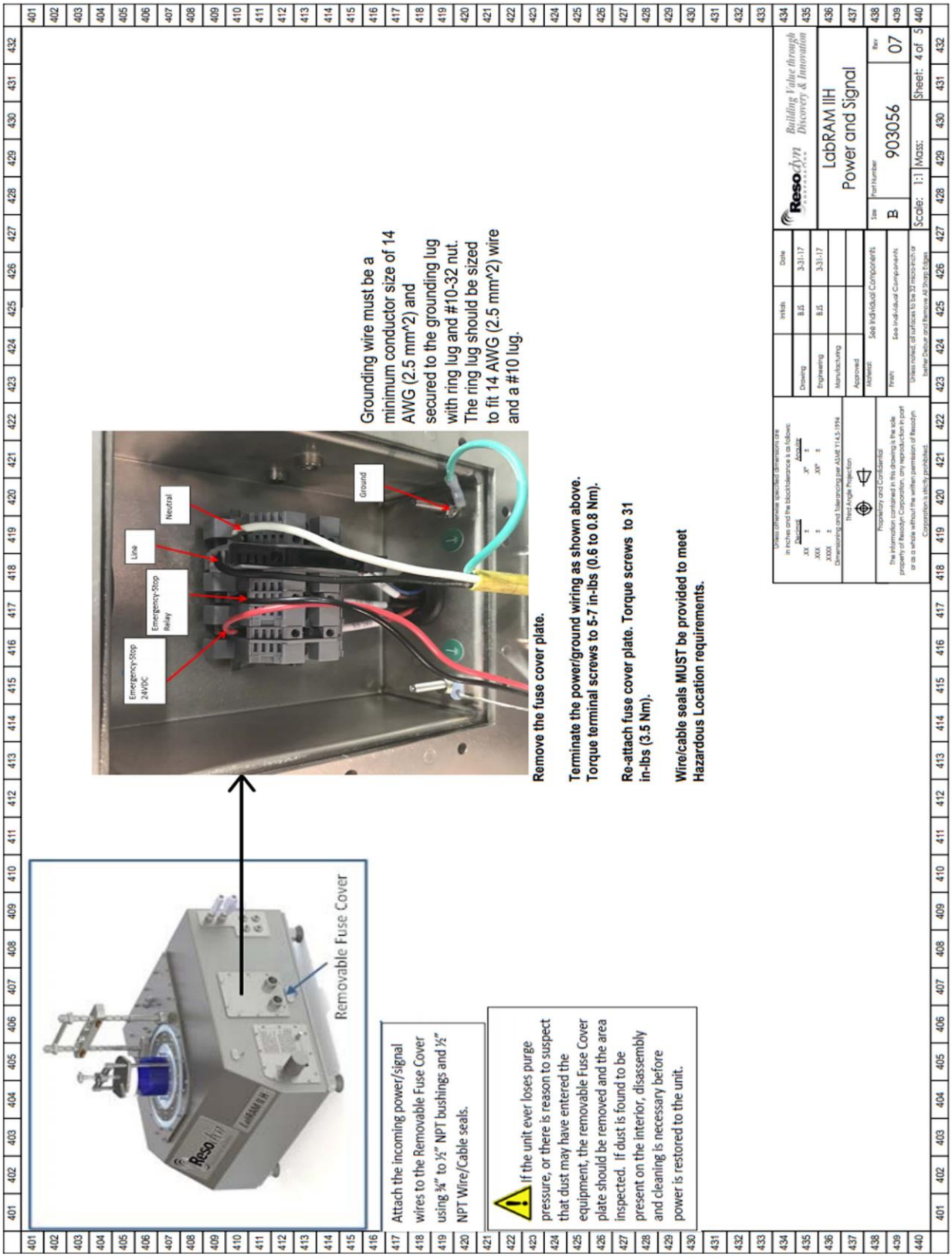
The Remote Control panel is NOT RATED FOR HAZARDOUS AREAS!

Resodyn Building Value through Discovery & Innovation

LabRAM IIH
Remote Control Panel

Size B | Part Number 903056 | Rev 07

Scale: 1:1 | Mass: | Sheet: 3 of 5


Removable Fuse Cover
Attach the incoming power/signal wires to the Removable Fuse Cover using ¾" to ½" NPT bushings and ½" NPT Wire/Cable seals.
If the unit ever loses purge pressure, or there is reason to suspect that dust may have entered the equipment, the removable Fuse Cover plate should be removed and the area inspected. If dust is found to be present on the interior, disassembly and cleaning is necessary before power is restored to the unit.
Emergency-Stop 24VDC
Emergency-Stop Relay
Line
Neutral
Ground
Grounding wire must be a minimum conductor size of 14 AWG (2.5 mm^2) and secured to the grounding lug with ring lug and #10-32 nut. The ring lug should be sized to fit 14 AWG (2.5 mm^2) wire and a #10 lug.
Remove the fuse cover plate.
Terminate the power/ground wiring as shown above. Torque terminal screws to 5-7 in-lbs (0.6 to 0.8 Nm).
Re-attach fuse cover plate. Torque screws to 31 in-lbs (3.5 Nm).
Wire/cable seals MUST be provided to meet Hazardous Location requirements.
Unless otherwise specified dimensions are in inches and the tolerance is as follows:
Drawing
Engineering
Manufacturing
Approved
Material: See Individual Components
Finish: See Individual Components
Proprietary and Confidential
The information contained in this drawing is the sole property of Resodyn Corporation, any reproduction in part or as a whole without the written permission of Resodyn Corporation is strictly prohibited.
Unless noted, all surfaces to be 32 micro-inch or better Deburr and Remove All Sharp Edges
Third Angle Projection
Dimensioning and Tolerancing per ASME Y14.5-1994
Resodyn Building Value through Discovery & Innovation
LabRAM IIH
Power and Signal
Size: B
Part Number: 903056
Rev: 07
Scale: 1:1
Mass:
Sheet: 4 of 5

The Remote Disconnect panel provides a disconnect means for the system, fuses, and surge suppression. Terminate incoming power in the disconnect and terminate the incoming ground to the ground lug provided.

Terminate power to the Purge Controller on the terminals shown in the image above.

The Remote Disconnect is NOT RATED FOR HAZARDOUS AREAS!

Unless otherwise specified dimensions are in inches and the tolerance is as follows:
Decimal ± Angular
XX ± XX° ±
XXX ± XXX° ±
XXXX ±
Dimensioning and Tolerancing per ASME Y14.5-1994
Third Angle Projection

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	Initials	Date
Drawing	B.S	3-31-17
Engineering	B.S	3-31-17
Manufacturing		
Approved		
Material	See Individual Components	
Finish	See Individual Components	

Unless noted, all surfaces to be 32 micro-inch or better Deburr and Remove All Sharp Edges

Resodyn Building Value through Discovery & Innovation

LabRAM IIH
Remote Disconnect

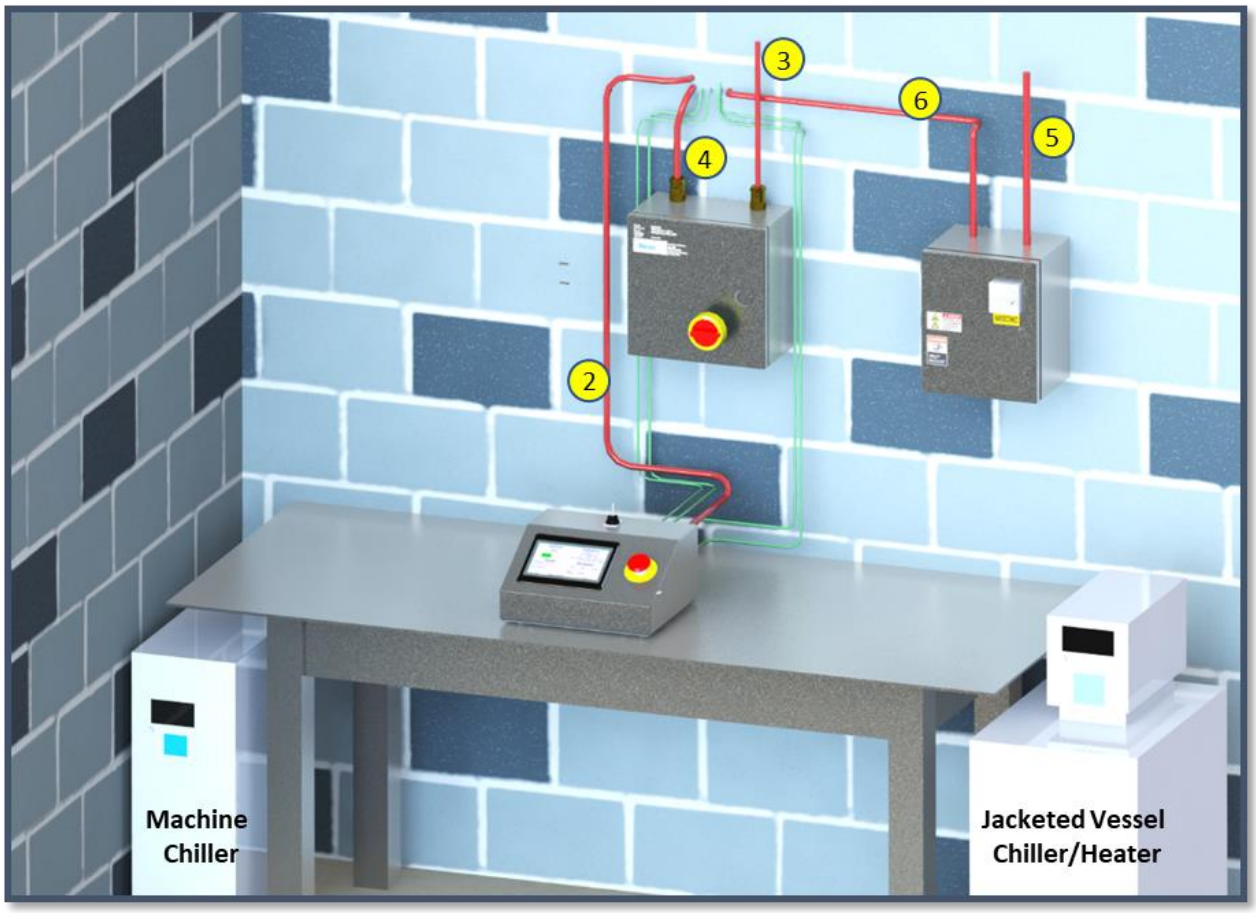
Size: B | Part Number: 903056 | Rev: 07

Scale: 1:1 | Mass: | Sheet: 5 of 5

APPENDIX B COMPONENT ARRANGEMENT

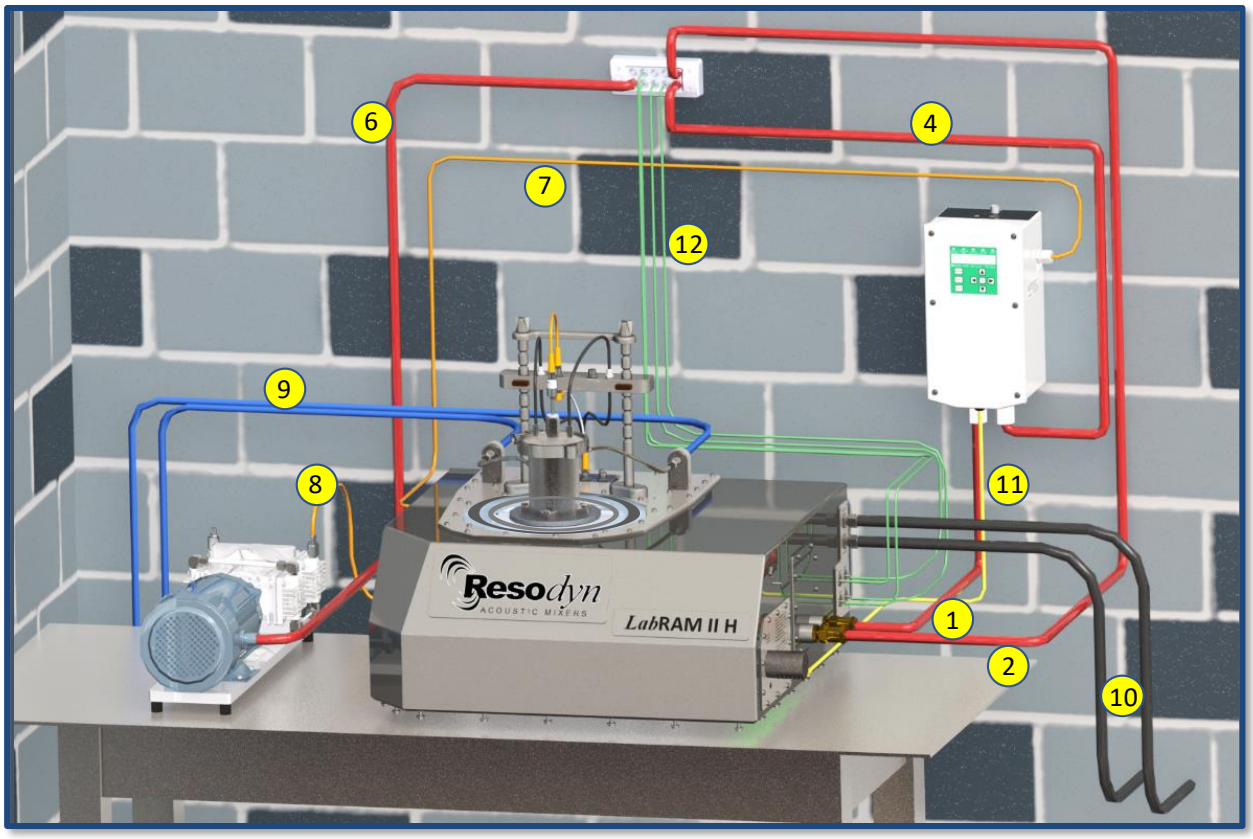
Control Room (Non-Hazardous Area)

US Version



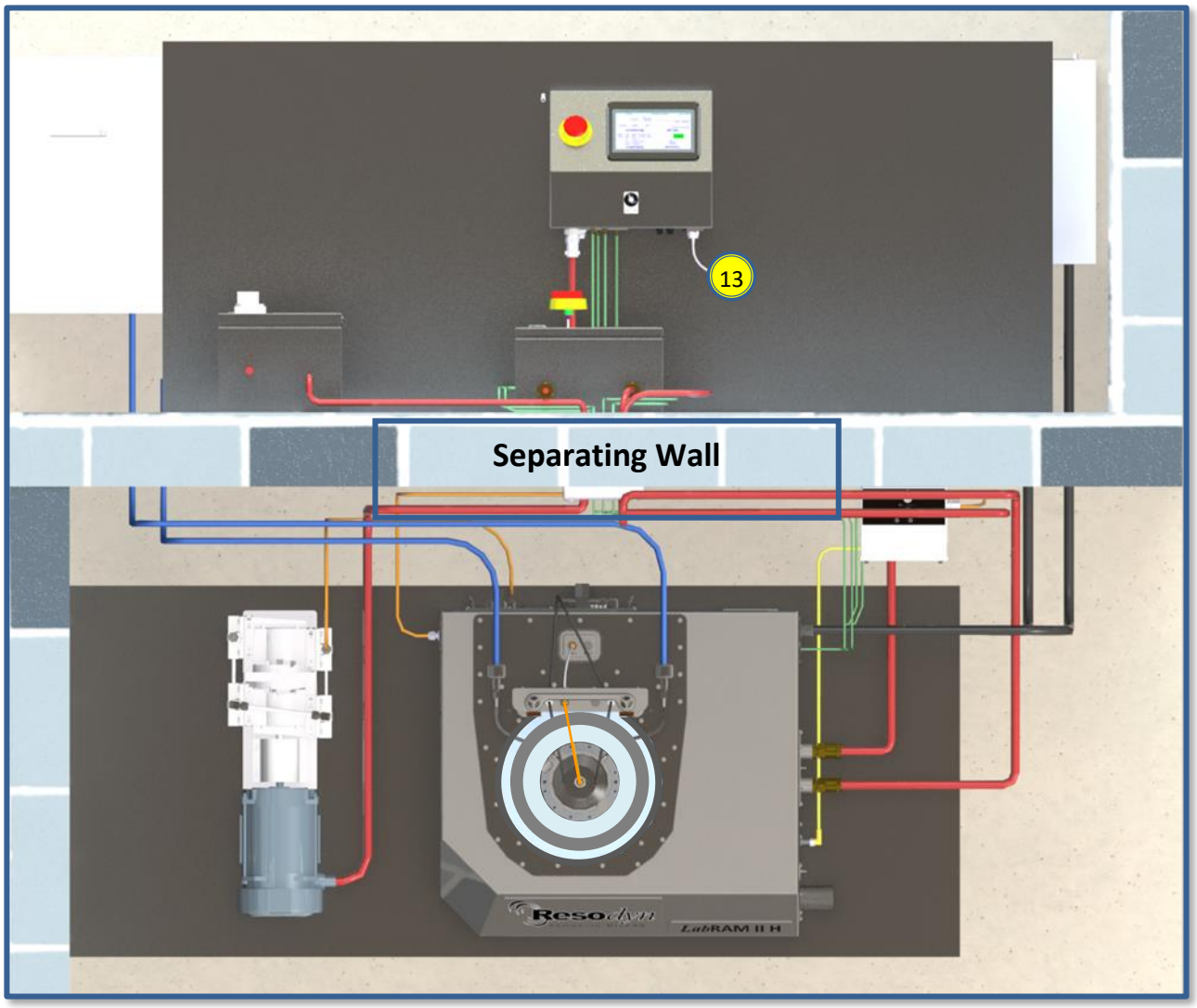
Color	ID	Description	Comments
Red	2	Machine Emergency Stop Cable	10 ft. of bare cable supplied from HMI. 22” of conduit supplied on LabRAM II-H. Customer must supply remaining wiring and conduit.
	3	Disconnect Enclosure Power Supply	Customer-supplied hose / piping
	4	Disconnect Enclosure to Purge Controller	Customer-supplied hose / piping
	5	Vacuum Starter Box Power Supply	Customer-supplied hose / piping
	6	Vacuum Power Cable	Customer-supplied hose / piping

Machine Room (Hazardous Area)



Color	ID	Description	Comments
Red	1	Machine Power Cable	22" of ¾" NPT hazardous conduit supplied on LabRAM II-H. Customer must supply remaining wiring and conduit.
Orange	7	Purge Controller compressed air supply	Customer-supplied hose / piping
	8	Vessel vacuum supply hose	Customer-supplied hose / piping
Blue	9	Jacketed Vessel heating/cooling supply and return hoses	Customer-supplied hose / piping
Black	10	Machine cooling supply and return hoses	Customer-supplied hose / piping
Yellow	11	Purge Controller communication cable	Supplied by Resodyn
Green	12	USB and Serial Fiber Optic Cables (Total 4)	Supplied by Resodyn Customer must specify length of cable
White	13	Remote HMI Power Cable	Customer-supplied cable

Electrical/Plumbing Connections



Color	ID	Description	Comments
White	13	Remote HMI Power Cable	Supplied by Resodyn

Table Information for International Machine Installations

Color	ID	Description	Comments
Red	①	Machine Power Cable	½" NPT hazardous rated gland and 100 ft of cable provided. Customer must supply remaining conduit.
	②	Machine Emergency Stop Cable	½" NPT hazardous rated gland and 100 ft of cable provided. Customer must supply remaining conduit.
	③	Disconnect Enclosure Power Supply	Customer-supplied hose / piping
	④	Disconnect Enclosure to Purge Controller	Customer-supplied hose / piping
	⑤	Vacuum Starter Box Power Supply	Customer-supplied hose / piping
	⑥	Vacuum Power Cable	Customer-supplied hose / piping
Orange	⑦	Purge Controller compressed air supply	Customer-supplied hose / piping
	⑧	Vessel vacuum supply hose	Customer-supplied hose / piping
Blue	⑨	Jacketed Vessel heating/cooling supply and return hoses	Customer-supplied hose / piping
Black	⑩	Machine cooling supply and return hoses	Customer-supplied hose / piping
Yellow	⑪	Purge Controller communication cable	Supplied by Resodyn
Green	⑫	USB and Serial Fiber Optic Cables (Total 4)	Supplied by Resodyn Customer must specify length of cable
White	⑬	Remote HMI Power Cable	Customer-supplied cable


RAM 55
OmniRAM
RAM 5 H
LabRAM II
LabRAM I
LabRAM II H