



***LabRAM I***  
**Installation  
and User  
Manual**



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## Revision History

Periodically, as required, this manual will be updated to correct errors and document added features. Table 1 documents the revision number, description, and release date.

Revision	Description	Date
Rev 1.0.080719	Initial Release	7 August 2019

**Table 1 Manual Revision History**

# 1 Safety

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




## 1.1 General Safety Considerations

For safe operation, the LabRAM I must be operated only within the limits outlined in the system specifications. The following classifications define acceptable use for the LabRAM I.


- Indoor use only.
- Main supply voltage fluctuations are not to exceed  $\pm 10\%$  of the nominal supply voltage.
- This equipment is suitable for continuous operation.
- For use in non-hazardous environments as classified by the United States National Electrical Code (NEC).

## 1.2 Warnings and Cautions


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

	<p>The caution symbol indicates a potentially hazardous situation which could result in minor injury or damage to the product.</p>
	<ul style="list-style-type: none"> <li>• The high voltage symbol indicates the possibility of electrical shock.</li> <li>• This symbol means to turn off the electrical supply before removing any cover with the symbol attached. Failure to do so may cause exposure to electrical shock hazard.</li> <li>• Access to electrical components should only be carried out by a licensed electrician or qualified electrical engineer.</li> <li>• <b>NEVER</b> attempt to modify any electrical components or circuits as this may affect the safe operation of the machine.</li> </ul>
	<p>Electrostatic Discharge (ESD) sensitive components.</p>


### 1.3 Important Safety Notes

	<p>This equipment should only be operated by trained and qualified personnel.</p> <p>Mixing operations can generate heat and internal pressure depending on the material and mixer accelerations. Do not mix materials longer than what has been characterized as safe.</p> <p>Do not attempt to run the machine without a Vessel Holder secured to the resonator plate, and a properly installed vessel. Equipment damage may result.</p> <p>Do not disable or tamper with any safety items, such as safety interlock switches, located on the LabRAM I system.</p> <p><b>NOTE:</b> Changes in noise level or frequency are common during mixing operations. If rattling, metal-on-metal, or obnoxious noises occur, turn off the LabRAM I and call or email Resodyn Acoustic Mixers Technical Support at +1-406-497-5333 or <a href="mailto:service@resodyn.com">service@resodyn.com</a></p>
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### 1.4 Location Advisory

	<p>The LabRAM I system is designed to be operated in non-hazardous environments.</p> <p>The LabRAM I system is protected by an IP20 enclosure which is not rated for operation in dusty environments.</p> <p>The LabRAM I system is rated for operating in ambient environments between 0°C – 40°C (32°F – 104°F).</p>
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### 1.5 Component Replacement

	<p>Non-factory replacement parts may not meet the LabRAM I operating requirements, which may compromise the safety of the operating personnel and may cause damage to the equipment.</p>
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The LabRAM I system is designed with components that are specifically rated for use with the LabRAM I machine. Replace worn or damaged components only with 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.

### 1.6 Customer Responsibility


Ensure that:

- All operators have received the correct training to operate the mixer.
- All operators have read and understood this *Installation and User Manual*.
- Only a qualified electrician performs electrical maintenance.
- Repairs to LabRAM I only by Resodyn Acoustic Mixers Service Engineers or via return to Resodyn after receiving a Return Authorization number.

## 1.7 Guards and Safety Devices

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

## 1.8 Handling/Lifting

	<p>The LabRAM I mixer weighs 180 lb. (82 kg) with no payload or additional options. For safe lifting and transporting of the mixer, it should be lifted by at least four (4) people via the handles and lift points on each side, as shown below.</p>
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The LabRAM I mixer weighs 180 lb. (82 kg) with no vessel holder, payload, or additional options. The mixer should be lifted by at least four (4) people, one on each side. The two primary lifting positions are on the left and right-hand sides of the LabRAM I machine where retractable, integral lifting handles are located (Figures 1 and 2 below). Two remaining personnel can assist in lifting the LabRAM I mixer at the front and back base plate next to the machine feet. Exercise caution when lifting and moving the LabRAM I to avoid striking other objects.

There is ~1 ½" (~38 mm) clearance under the LabRAM I. This space allows clearance for fingers, and for the retractable handles to be securely positioned under the machine when not in use. The images below show the recommended locations for lifting the mixer using a combination of base plate handholds and retractable handles.

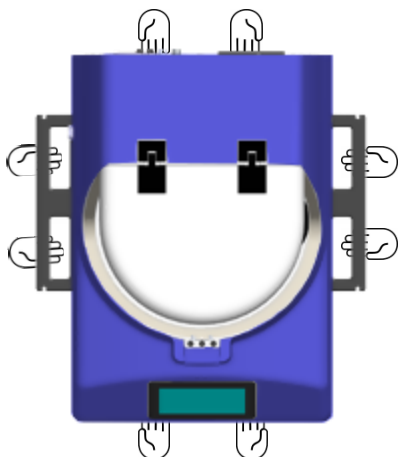


Figure 1 – Overhead View, lifting positions and handles

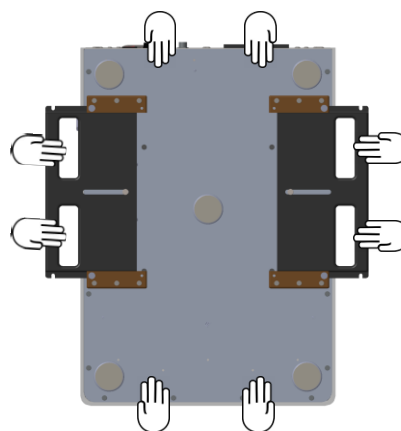


Figure 2 - Underside View, lifting positions and handles

**Do not** lift using any location other than the retractable handles and the mixer's baseplate handholds as indicated above. Lifting it any other way may cause damage to the LabRAM I mixer and may result in personal injury.

## 2 ResonantAcoustic® Mixing (RAM) Basics

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

RAM Technology Delivers:

- Exceptionally uniform mixing and/or processing of virtually any materials.
- Significantly faster mixing and processing 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.

### How RAM Works

The primary 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 way to describe this is the acceleration of gravity 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  $\sim 9.81$  meters per second squared.

Acceleration is generated by the 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, and intense, yet generates 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. This 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 the energy from the system motors is applied directly to the materials being mixed and/or processed, resulting in a highly 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, the impedance to the system changes as well, requiring 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**

The RAM 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
- processed material fill height of the vessel
- order of material added to the vessel for some processes.

For more information on the basics and practice of RAM technology, visit the Resodyn Acoustic Mixers website at <https://resodynmixers.com>, or contact Technical Support (see Section 5 Technical Support).

### **How RAM Processing Scales**

The processing settings used for the same material perform similar across all RAM technology platforms, no matter the scale. This means that a finding of optimal settings on the bench scale LabRAM I or LabRAM II mixer will be nominally equivalent to settings on the OmniRAM, RAM 5, or RAM 55 mixers to process the same materials. As such, transitioning from discoveries made in the laboratory to the pilot or production scale is seamless for most processes.

### 3 Definitions

Acceleration:	A change in velocity with respect to time that is expressed in “g.” Different materials mix at different accelerations, based on the material properties and other factors. (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 force applied to the vessel and materials during mixing. For example, 10 g is 10 times the force of gravity. It may also be shown as g. Another term that may be used to describe acceleration is “gravities.” (See “Acceleration” above.)
HMI:	Human Machine Interface. The control and input system screen used to operate RAM Mixers. Also called an operating system.
Headspace:	The volume of compressible air, gas, or void space above the mixing media in the vessel that is not occupied.
Impedance:	See “Damping” above.
Mix Media:	The material inside the mixing vessel.
Mixing Power:	The amount of power being delivered by the RAM system to perform mixing.
Mixing Regime:	This term identifies certain modes of mixing. The mixing regime defines the bulk flow pattern of the ingredients 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 then across the top and down the sides. Another mixing regime, for example, is characterized by a thick paste that does not couple with the vessel sides.
RAM:	ResonantAcoustic® Mixing or ResonantAcoustic® Mixer.
RAMWare:	Control software and its versions that run on a Personal Computer (PC) and provides control to, and feedback from, the mixing process.
Resonance:	The frequency (nominally 60 Hz) at which the RAM mechanical system operates in the most efficient manner.
Vacuum:	Internal vessel pressure that is less than atmospheric pressure

## 4 Installation

### 4.1 Unpacking, Lifting, and Placing LabRAM I



The LabRAM I mixer weighs 180 lb. (82 kg) with no vessel holder or additional options. For safe lifting and transporting of the mixer, it should be lifted by at least four (4) people via the handles and lift points on each side as shown in Section 1.8 Handling/Lifting on the previous page.

Upon receipt of the LabRAM I, do not unpack or remove any packaging materials until the carton has been positioned as close to the installation location as possible. When in position, remove all wrapping and strapping, and file shipping paperwork for your records.

*Retain all packaging material for at least one year in case mixer transportation or shipment for factory service is necessary. Original packaging is required for service shipment during the warranty period and is highly recommended for any shipment performed during the life of the product.*

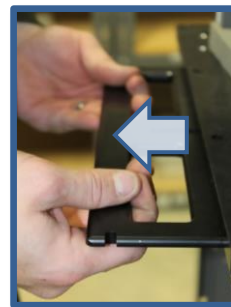
- Open the top of the box and remove any packing materials, bubble wrap, or other items. When all packaging material is removed, slide the packaging box/sleeve up and over the LabRAM I. The LabRAM I should be the only remaining item, resting on cushioning bags in a corrugated tray on the shipping pallet.
- Make sure to remove any loose packaging material from the area, and check for tripping hazards before attempting to move or install the LabRAM I.
- With a minimum of four people lifting at all four lifting locations, and using appropriate safe lifting practices, lift the LabRAM I straight up and carry to its installation location. See Section 1.8 Handling/Lifting on the previous page for lifting locations.
- When placing the LabRAM I at its location, allow enough room around the machine to complete the installation, route wires and tubing, and allow for working space, etc.

## 4.2 Using the Retractable Handles

Retractable handles are located on both sides of the LabRAM I, installed in the base plate and conveniently out of the way when not in use.

When you are prepared to lift and place the machine:

1. Locate the locking pins on either end of the handle brackets.



2. Pull straight down to release the locking pins while pulling the handles horizontally toward you until they click-lock into the open, lifting position. Make sure the locked position is attained before attempting to lift.
3. Reverse the procedure when the LabRAM I has been placed in its intended position. The locking pins will automatically click-lock back in place when the handles are fully stowed back under the machine. Make sure the locked position is attained before using the mixer.
4. Check for any blockage below the machine if the handles do not smoothly slide to their locked storage position.

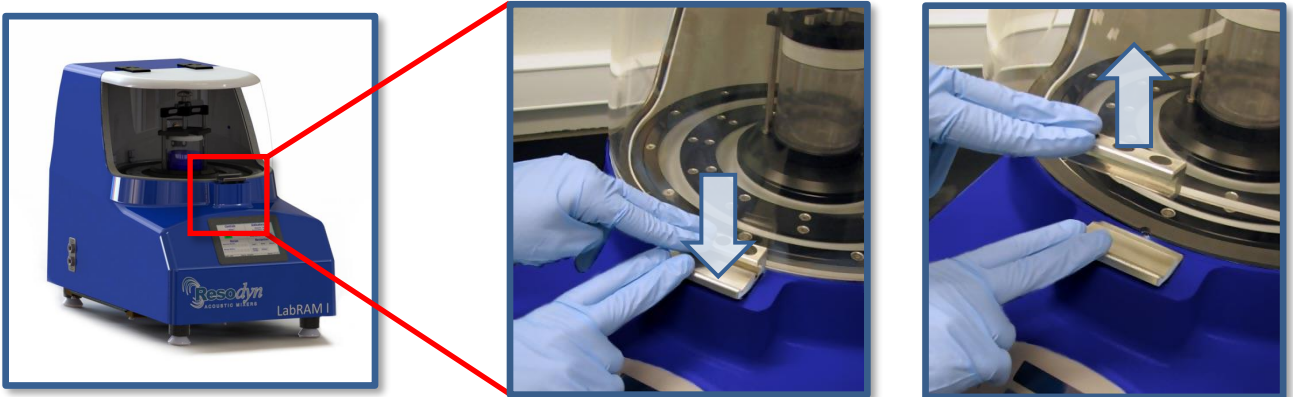
## 4.3 Mounting

The LabRAM I should be installed on a level, stable, and rigid surface capable of supporting the machine weight of 180lbs (82kg) plus the weight of the vessel holder, vessel, and mix payload. If other equipment or materials are to be placed or used on the same surface, a higher weight rating should be used as appropriate.

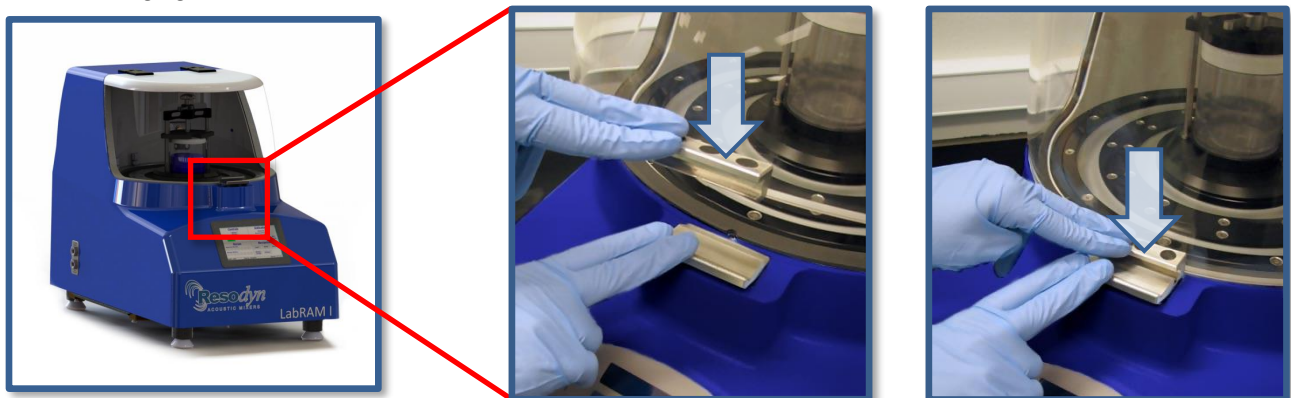
ResonantAcoustic® Mixing (RAM) technology imparts near-zero forces in addition to the machine's weight to the surface on which it is mounted. Careful placement and leveling of the surface by a qualified technician are recommended, as is a periodic inspection of the position and condition of the surface. Surrounding instruments and accessories should be considered in an overall placement plan. Contact Resodyn customer service with any questions regarding appropriate mounting surfaces and your placement plan at +1-406-497-5333 or email [info@resodyn.com](mailto:info@resodyn.com).

#### 4.4 Lid Operation

1. To access the mix platform, mixing chamber, and install the vessel holder, press down firmly on the latch located on the front of the mixer, above the HMI. The lid will release, and gently open automatically via the lift-assist cylinder.



2. To close the lid, pull the lid down with one hand while holding the latch open with the other.
3. Push downward on the lid until the lower edge of the lid bracket has cleared the upper edge of the latch, and then release the latch. Check to confirm the latch is securely engaged.



**NOTE:** The lid is equipped with a Safety Interlock Switch. If the lid is not fully secured, the LabRAM I will not operate. If the lid is opened while mixing, the mixer will stop.



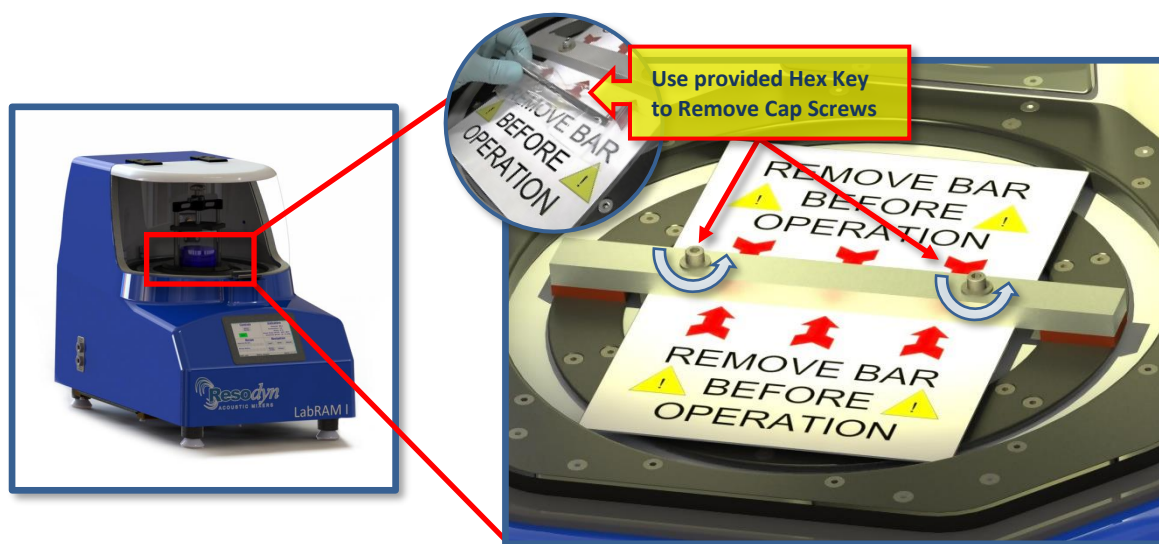
Do not attempt to override the Safety Interlock Switch as serious injury may result. During operation the Payload Plate, Driver Plate, Fixture, and Vessel move up and down rapidly, accelerating up to 100 g at nominally 60 times per second. Serious bodily injury is possible if one comes into contact with these moving surfaces.

## 4.5 Remove the Shipping Lock Bar

The LabRAM I is shipped with a Lock Bar that secures the resonator during transportation. The Lock Bar **must** be removed before proceeding with installation or attempting to operate the LabRAM I.

1. Open the lid and remove the 3/16" Hex Key from its shipping bag attached to the Warning Label. Use the Hex Key to remove the two ¼-20 Socket Head Cap Screws securing the Lock Bar.
2. Lift the Lock Bar off the platform and retain it along with screws for future re-positioning or transport of mixer. A black-padded Resodyn case is provided for your documentation, manuals, and other materials, like the Lock Bar and hardware.

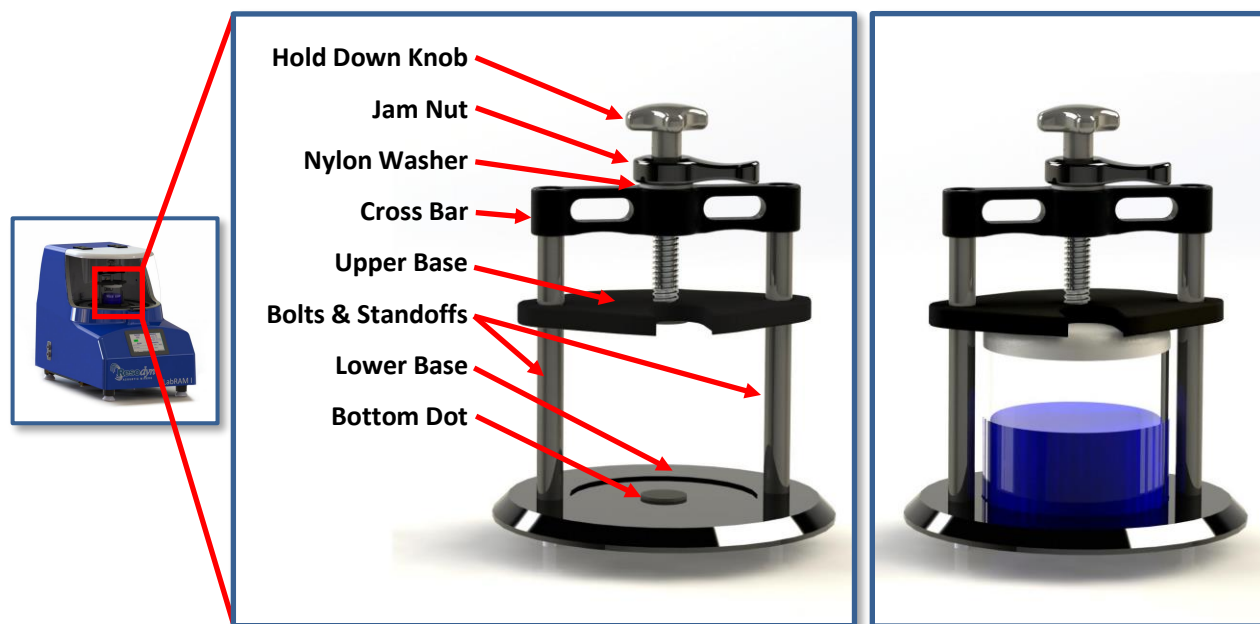
Once the Lock Bar has been removed, the Vessel Holder assembly can be installed using the instructions that follow.



## 4.6 Install Vessel Holder Assembly

1. Remove the Vessel Holder Assembly from the accessory box accompanying the shipment. The Vessel Holder ships loosely assembled.

**NOTE:** The Vessel Holder is shipped with nuts fastened to the bottom of the ¼-20 socket head cap screws. These nuts hold the Vessel Holder together during shipment. Prior to installation, remove the nuts and store them with the other hardware. Do not remove the cap screws or change the configuration of the components until familiar with the parts and the assembly.



**Figure 3 Vessel Holder & Vessel Holder with Mixing Vessel**

2. Follow the positioning and sequence below for installation, or if reassembly or vessel holder movement is needed in the future.
3. 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 Top Cross Bar, Upper Base, Standoffs, and Lower Base as shown.
4. Thread the two ¼-20 socket head cap screws into the mix platform loosely, alternating between screws. When fully-seated, torque each cap screw to 8 ft-lb (10.8 Nm) using a 3/16" Hex Wrench tool.



On its highest setting, the LabRAM I mixer payload operates at 100 g of acceleration. The vessel holder screws must be torqued to 8 ft-lb (10.8 Nm) to prevent the Vessel Holder and Vessel from loosening during operation.

All Vessel Holder assemblies will match a hole pattern in the Top Plate of the LabRAM I. The mounting hole pattern for the standard 4" Vessel Holder is ¼-20 threads measuring 4.375" (111.13 mm) center-to-center. See the detailed illustration below for the position of these mounting holes.

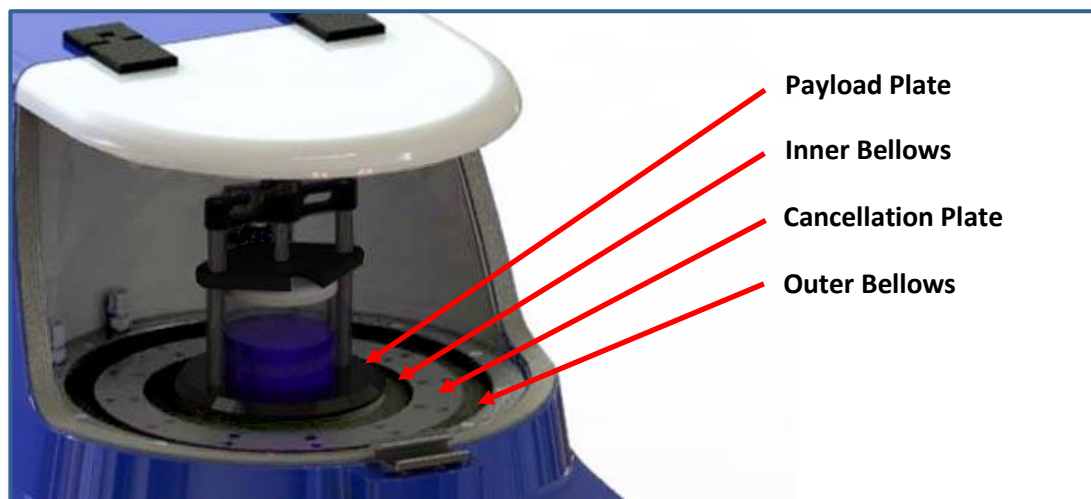


**Figure 4 Payload Plate Mounting Hole Locations**



*Only* use the Vessel Holder Mounting Holes, shown in Figure 4, to mount the Vessel Holder to the LabRAM I. Never use the mounting holes for mounting any other equipment to the LabRAM I.

Never use other screw locations on the Payload or Cancellation Plates, see Figure 5, to mount any other equipment. Never allow hardware to span from the Payload Plate to the Cancellation Plate. Failure to comply is likely to damage the LabRAM I.



**Figure 5 Resonator Platform Components**

## 4.7 Electrical Connections

Electrical power is supplied to the LabRAM I through the provided cord which inserts into the Power Cord Socket on the back panel of the LabRAM I. Plug the other end into a power receptacle delivering 100-120 VAC or 200-240 VAC.

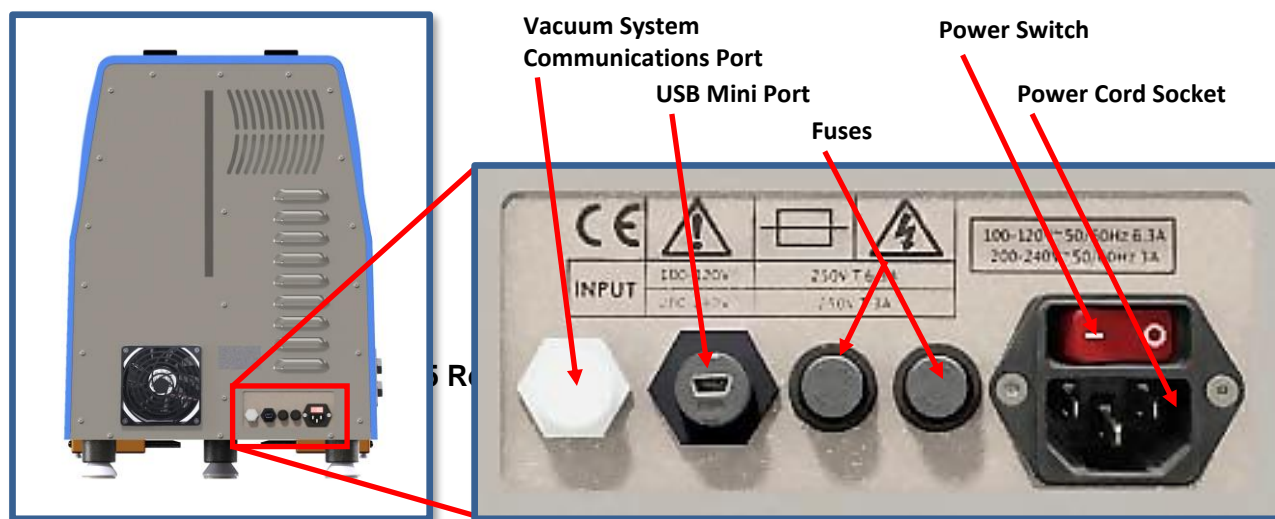


Figure 6 LabRAM I Back Panel

**NOTE:** The cord and fuse ratings for supported voltages are as follows: 10 Amps for 100-120 VAC and 8 Amps for 200-240 VAC.

## 5 Technical Support

Every effort is made to ensure your LabRAM I is intuitive to use, and that it provides a long life of reliable operation. If you have questions about its operation, or if your LabRAM I appears to be malfunctioning, please do not hesitate to contact Resodyn Acoustic Mixers. You may contact your customer service representative directly or utilize the general contact information provided below.

### Technical Support Contact Information:

Phone:	+1-406-497-5333	Resodyn Acoustic Mixers, Inc. 130 North Main, Suite 630 Butte, Montana 59701 USA
Fax:	+1-406-497-5206	
Email:	<a href="mailto:service@resodynmixers.com">service@resodynmixers.com</a>	
Web:	<a href="https://resodynmixers.com/support">https://resodynmixers.com/support</a>	

**NOTE:** Please do not ship any products back to Resodyn Acoustic Mixers without express authority, and a Return Authorization (RA) number from your customer service representative. Any shipments made to Resodyn without an RA number clearly written on the shipping container will be refused.

## 6 System Specifications

The LabRAM I is equipped with the following external electrical connections:

- AC Power Cord Inlet
- Mini USB
- Communication Connector for Automatic Vacuum System

All external connections are found in the back panel of the LabRAM I machine. See Figure 6 on Page 17 for a detailed illustration.

**Table 6-1. LabRAM I System Specification.**

Maximum Payload Capacity	1.1 lb (500 gram)
Sound Emitted	<70 dB at 3' at 100 g with an empty vessel
Vessel Temperature Monitoring	1 RTD monitored and recorded (optional)
Automatic/Programmable Vacuum	Yes (optional)
Data Logging	Yes
Computerized Operator Interface (HMI)	Yes
Weight	180 lb (82 kg) plus vessel holder fixture
Dimensions	18" wide x 26" deep x 25" high
Electrical @ 50/60 Hz, CE Certified	100-120 / 200-240 VAC

### 6.1 Voltage Level

The LabRAM I is designed to utilize single-phase 100-120 or 200-240 VAC 50Hz/60 Hz supply for use worldwide.

### 6.2 Power Consumption

The LabRAM I is designed to be energy efficient by operating at a resonant condition when mixing. Depending on the acceleration setpoint, vessel selection, and mix media, the LabRAM I will draw between 80 and 1200 Watts

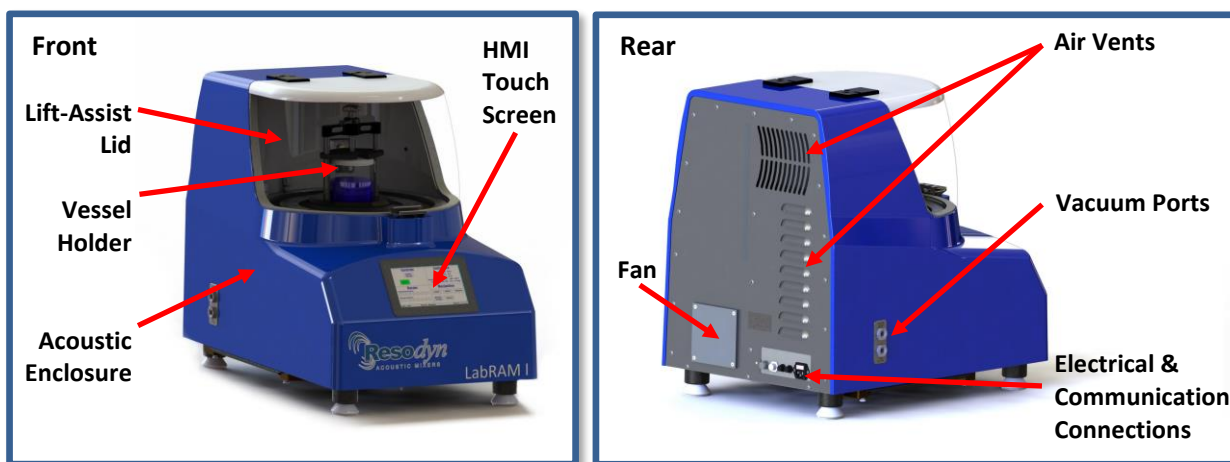
## 7 System Overview

The LabRAM I is a ResonantAcoustic® Mixer (RAM) specifically designed and manufactured for use in processing up to 1.1 lb (500 g) of materials per batch. The LabRAM I is a highly versatile mixing system designed for laboratory and development environments. The mixer is equipped with proprietary mixing control circuitry and an acoustically insulated, compact enclosure, enabling powerful, yet quiet operation.

Features include an adjustable Vessel Holder, Safety Interlocked Lift-Assisted Lid with viewing window, and a Touch Screen Human Machine Interface (HMI). Optional features include RTD temperature monitoring, Manual & Automatic Vacuum System integration, and custom Vessels and Vessel Holders.



**Figure 7 External Dimensions**




**Figure 8 LabRAM I External Features**

The LabRAM I delivers energy to the material being mixed by moving the mixing vessel up and down, 60 times a second, at up to 100 g of acceleration.

## Acoustic Enclosure

The acoustic enclosure surrounds the resonator system. The enclosure reduces the sound emitted by the LabRAM I and covers all the moving parts that could pose a risk to operators.

	<p>During operation the Payload Plate, Cancellation Plate, Vessel Holder, and Vessel move up and down rapidly, accelerating up to 100 g at nominally sixty times per second. Serious bodily injury is possible if one comes into contact with these moving surfaces.</p>
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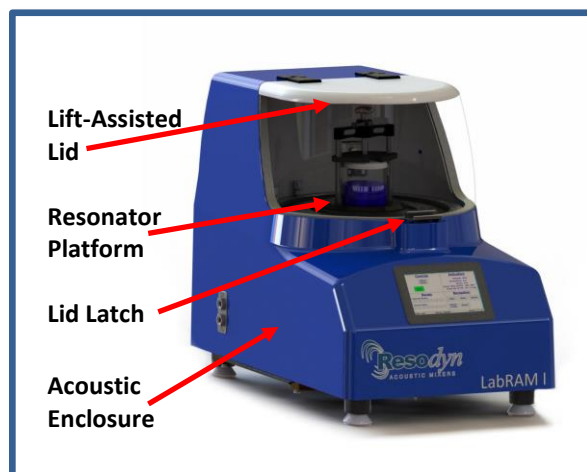


Figure 9 LabRAM I Acoustic Enclosure

## 7.1 Touch Screen Human Machine Interface (HMI)

The LabRAM I 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 are described in detail in Section 9 HMI (Human Machine Interface) – Overview.

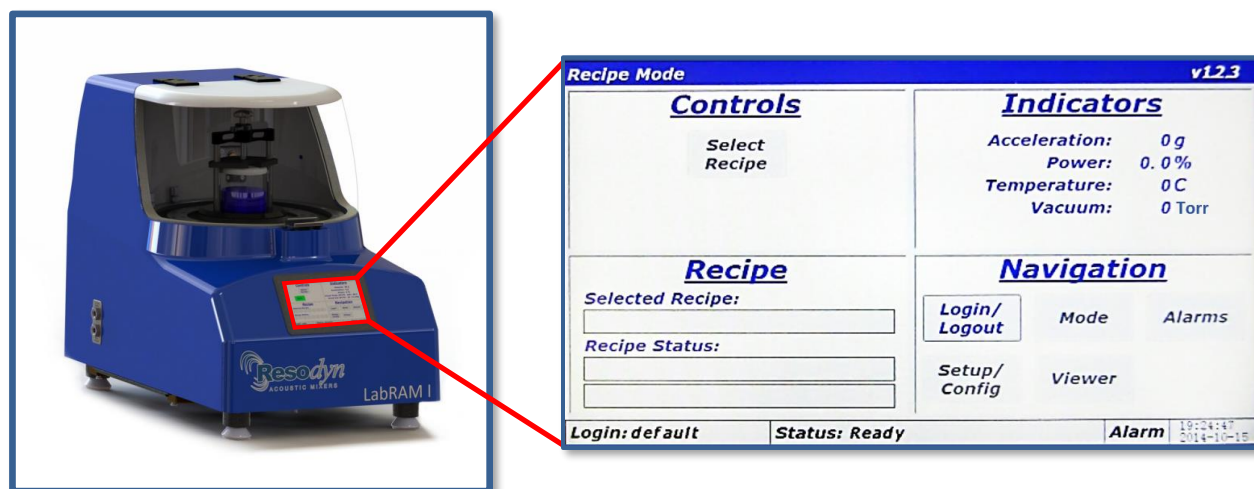


Figure 10 LabRAM I Touch Screen HMI

## 7.2 Standard Vessel Holder Fixture and Vessels

A variety of vessel sizes and types, along with appropriate Vessel Holder fixtures, are available for the LabRAM I. The standard and supplied Vessel Holder is 4" (101.6 mm) in diameter and accommodates Mixing Vessels between 3.25" and 4.6" high (82.55 mm and 116.84 mm). Components and function of the Vessel Holder are described in detail below.

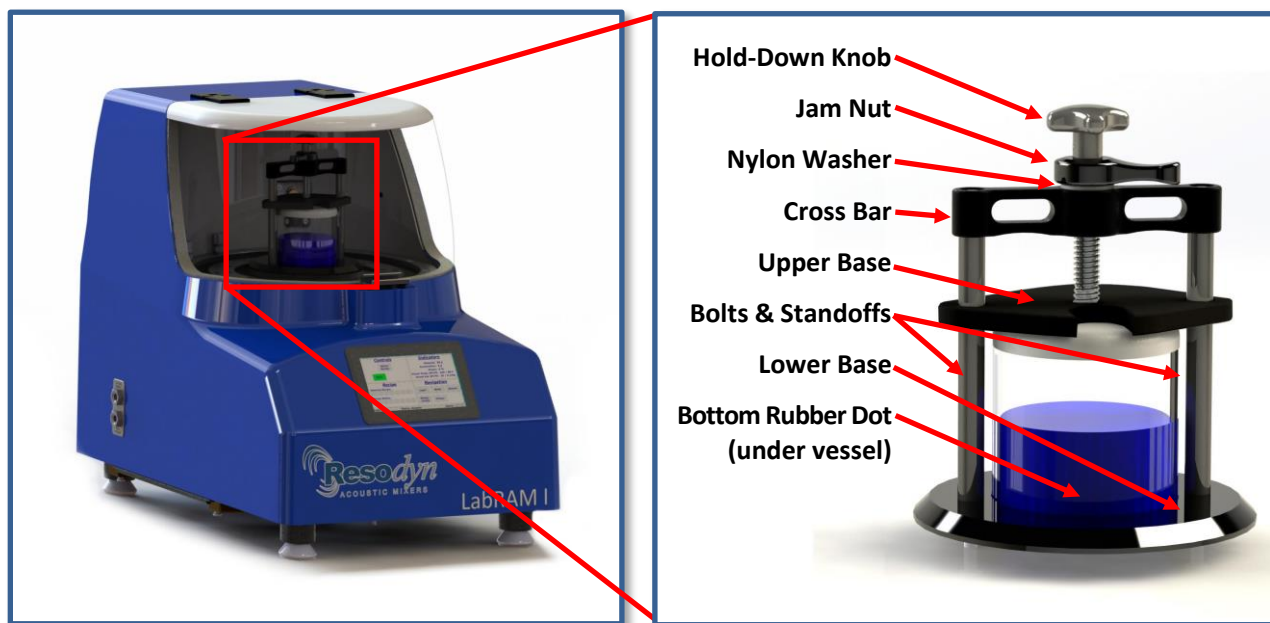


Figure 11 LabRAM I Standard Vessel Holder

The Hold-Down Knob turns a threaded shaft connected to the Upper Base. Turn the Hold-Down Knob clockwise to lower the Upper Base. Turn it counterclockwise to raise the Upper Base. When tightened against the vessel, the Upper Base holds the vessel in place. The Bottom Rubber Dot provides support to the center-bottom of the Mixing Vessel and prevents the vessel from moving laterally during mixing.

**The Jam Nut is critical for locking the vessel in place.** When lightly tightened against the top of the Cross Bar, the Jam Nut prevents the Hold-Down Knob from loosening during operation. The Jam Nut must be secured after the Mixing Vessel is firmly held in place using the Hold-Down Knob. While the Nylon Washer allows easier manual release of the Jam Nut after mixing, avoid overtightening the Jam Nut, or it may be difficult to loosen.

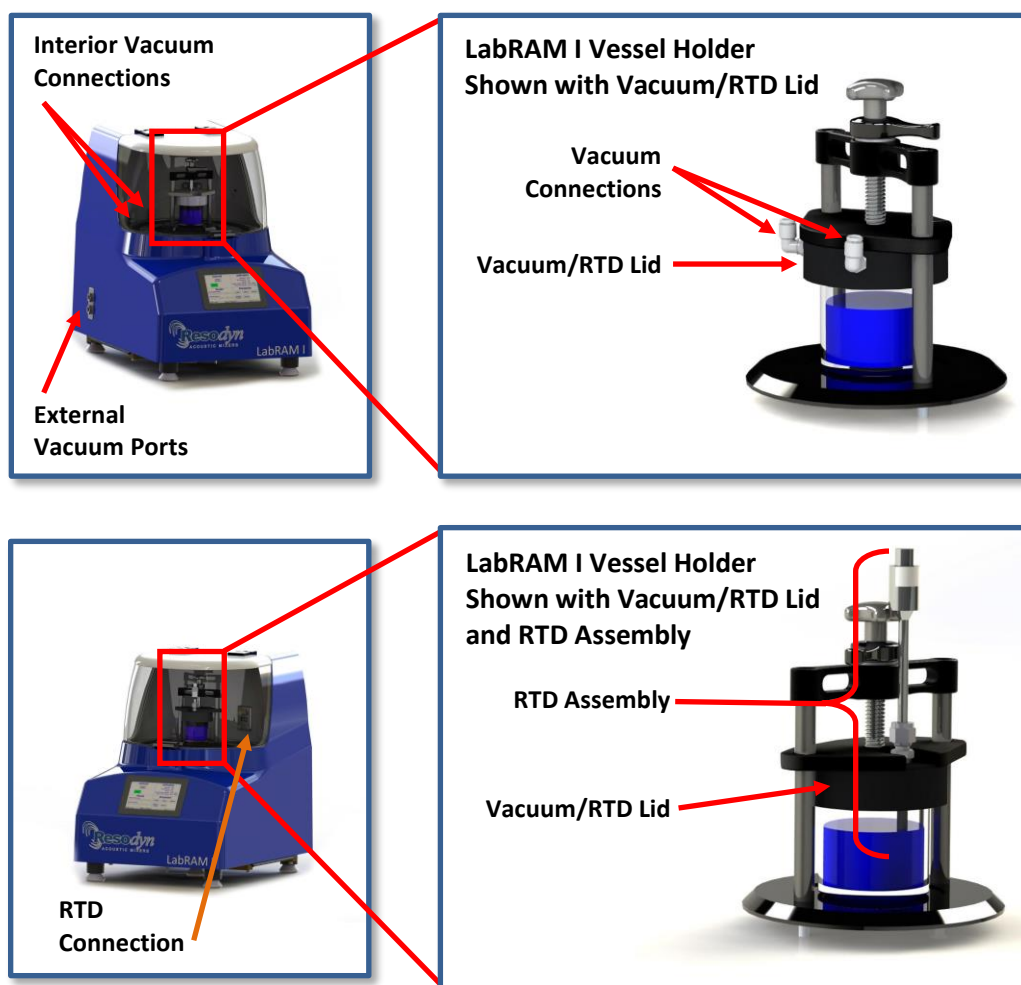
If the Mixing Vessel is not secure in the Vessel Holder during operation, damage may occur to the mixer, vessel, and the mixing material. Significant mixing ingredient spillage may also occur. If you require vessel spacers or a custom Vessel Holder please contact your Resodyn Acoustic Mixers sales representative at +1-406-497-5333 or email [info@resodynmixers.com](mailto:info@resodynmixers.com).

### 7.3 Processing Accessories

LabRAM I accessories are available to expand its processing capabilities. The accessories include Manual and Automatic Vacuum Systems, and RTD Temperature Monitoring.

**For details on the operation of these systems with the LabRAM I, refer to the detailed Installation and Operation Manual provided with each Processing Accessory.**

- Manual Vacuum System - Enables the user to control the pressure inside the Mixing Vessel. The pressure is controlled manually by the user to develop optimal processing characteristics that can be integrated with processing recipes.
- Automatic Vacuum System – Enables the user to control the pressure inside the Mixing Vessel. Pressure can be controlled manually by the user, or automatically by the LabRAM I as a parameter of a processing recipe.
- RTD Temperature Monitoring – Mixing ingredient temperature is monitored by the LabRAM I HMI via an RTD sensor installed in a vacuum system lid. The LabRAM I has an RTD communications connector directly behind the vessel holder.



## 8 Recipe Demonstration Quick Start

This section defines the minimum steps required to operate the LabRAM I. All instructions and guidelines in Section 4 Installation must be completed before attempting a Quick Start or operation of the LabRAM I.

### 8.1 Setup

A Mixing Vessel must be installed in the Vessel Holder before operating the mixer.

#### 8.1.1 Open the Lid

Lid operation is described in detail and illustrated in Section 4.4 Lid Operation.

#### 8.1.2 Loosen the Vessel Holder

Turn the Hold-Down Knob counterclockwise, raising the Upper Base until the Mixing Vessel can slide under it.

#### 8.1.3 Secure Mixing Vessel in the Vessel Holder

1. Center the Mixing Vessel over the Bottom Rubber Dot on the Lower Base. If the Bottom Rubber Dot is missing, please check your shipment package for a small zip-lock bag holding small replacement parts. If not found, call Resodyn Customer Service at +1-406-497-5333 for a replacement.
2. Turn the Hold-Down Knob clockwise until the Mixing Vessel is securely positioned in the center of the Resonator platform.
3. Tighten the Jam Nut against the Cross Bar to lock the Vessel in place.

**NOTE:** The Jam Nut should not be overtightened, simply turn clockwise until finger tight. Overtightening the Jam Nut may make vessel removal difficult after mixing.

The Mixing Vessel should not feel loose if properly secured in the holder. If the vessel can be moved at all by hand, loosen the Jam Nut, tighten the Hold-Down Knob further, and re-secure the Jam Nut. Vessel Spacers must be used to accommodate Mixing Vessels shorter than 3.25" (82.55 mm). Contact Resodyn if you need Spacers.



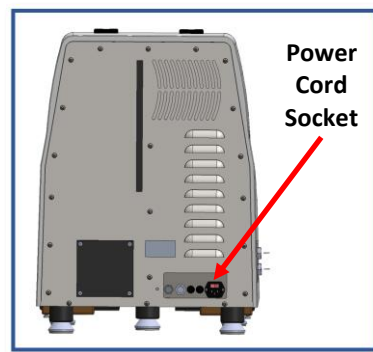
The Mixing Vessel should not feel loose if properly secured in the holder. If the vessel can be moved by hand, loosen the Jam Nut, tighten the Hold-Down Knob further, and re-secure the Jam Nut. Failure to properly secure the Mixing Vessel can result in damage to the LabRAM I, the Mixing Vessel, and the Mix Materials, as well as significant mixing material spillage.

#### 8.1.4 Close the Lid

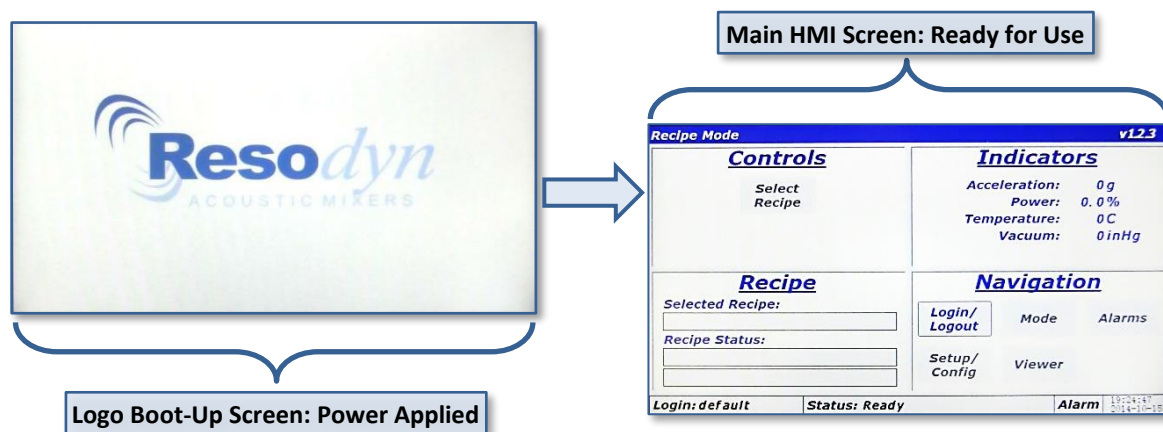
Lid operation is described in detail and illustrated in Section 4.4 Lid Operation.

## 8.2 Power-Up

1. Plug the provided AC power cord into the Power Cord Socket (shown at right) and an electrical outlet.
2. Toggle the power switch (located above the Power Cord Socket) to the on, or “I”, position.



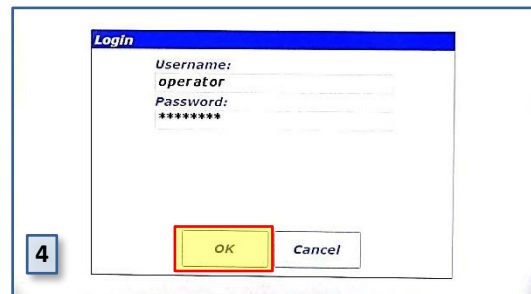
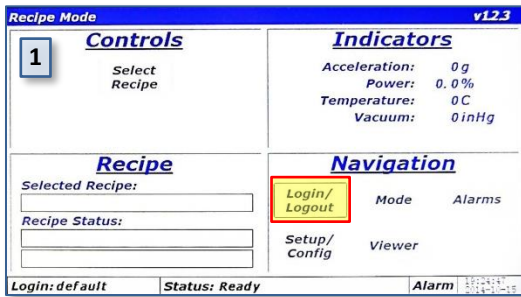
When power is applied to the system, the Resodyn Acoustic Mixers logo is displayed on the HMI boot-up screen. When ready for operation, the second screen shown below to the right will be displayed. This screen, shown after the boot-up is complete, displays “Recipe Mode” in the title bar, and will be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



## 8.3 Login

Before running the LabRAM I, a user login is required. For the example, the lowest, or most restricted, level login will be used. Both the username and password are “operator.”

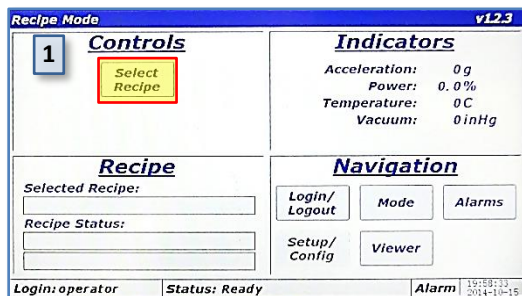
1. Touch the <Login/Logout> button.
2. Touch the <Username:> text box. This will open the “Enter Username” alpha-numeric keypad.
3. Using the keypad, enter the “operator” username.
4. Touch the <OK> button after entering a username.
5. Repeat steps 1-3, entering “operator” for the password.
6. When both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

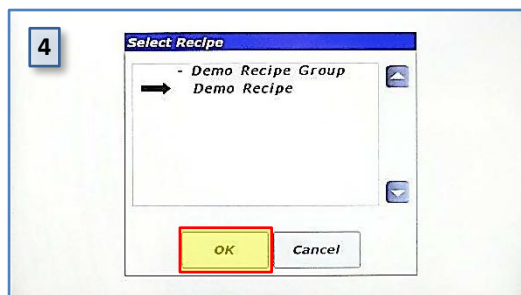


## 8.4 Select the Recipe

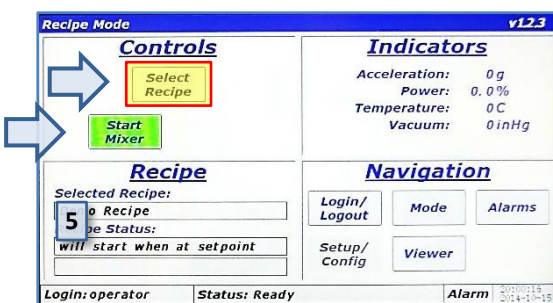
The LabRAM I is provided with a demonstration recipe to use as a reference and guideline. The following steps illustrate how to select and use that demonstration recipe.

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 I 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.





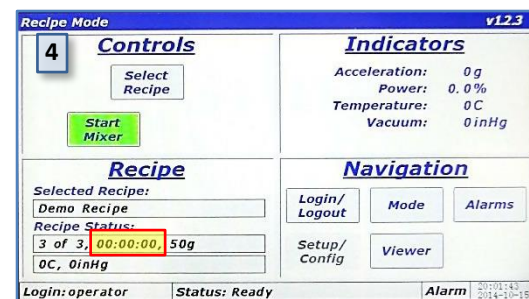
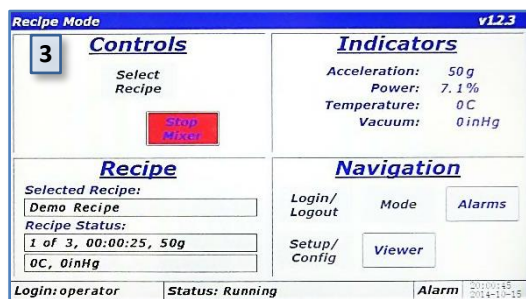
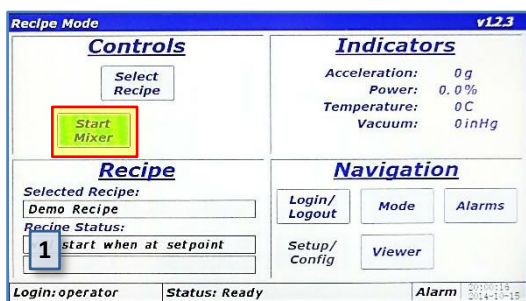
- The Main Screen will display the name of the selected recipe in the “Recipe” pane, and the green <Start Mixer> button will also appear.



## 8.5 Run the Recipe

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

- Press the <Start Mixer> button to begin the mix cycle.
- The “Enter Mix Comment” screen will appear. Enter a description of the mix or comment about the mixing routine to be performed, e.g., Batch #123, or Test #1. Use the keypad to enter mix comment.
- After touching the <OK> button on the “Enter Mix Comment” screen, the accelerating/mixing will begin, and the Main Screen will be displayed again. The <Start Mixer> button will have changed to the red <Stop Mixer> button on the Main Screen. The “Recipe” pane will update as the recipe executes by displaying the current segment, total segments, current segment timer, acceleration setting, temperature setting, and vacuum setting. Measured values will be displayed in the Indicators Pane.
- When the 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.



## 8.6 Completion

When the middle section of the Recipe Status Bar (See Section 9.1 Main Screen for Status Bar location) reads “Status: Ready,” the mixer’s Lid can be opened, and the Mixing Vessel can be removed.

1. Open the Lid.
2. Loosen the Jam Nut.
3. Loosen the Hold-Down Knob.
4. Remove the Mixing Vessel.
5. Close the Lid.
6. If no further mixes are required, toggle the power switch to the off, or “0” position.

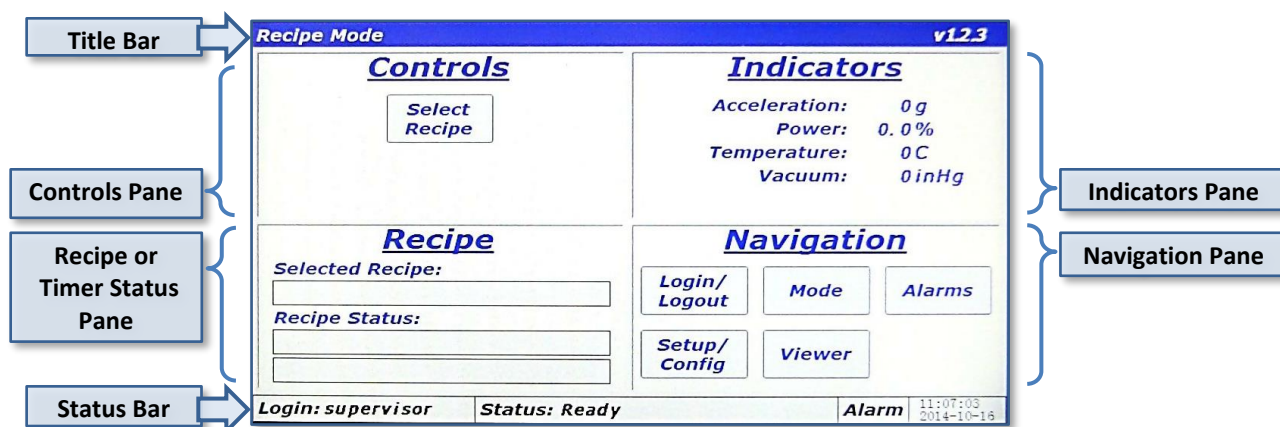
## 9 HMI (Human Machine Interface) – Overview

The HMI is a digitally-controlled user interface on the LabRAM I. All data entry and operations are provided 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.

### 9.1 Main Screen

The Main Screen controls the LabRAM I. 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** – Area where the user selects, starts, and stops operations in Recipe Mode, or enters setpoints (Acceleration, Temperature, and Vacuum) in Auto Mode.
- **Indicators Pane** – Displays the value of measured parameters.
- **Recipe or Timer Status Pane** – Follows Recipe and shows Auto Mode Timer status.
- **Navigation Pane** – Buttons for screen navigation.
- **Status Bar** – Displays current username, machine status message, alarm status, and date/time.

## 9.2 Login

To operate the LabRAM I, user authentication (login) is required. Four different login privilege levels are provided to control access to machine features. The LabRAM I is pre-configured with the default “users” names and passwords at each level of login. These logins are tabulated below. Delete these users and/or change the passwords upon familiarization with their use and establishing 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 detailed descriptions of available features and definitions of the login levels which can be found in Section 10 Login Levels and Privileges.

## 9.3 Operational Modes (Recipe and Auto)

The LabRAM I is controlled through two operating modes: Auto Mode and Recipe Mode. Recipe Mode should be the primary mode for operators, while Auto Mode is used by advanced users to characterize a mixing process for eventual recipe programming. 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 I is in operation.

## 9.4 Alarming

Several operational parameters are monitored in the LabRAM I to protect the equipment and the user. 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 field reads “Alarm,” in an alarm condition. This 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 both review and acknowledgment. Acknowledging alarms will clear them and allow the operation to continue.

## 9.5 Setup and Configuration Screens

The Setup and Configuration screens are accessed with the <Setup/Config> button. This screen set allows setting customizable options, viewing critical machine parameters, data management, 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 10.1 Login Levels and Privileges.

## 9.6 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. Please see Section 13 HMI Operation – Viewer for detailed description and instructions.

# 10 Detailed HMI Operation – Security and Login

To protect the LabRAM I from unauthorized use, and to maintain a record of which users operated the mixer, the system incorporates 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, the current user will be automatically logged out.

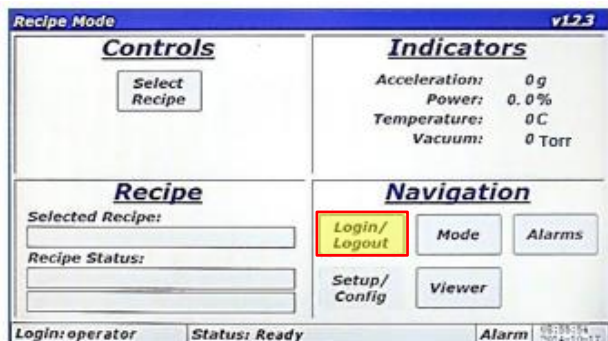
## 10.1 Login Levels and Privileges

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

Level	Name	Privilege Description
3	supervisor	Highest level of access Instrument calibration Status viewing for troubleshooting User creation/maintenance Date/time setting Recipe creation Optional feature configuration Data file management Recipe Mode operation Auto Mode operation
2	calibration	Instrument calibration Status viewing for troubleshooting Recipe Mode operation Auto Mode operation
1	technician	Status viewing for troubleshooting Recipe Mode operation Auto Mode operation
0	operator	The lowest level of access Recipe Mode operation Optional Auto Mode operation

## 10.2 Screen Operations - Logging In/Out

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



1. Touch the <Login/Logout> button



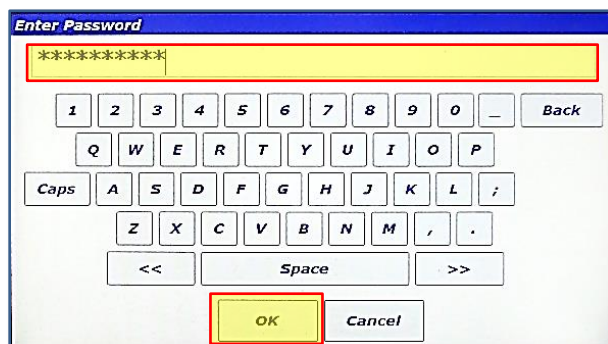
2. The "Login" screen will appear. Touch the textbox beneath "Username:"



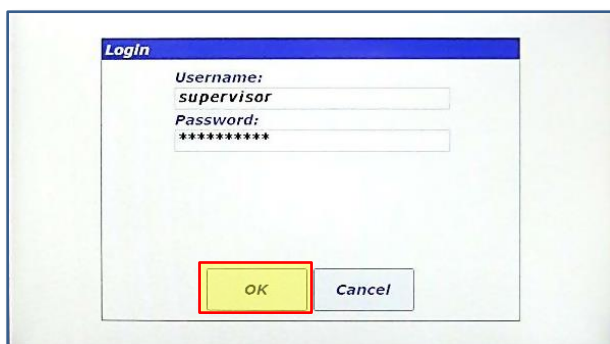
3. Using the keypad, enter "supervisor" for the username. Touch the <OK> button when finished.



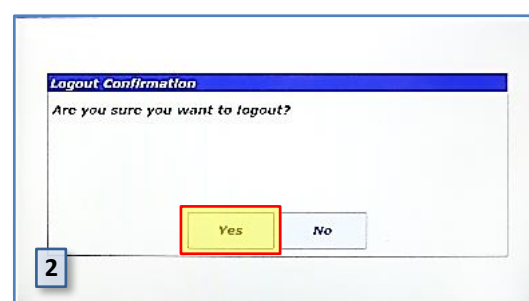
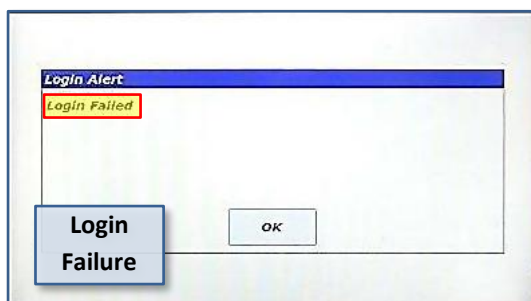
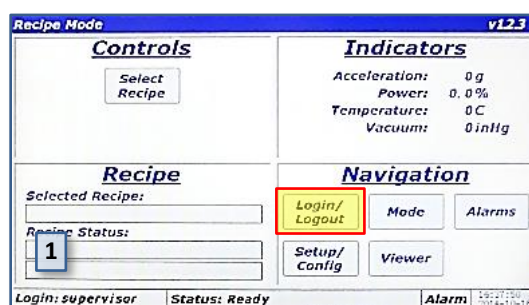
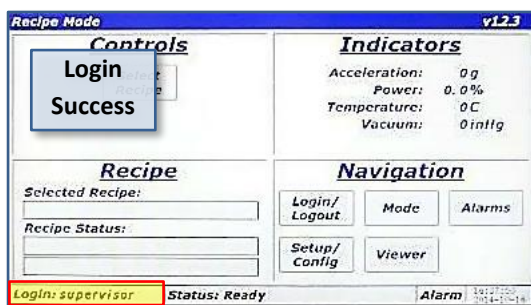
4. The "Login" screen will reappear, and "supervisor" will be visible in the "Username:" textbox. Now, touch the "Password:" textbox to enter the password.



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 the <OK> button to log in.



7. If the login attempt is successful, the Main Screen will appear (top image, above) and the "supervisor" username will be displayed in the lower-left corner. If login is unsuccessful, a dialog box will be displayed notifying the user (lower image, above). Touch <OK> to try again
8. To logout, simply touch the <Login/Logout> button again. A confirmation dialog box will appear. Touch <Yes> to log the current user out.

### 10.3 Log Files

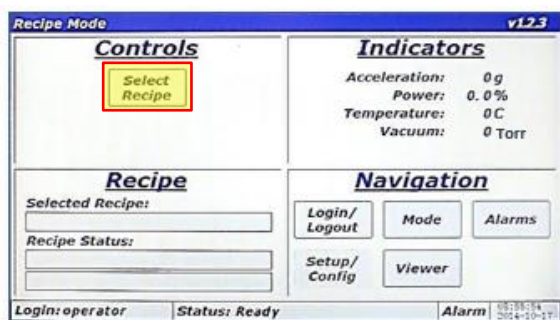
Every login attempt, successful or not, is logged to data files in the LabRAM I's memory. These files can be uploaded to a PC via USB for data archiving. See Section 14.8 Data Tab.

## 11 HMI Operation – Modes of Operation

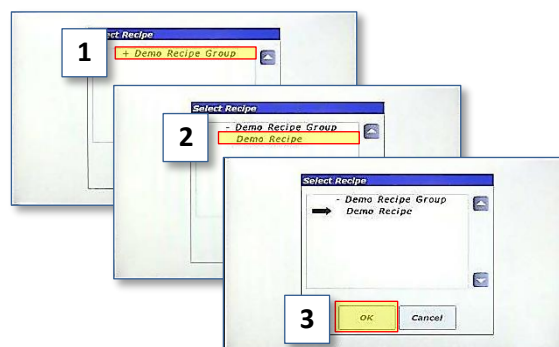
As previously noted, the LabRAM I is controlled in one of two operating modes: Auto Mode and Recipe Mode. Recipe Mode is the primary mode used by operators, while Auto Mode is used by higher levels to characterize a mixing process for eventual recipe programming. This section covers the details of the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

### 11.1 Working in Recipe Mode

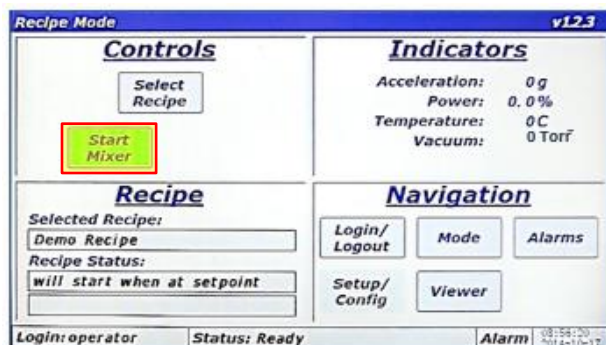
This sequence assumes the user has already logged in to the system. See Section 10 Detailed HMI Operation – Security and Login for login instructions.



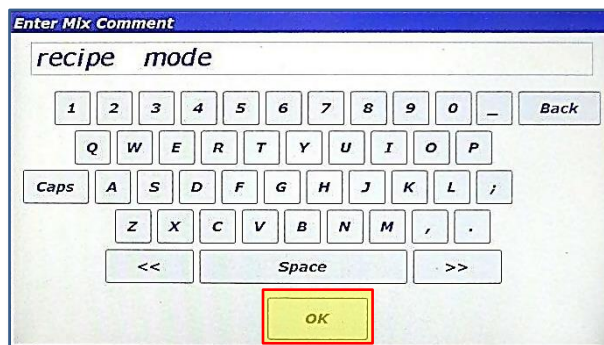
1. Touch the <Select Recipe> button.



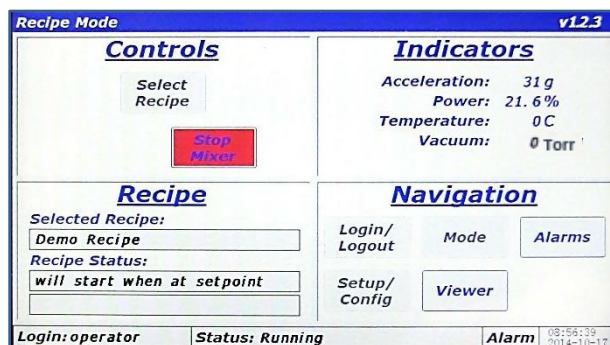
2. Touch "Demo Recipe Group" (item 1) to expand the group. Touch "Demo Recipe" to select it (item 2). A black arrow will appear next to the recipe. Touch <OK> to load the recipe (item 3).



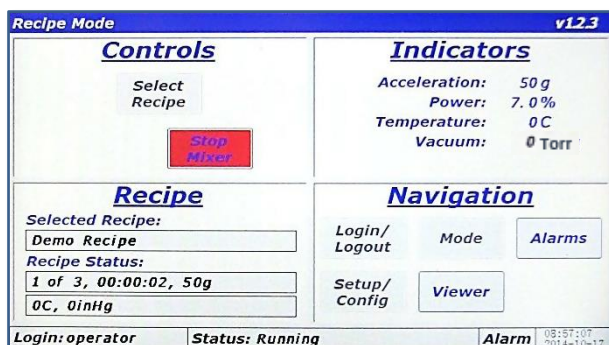
3. The main screen is displayed, and the <Start Mixer> button will be visible while the Recipe pane will display the name of the recipe just selected. Touch the <Start Mixer> button to begin the recipe mixing cycle.



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 I's memory. Touch <OK> when finished.

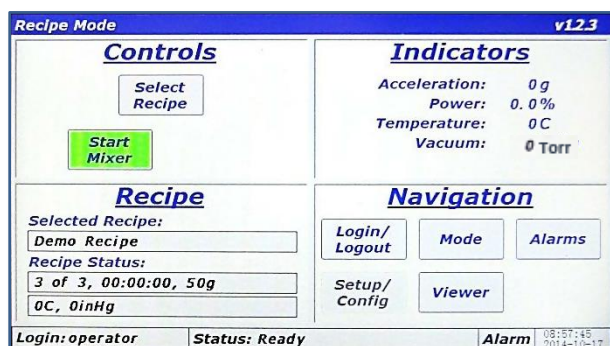


5. The Main Screen is again displayed, and the LabRAM I will begin accelerating/mixing. The <Start Mixer> button changes to the <Stop Mixer> button. The recipe pane content will not update until the measured acceleration reaches the programmed setpoint e.g., if the recipe calls for 60g of acceleration,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

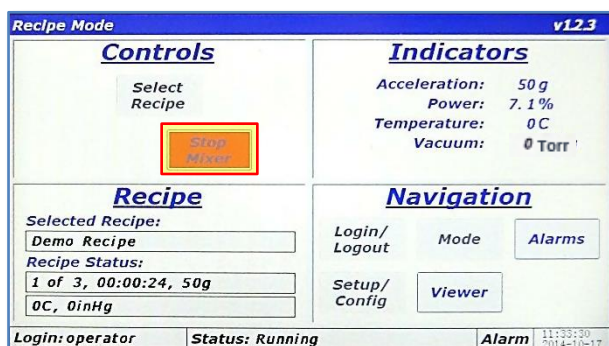


6. When acceleration reaches setpoint, the Recipe pane will update and display the currently executing segment, total segments, and remaining time on the current segment, acceleration setpoint, temperature setpoint, and vacuum setpoint.

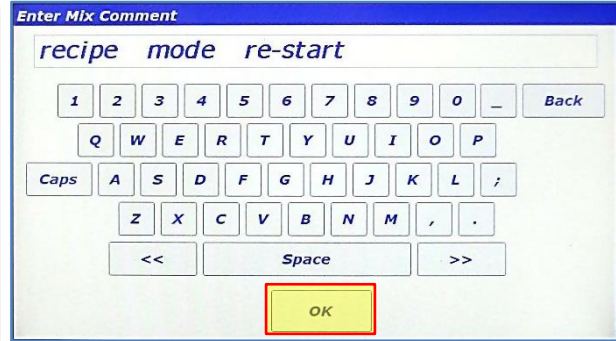
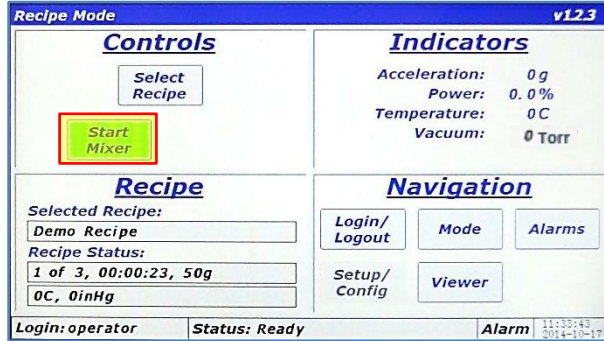
**NOTE:** If not equipped with temperature or vacuum control, the setpoints for these parameters will read 0C and 0torr, respectively.



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

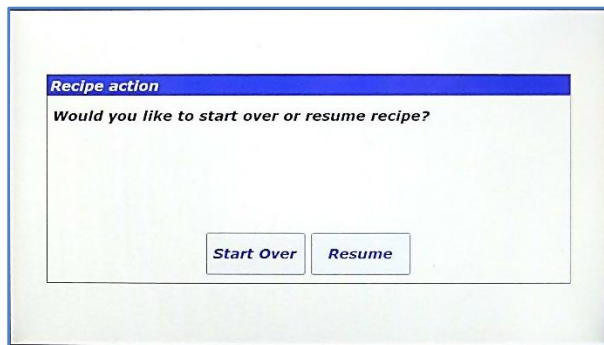


8. The LabRAM I can be stopped by touching the <Stop Mixer> button during a recipe mix. Normally, this is only done if a user forgot to add an ingredient. Upon stopping the recipe, the timer will pause. To stop the mixer while running in Recipe Mode, simply touch the <Stop Mixer> button.



9. When the machine is stopped, the Lid can be opened, and ingredients added (or the cause for stopping can be corrected). The LabRAM I can then be restarted by touching the <Start Mixer> button.

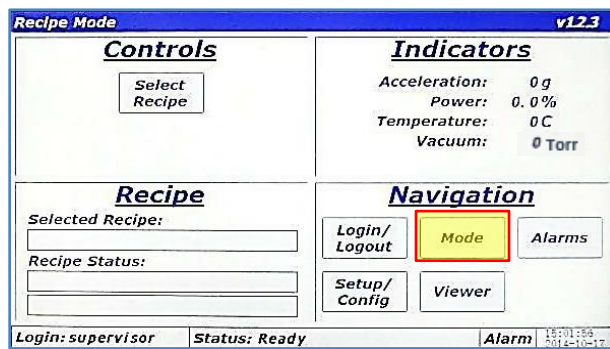
10. The "Enter Mix Comment" screen will appear again. Enter a fitting description. Touch <OK> when finished.



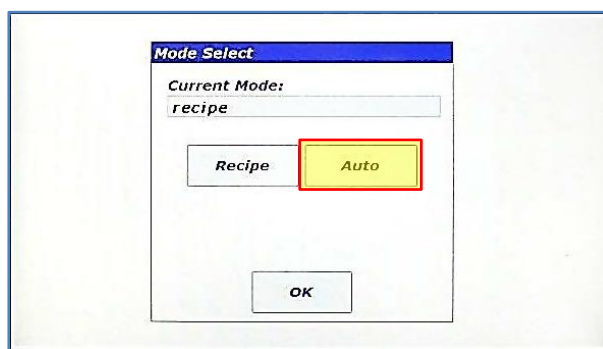
11. The LabRAM I will give the option of starting from the beginning of the recipe, by touching the <Start Over> button, or continuing from the point the mixer was stopped, by touching the <Resume> button.

## 11.2 Screen Operations - Auto Mode

The following details the steps for operating the LabRAM I 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.



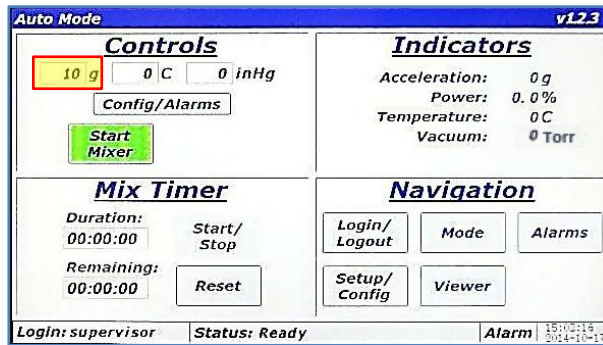
1. Touch the <Mode> button.



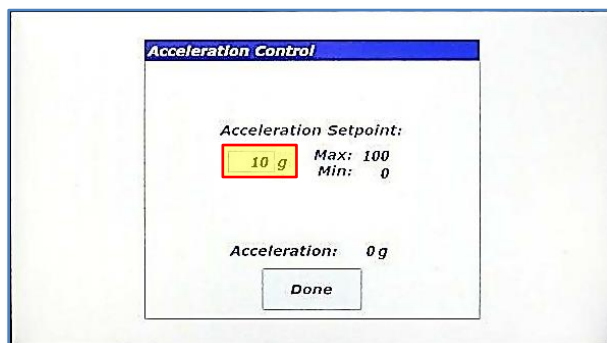
2. The "Mode Select" dialog is displayed. Touch the <Auto> button to change from Recipe to Auto Mode.



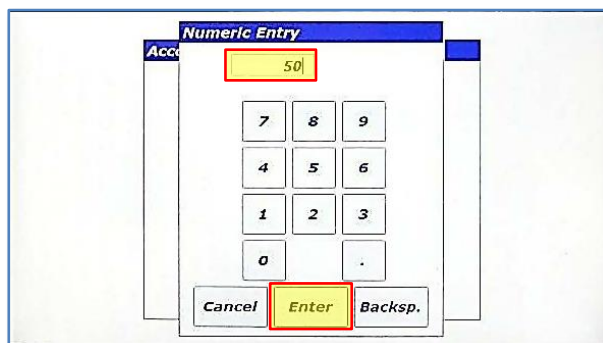
3. Touch the <OK> button to close the "Mode Select" dialog.



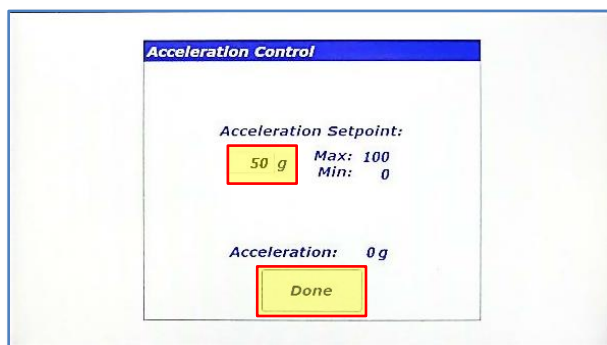
4. The Main Screen will appear but will look differently in Auto Mode than it did in Recipe Mode. The Controls Pane now has three textboxes that are used to enter setpoints for acceleration (in g), temperature (in C), and vacuum (in torr). The <Config/Alarms> button is used for entering user limits for 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."



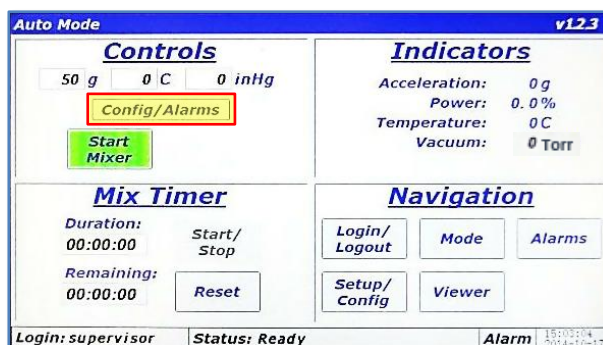
5. The "Acceleration Control" dialog will appear. The acceleration setpoint can be entered in this dialog and must lie between 0 and 100 values to be accepted. To change the acceleration setpoint, touch the textbox next to "g."



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

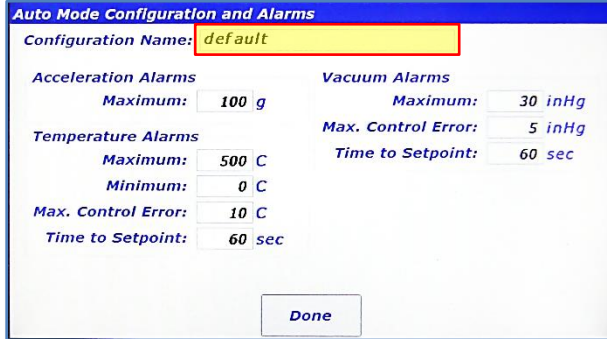
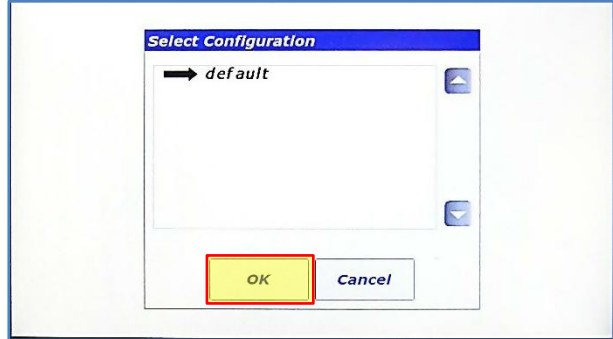


7. The newly entered setpoint will now appear in the textbox. Touch the <Done> button to close the "Acceleration Control" dialog.



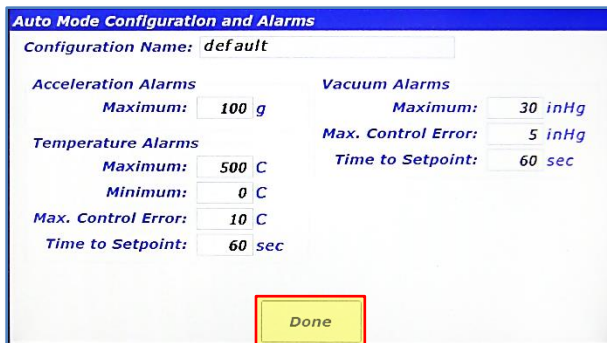
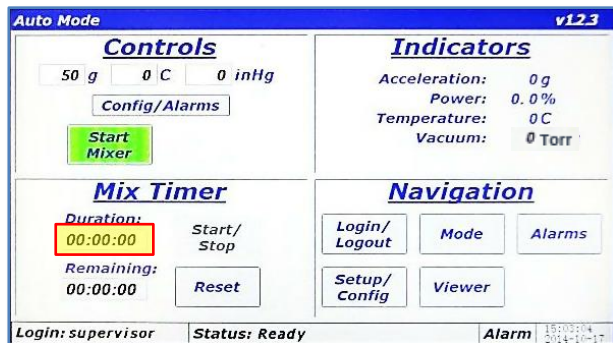
8. The new setpoint will now be updated in the Main Screen. To enter user-defined limitations and select a Configuration, touch the <Config/Alarms> button.

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

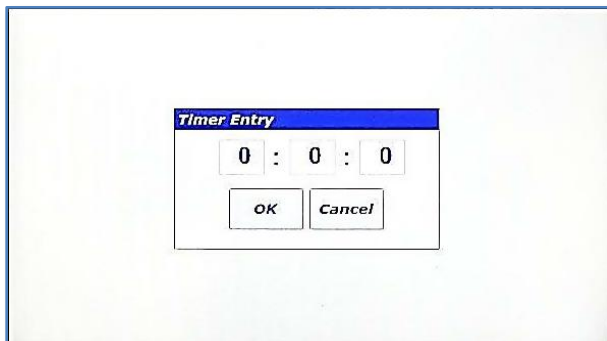
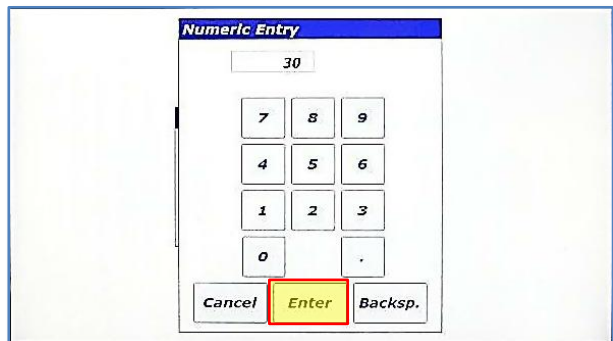
9. The "Auto Mode Configuration and Alarms" screen is displayed and allows a user to define limits to setpoint entry or shut the machine down if exceeded. For example, a material being mixed may be acceleration sensitive. The Maximum Acceleration could be limited in this screen. The Configuration for 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.

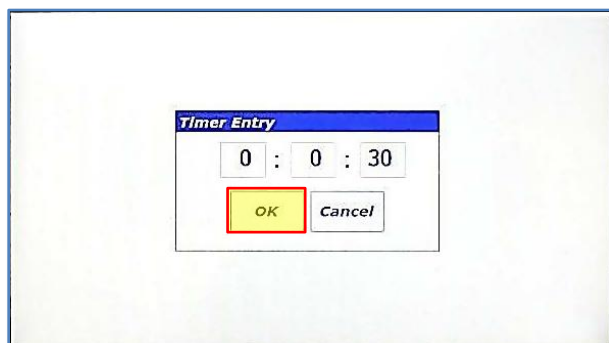
11. The "Auto Mode Configuration and Alarms" screen will be displayed again. To close the dialog touch <Done>.

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

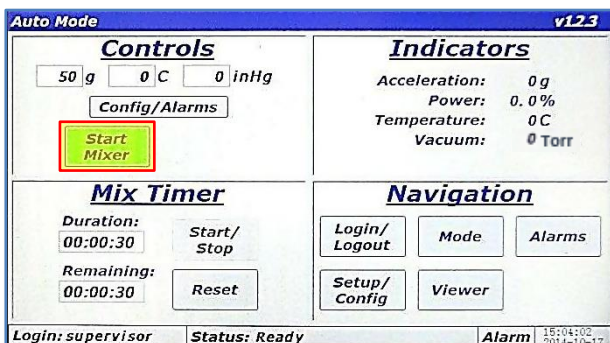



13. The "Timer Entry" dialog appears. The dialog has three textboxes, which are, going from left-to-right hours:minutes:seconds. Touch the right textbox to enter seconds.

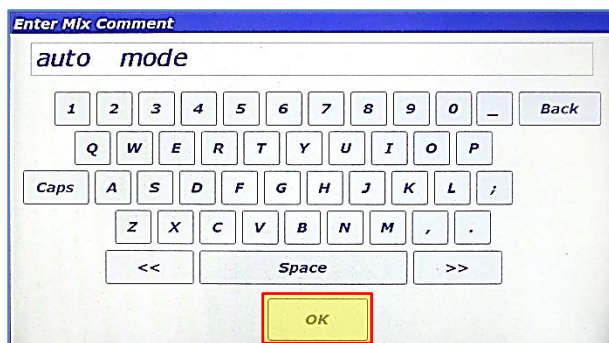
14. The "Numeric Entry" dialog will popup. Using the numeric keypad, enter 30 (for 30 seconds). Touch <Enter> when complete.



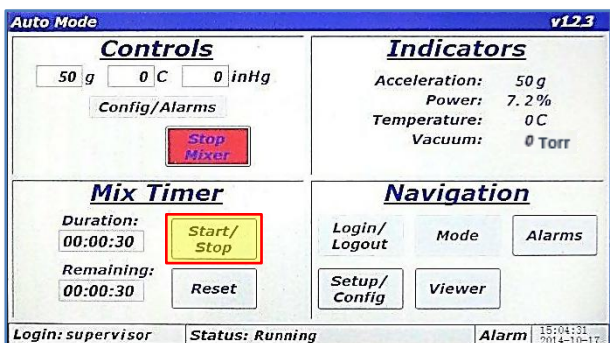
15. The entry from the previous step is displayed in the "Timer Entry" dialog. To edit hours and minutes, simply repeat the previous steps using the other text boxes. When complete, touch the <OK> button.



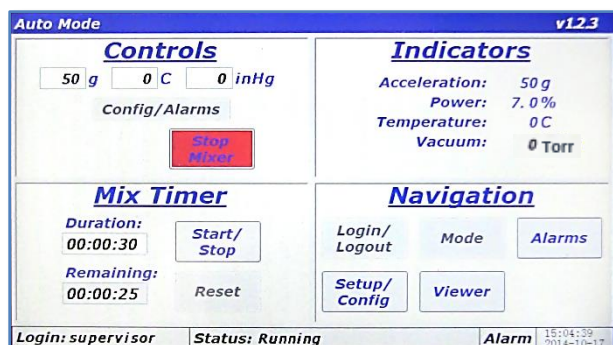
16. The timer value, 30 seconds, in this case, will appear in the Mix Timer pane in the text boxes under "Duration:" and "Remaining:." Touch the <Start Mixer> button to begin a mix cycle in Auto Mode.



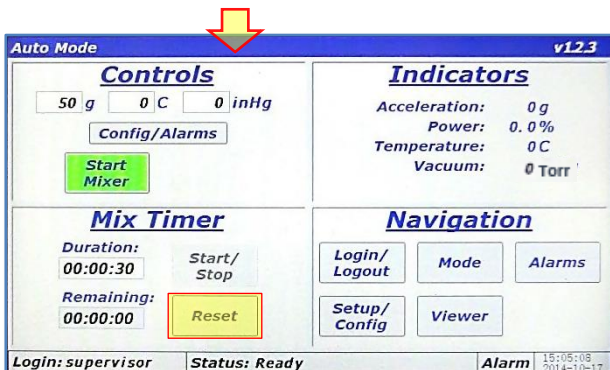
17. The "Enter Mix Comment" screen will appear. Enter a fitting description of the current mix. The text entered in this screen is stored in a log file in the LabRAM I's memory. Touch <OK> when finished.



18. The Main Screen is again displayed and the LabRAM I 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 running the <Reset> button will be disabled. 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 the timer expires, the LabRAM I 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)" and the <Start Mixer> button is hidden. Press the <Reset> button or load a new duration for the Auto Mode mix timer.

## 12 HMI Operation – Alarms

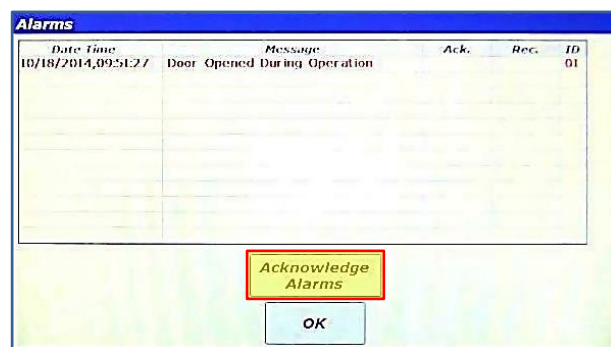
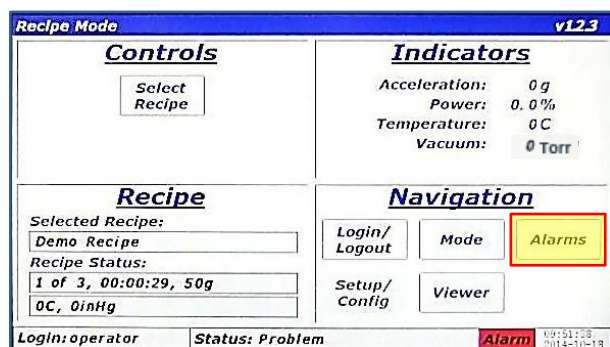
The LabRAM I protects the user and itself by monitoring parameters that could cause injury or damage. An alarm is triggered when any of these parameters are violated. The user is notified in the Alarm Section of the Main Screen Status Bar by a change in color to either red or yellow. A red alarm, or shutdown error, will immediately stop acceleration/mixing. A yellow alarm indicates a warning is active but will not halt mixer operation.

The Alarms Screen is accessed by touching the <Alarms> button from the Main Screen Navigation Pane. The Alarms Screen provides a tabular format that shows when an alarm is posted, its message, when it recovered or the condition was corrected, when the alarm was acknowledged, and the alarm ID number.

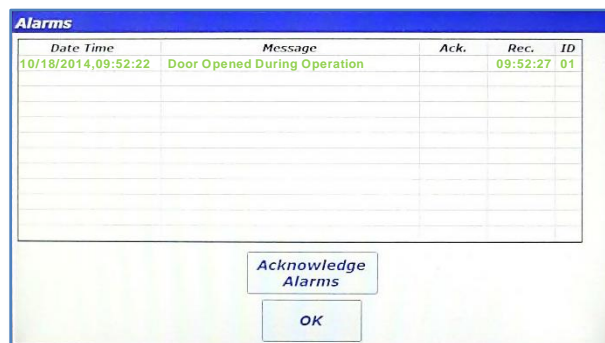
Whenever an alarm is triggered, acknowledged, or recovered, a log file in the LabRAM I's memory is updated. The alarm logs can be uploaded to a computer through a USB connection. (See Section 13.8 Data Tab for uploading instructions.)

### 12.1 Screen Operations - Alarms

The following details the steps for viewing and managing alarms.



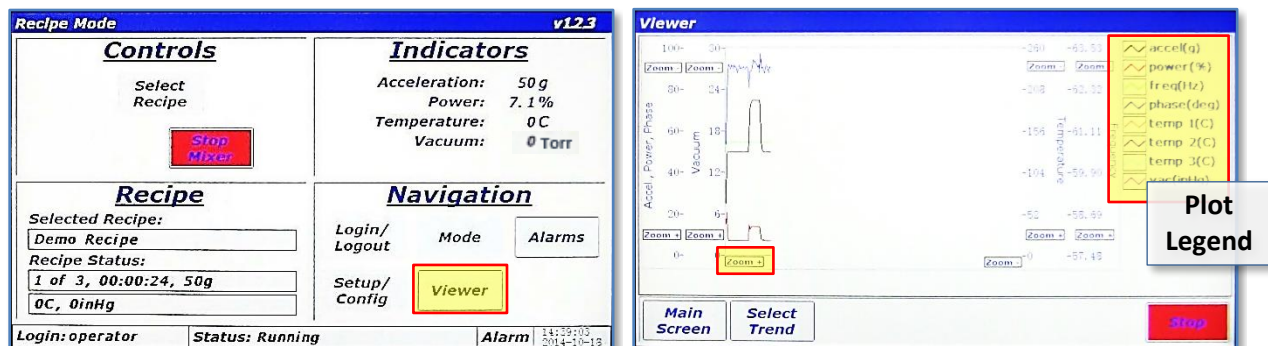
1. When an alarm is active, the "Alarm" section of the Status Bar will turn red for a shutdown alarm and yellow for a warning. To view the alarm, touch the <Alarms> button.
2. The "Alarms" screen is displayed with the alarm message on the first line of the table, such as the "Door Opened During Operation" alarm has been triggered indicating the LabRAM I door is opened during a mixing cycle. Note that when an alarm is active and unacknowledged the alarm message will be red. The columns of the table are as follows:
  - **Date Time:** when the alarm was activated
  - **Message:** the alarm description
  - **Ack.:** time the alarm was acknowledged
  - **Rec.:** time the alarm was recovered
  - **ID:** alarm identification number
 Touch <Acknowledge Alarms> to acknowledge the alarm.



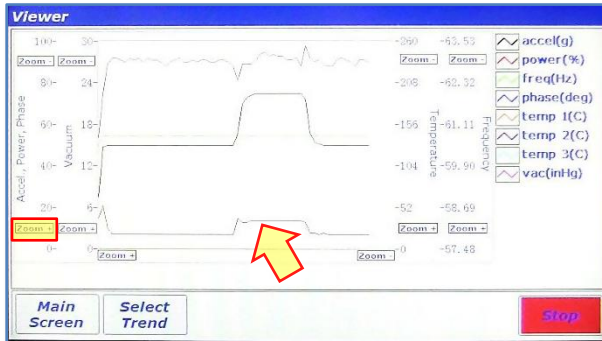
3. The alarm font turns blue and a time is inserted into the "Ack." Column. The blue color indicates an alarm that is still active but is now acknowledged. If the door is physically closed after acknowledgment, the alarm will recover, and the message will disappear, having been both acknowledged and recovered.
4. If the door is closed (alarm recovered) before acknowledgment, the alarm message turns green and the "Rec." column is populated with a time. If the <Acknowledge Alarms> is touched now, the alarm message will disappear, having been both acknowledged and recovered.

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

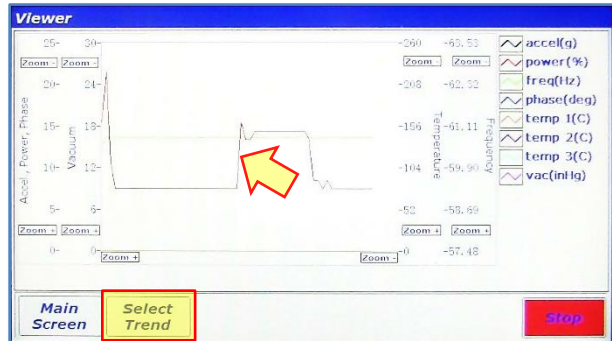
The following details the steps for viewing real-time measured parameters.



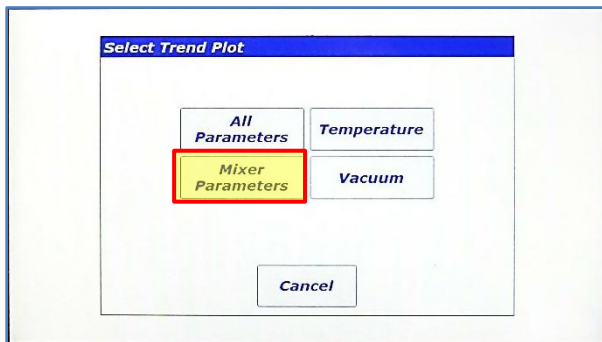
1. With the LabRAM I mixing/accelerating in either Recipe or Auto Mode, touch the <Viewer> button in the Navigation Pane.
2. The “Viewer” screen will appear. This screen is a time-history plot of a maximum of eight parameters. The plot colors and names are located in the Plot Legend. Four Y-Axes have 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.



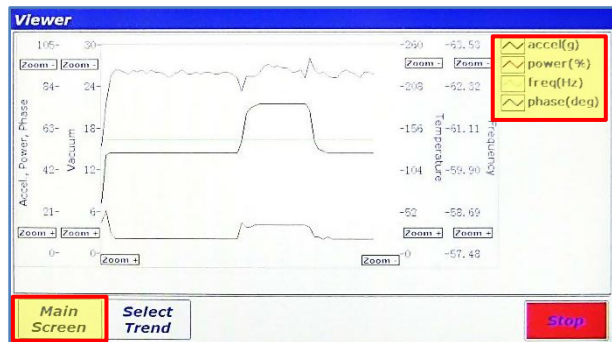
- The visible plots will now have a shorter overall time and will be “zoomed in.” Touching the <Zoom -> button will have the opposite effect. Zooming on the vertical Y-Axes uses the same method. To zoom in on the smaller “power(%)” plot, touch and hold the <Zoom +> button on the “Accel., Power, Phase”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



- The smaller “power(%)” can now be examined more closely. To focus on a specific parameter of interest, paring down other visible parameters, touch the <Select Trend> button.



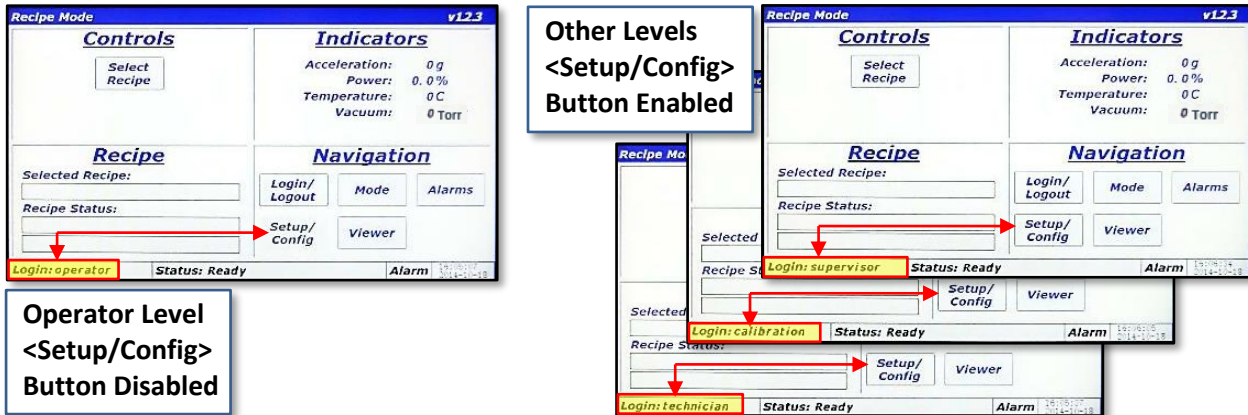
- The “Select Trend Plot” dialog allows the user to select which parameters to display. The buttons on this dialog will generate different versions of the graph. Touching the <Mixer Parameters> displays only the four parameters related to mixing.



- This image shows only the four mixer parameters in the plot as indicated by the contents of the Plot Legend. To return to the Main Screen, touch <Main Screen>.

## 14 HMI Operation – Setup and Configuration

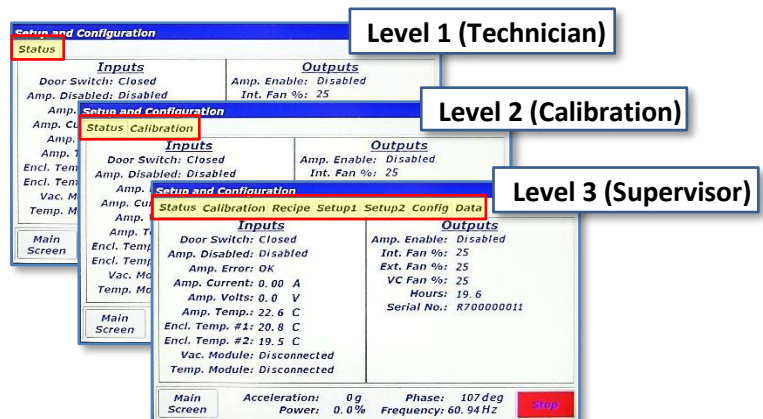
The LabRAM I offers the user extensive customization and flexibility. The Setup and Configuration screen provides user control of optional features and manages the configuration of the LabRAM I. The Setup and Configuration screen is accessed by touching the <Setup/Config> button from the Main Screen. If logged in at Level 0 (operator), this button is *disabled*, while the button is *enabled* for all other login levels (see below right), and 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, similar to many modern web browsers. Touching a tab title will switch between tabs. Tabs are visible based on the user's login level. The table to the right 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 the login level.

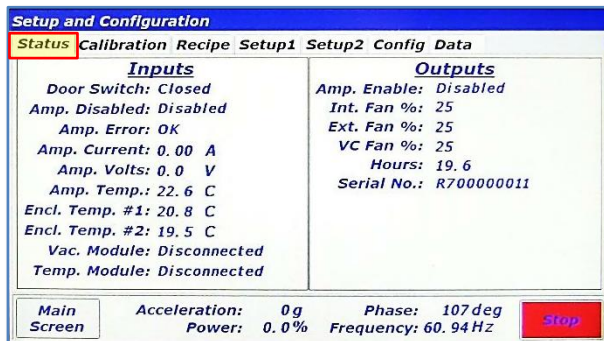
**NOTE:** The following descriptions and instructions of the Setup and Configuration screen in Section 14 HMI Operation – Setup and Configuration assume a Level 3 (Supervisor) login.

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



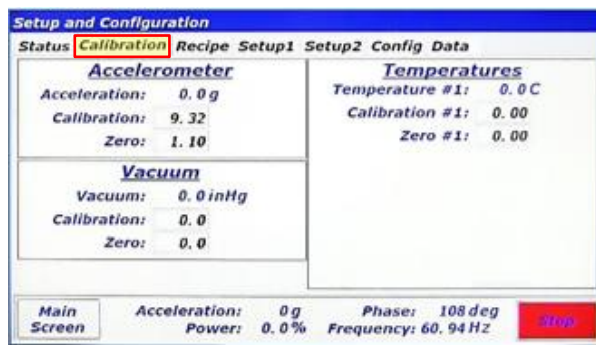
### 14.1 Status Tab

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** including 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.



### 14.2 Calibration Tab

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

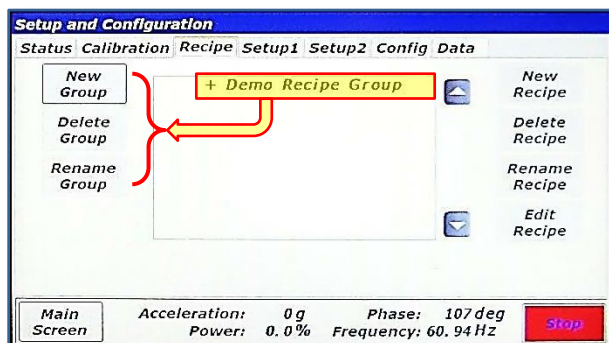


### 14.3 Recipe Tab

The Recipe Tab is used to create and edit recipes and recipe groups. The LabRAM I 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,” and recipes are analogous to “files” on a computer. Recipe *Groups* can be created, renamed, and deleted in the recipe tab. Individual *Recipes* can be also be created, renamed, deleted, and edited from the Recipe Tab. The remainder of this section provides detail of recipe operations.

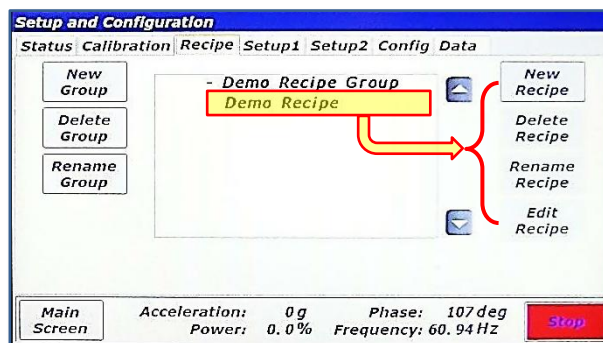
#### 14.3.1 Screen Operations – Edit an Existing Recipe

The following section details how to edit an existing recipe. The LabRAM I is shipped with a demonstration recipe and group, used as the example to be edited below.

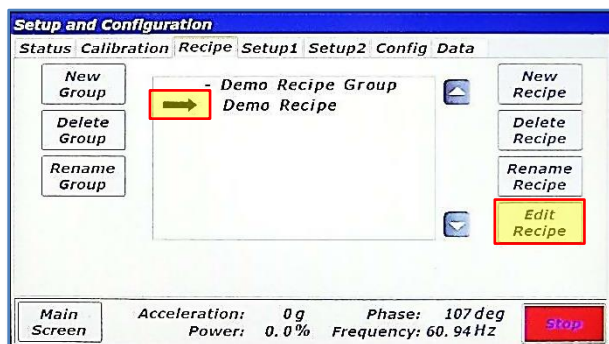


1. While in the Recipe Tab of the Setup and Configuration screen, touch the "+ Demo Recipe Group" line. This will expand the recipe group.

**NOTE:** The buttons on the left side of this tab are used for recipe *group* management, while the buttons on the right are used for *recipe* management. The buttons on both sides will change enabled/disabled state based on a selection of recipe groups and recipes. In the image above, all of 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 because no recipe group has been selected.

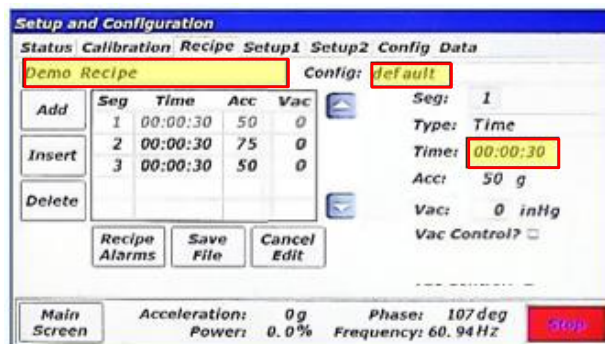


2. After expanding the "Demo Recipe Group", the "+" next to the group name changes to a "-" and the recipes in that group are listed. In this case, there is only one recipe listed named "Demo Recipe." Touch the line with the recipe.



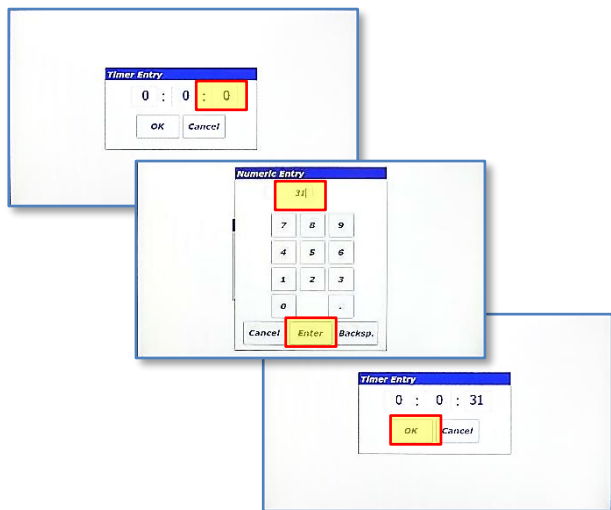
3. After touching the recipe name, an arrow will appear indicating that the recipe has been selected. To view/edit the contents of this recipe touch the <Edit Recipe> button.

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

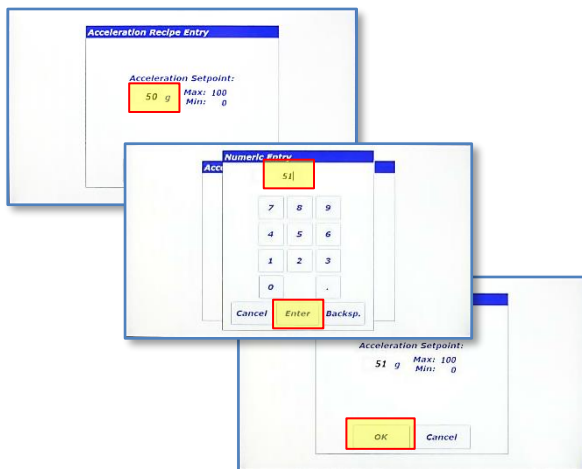


4. The recipe contents will be read from the LabRAM I's memory and displayed on the screen shown above. The recipe name (*Demo recipe*) is displayed in the top-left textbox. The Configuration associated with this recipe (default) is displayed in the top-right textbox. The <Add>, <Insert>, and <Delete> 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 already 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 time "Time:"

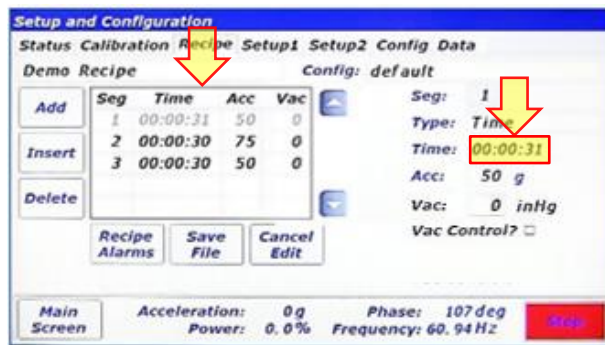
**NOTE:** Segments are time steps of the recipe. In the screen above, each row in the table is a segment.



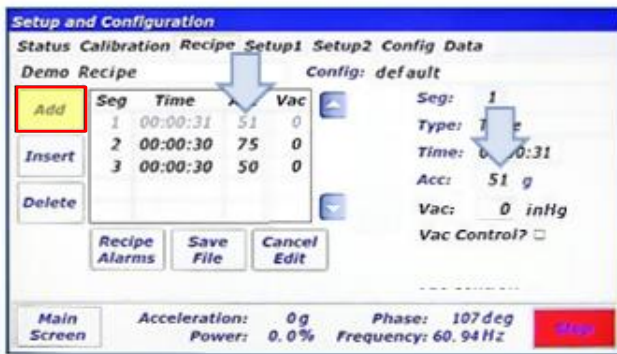
5. The timer entry for recipe editing is the same as in Auto Mode. Touch the seconds textbox, enter 31 using the "Numeric Entry" dialog and then touch the <Enter> button. Touch the <OK> button in the "Timer Entry" dialog when complete.



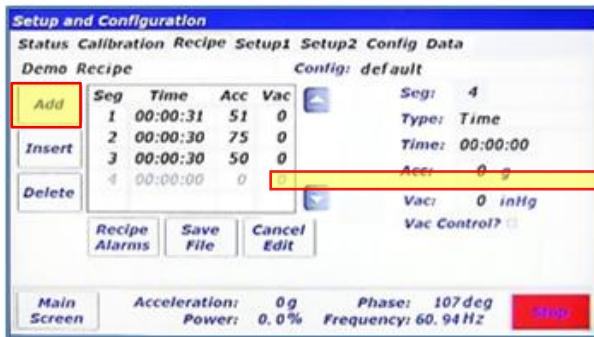
7. The "Acceleration Recipe Entry" dialog will appear. Use this dialog entry the same as the Auto Mode acceleration entry. Touch the textbox and enter 51 using the "Numeric Entry" dialog and then touch the <Enter> button. When complete, touch the <OK> button.



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



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



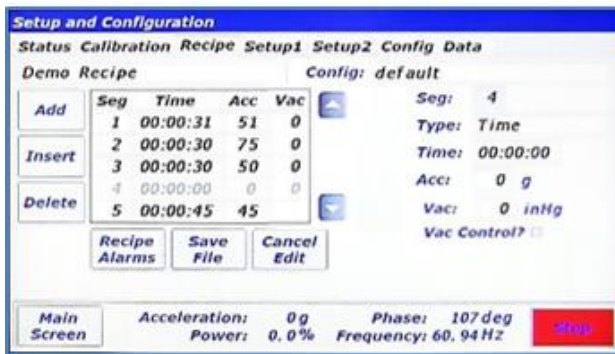
9. A new segment, segment 4, is now added to the end of this recipe. Using the methods previously described, this segment can be edited to have a time duration of 45 seconds and an acceleration setpoint of 45g, as shown on the following screen.



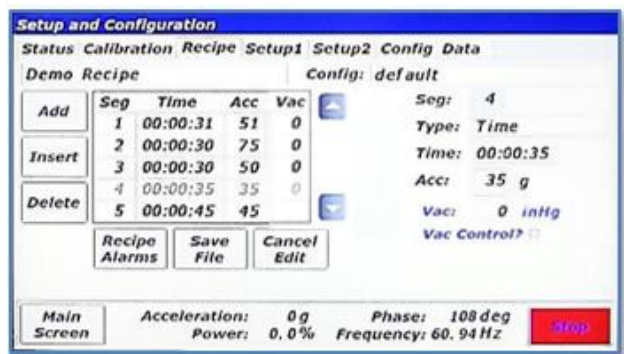
10. To add another segment between existing segments in the recipe, the <Insert> button will be used this time.

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, as shown in the next screen.

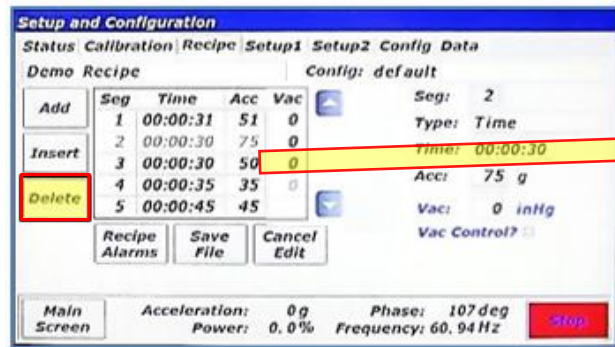
**NOTE:** The selected segment is a lighter grey color than the other segments. To select a different segment, touch the desired segment in the table control.



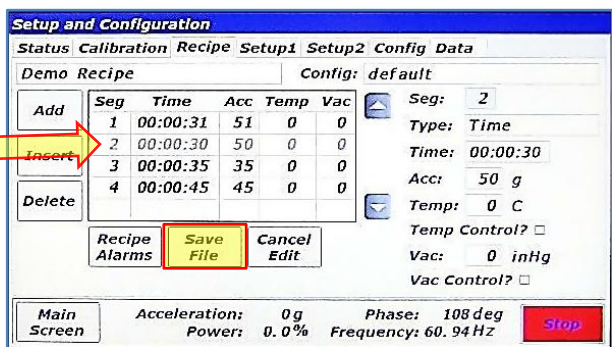
11. To edit the contents of the new segment 4, use the methods previously described. This segment is edited to have a time duration of 35 seconds and an acceleration setpoint of 35g, as shown in the next screen.



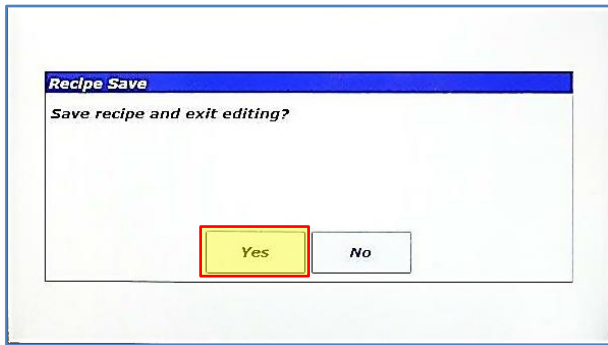
12. The new segment 4 now has updated time and acceleration setpoint. Segment 2 will now be deleted. Touch the line that contains segment 2.



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 position. To complete this recipe edit, touch the <Save File> button.



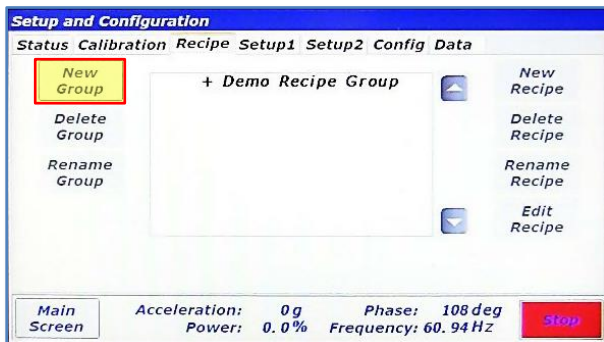
15. A confirmation dialog will appear. Touch <Yes> to save.

This concludes the “edit Recipe portion of Section 14.3.1 Screen Operations – Edit an Existing Recipe.

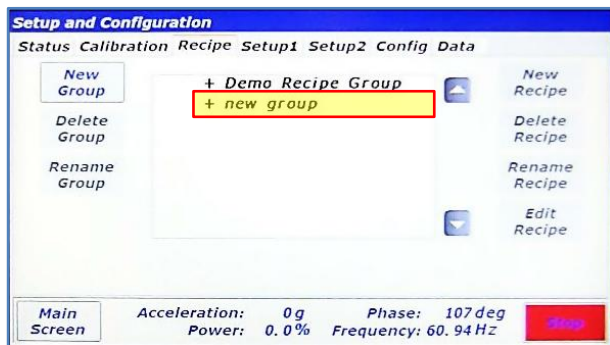
The following section continues to assume Log In as a Supervisor.

### 14.3.2 Screen Operations – Create New, Rename, and Delete

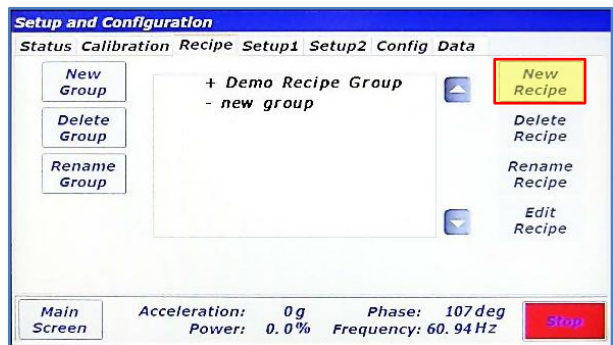
The following details how to create a new recipe group and then add a new recipe to that group.



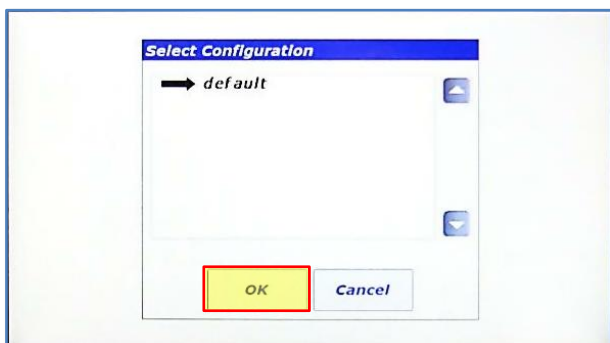
1. To create a new recipe group, touch the <New Group> button.
2. Using the keypad enter the new group's name. Then touch <OK>.



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 with "+ new group"



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



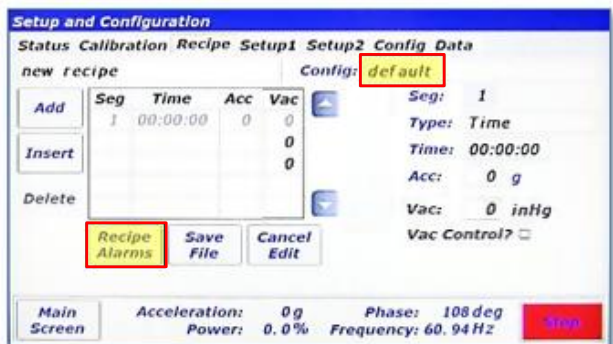
5. The "Select Configuration" dialog will appear. Configurations will be discussed in a later section. Touch <OK>.



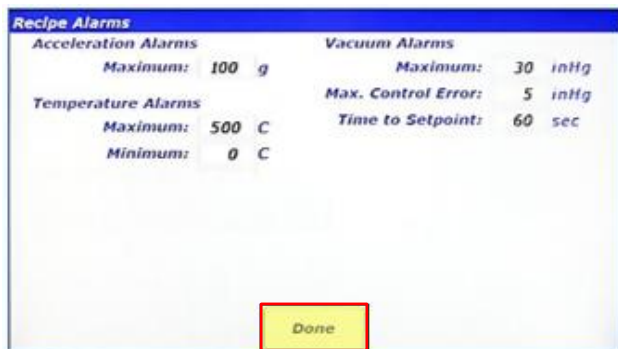
6. When a new recipe is created, a default name is given to the recipe. Also, a blank segment 1 is automatically added. To change the name, touch the textbox in the top-lefthand corner.



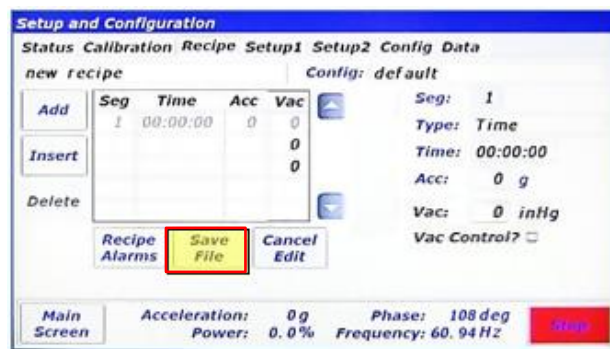
7. Rename the recipe and touch <OK>.



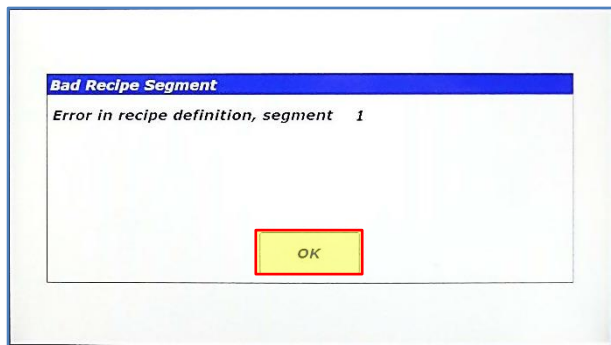
8. If the configuration ever needs to be changed, touch the textbox next to "Config:." This will launch the "Select Configuration" dialog as seen in step 5. The "Type:" textbox is used for selecting the segment type. **NOTE:** Currently Time segments are the only option. This feature will be expanded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



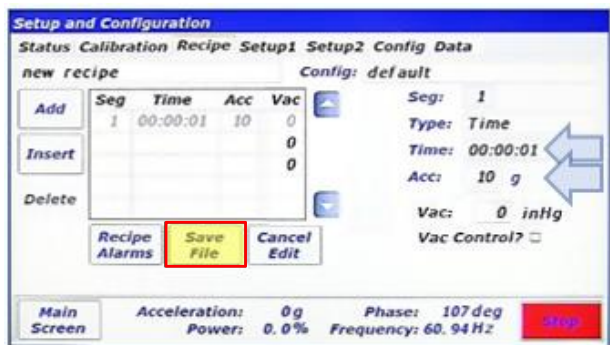
9. The "Recipe Alarms" screen will appear. This screen performs the identical function as the "Auto Mode Configuration and Alarms" but for Recipe Mode. This screen allows the user to enter limitations for the recipe. If, for example, the material that will be mixed with this recipe was temperature-sensitive, the Maximum temperature could be set here to protect the material from overheating. Touch <Done> when done entering alarm limits.



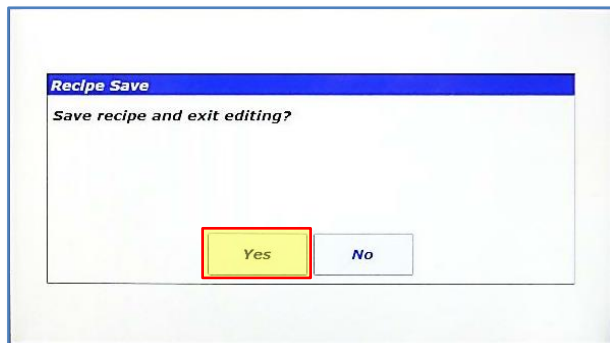
10. LabRAM I will automatically check for input errors. To demonstrate the error checking functionality, touch the <Save File> button without editing the empty segment 1.



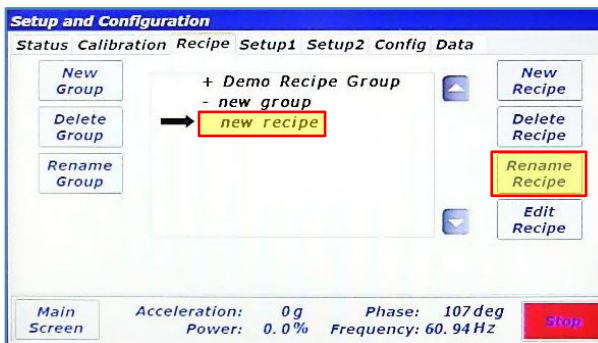
11. The "Bad Recipe Segment" dialog will appear and it specifies that something is wrong with the definition of segment 1. The time for segment 1 is 00:00:00, which is not allowed. Acceleration, temperature, and vacuum setpoints all need to lie between values entered in the "Recipe Alarms" as well to 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 by entering qualifying data allows saving. Touch <Save File>.



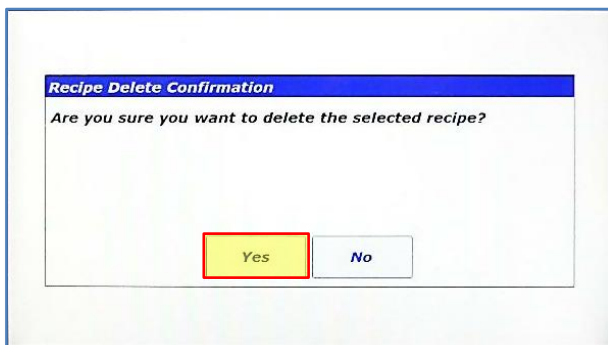
13. Now that the recipe is correct, the "Recipe Save" dialog appears. Touch <Yes>.



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



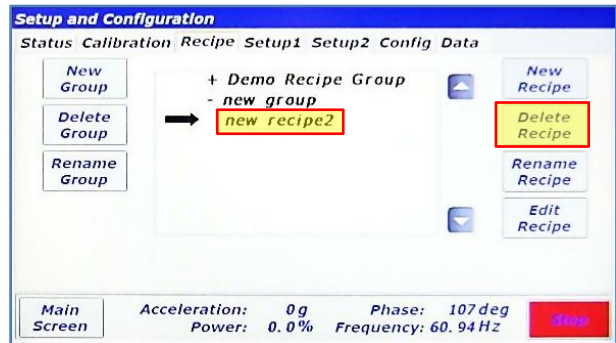
15. Rename the recipe and touch <OK>.



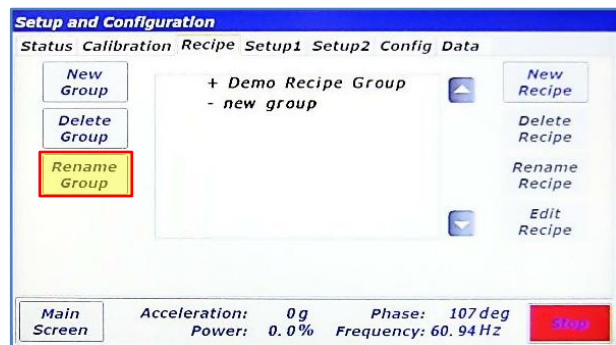
17. Touch <Yes> on the "Recipe Delete Confirmation" dialog to delete the recipe.



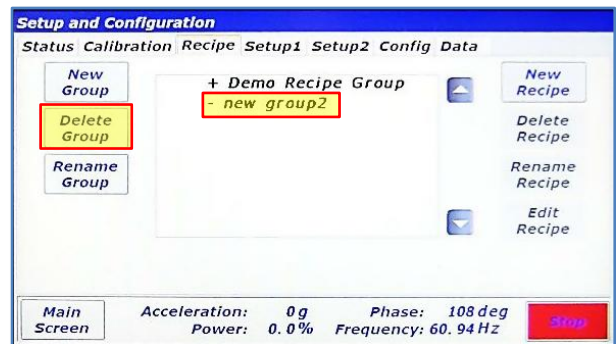
19. Rename the recipe group and touch <OK>.



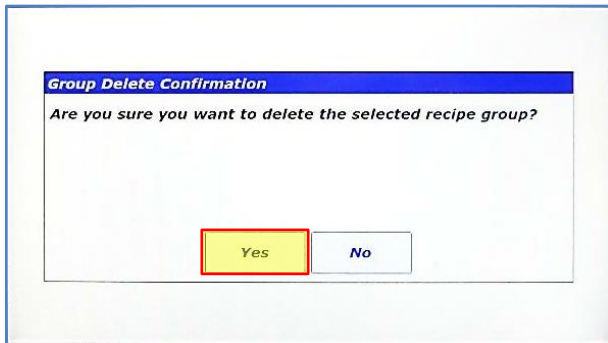
16. Recipes are also deleted from this screen. Select the renamed recipe and Touch the <Delete Recipe> button.



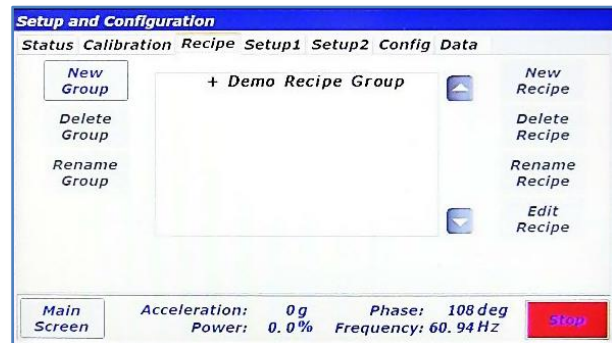
18. Selecting "new group" again will confirm that the recipe is deleted. Recipe Groups are also renamed and deleted from this screen. The process for this is identical to recipe renaming and deleting. With "new group" selected ("- " next to "new group"), touch the <Rename Group> button.



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



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



22. The group has been deleted.

## 14.4 Setup1 Tab

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

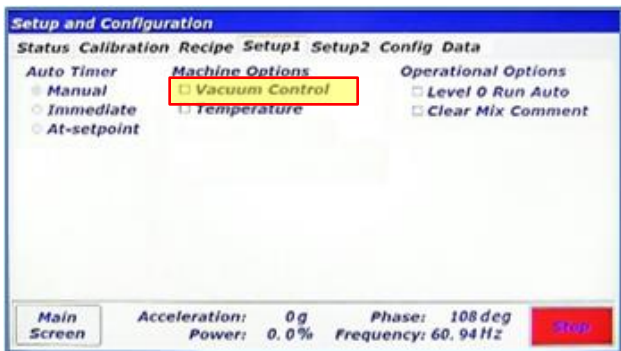
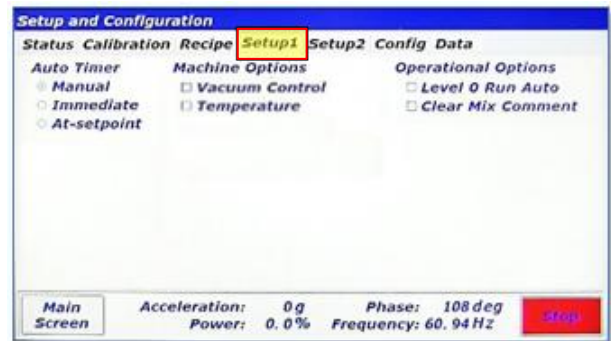
### 14.4.1 Auto Timer Group Box

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

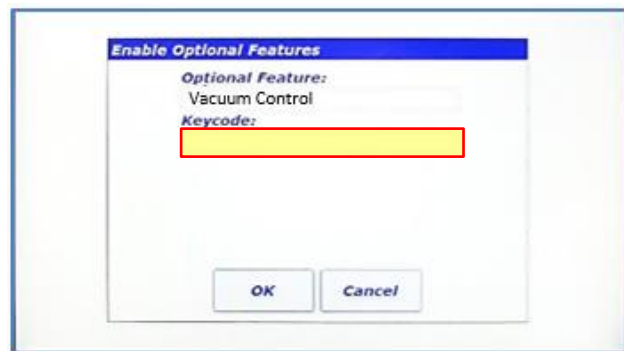
- **Manual:** Auto Mode timer starts only when the user presses <Start/Stop>.
- **Immediate:** Auto Mode timer starts as soon as LabRAM I starts mixing/accelerating.
- **At-setpoint:** Auto Mode timer starts as soon as LabRAM I acceleration reaches initial setpoint.

### 14.4.2 Machine Options Group Box

If a LabRAM I user decides to enable features after initial purchase, a keycode must first 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 indicates enabled features with a checked box. The following illustrates the process of enabling an optional feature.



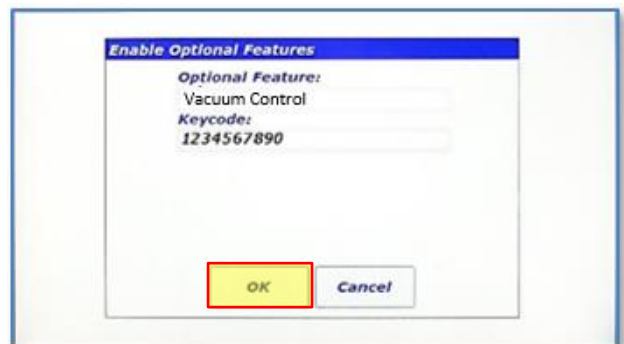
1. To enable the strobe light feature, touch the strobe light checkbox. Call Resodyn Acoustic Mixers to access a key code at 406-497-5333.



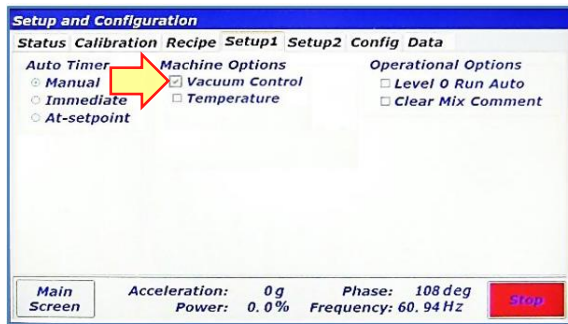
2. The "Enable Optional Features" dialog will appear. Touch the textbox under "Keycode:"



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.

### 14.4.3 Operational Options Group Box

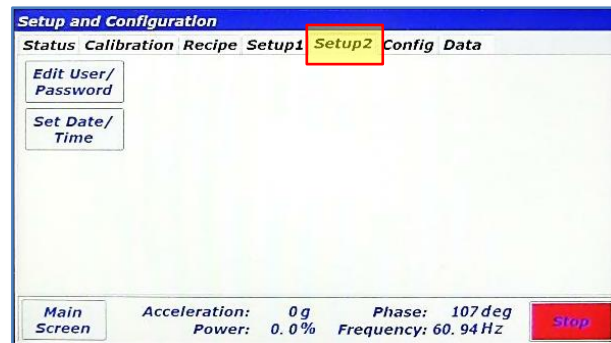
User preference options are located in the Operational Options Group Box. There are two options:

- **Level 0 Run Auto:** If this checkbox is checked, Level 0 (Operator) is allowed to operate the LabRAM I in Auto Mode.
- **Clear Mix Comment:** By default, the previous Mix Log Comment is retained between a LabRAM I shut down and re-start. This can be useful if a specific comment protocol is required. Checking this option will clear the Mix Log Comment between starts and force the user to re-type the mix comment.

### 14.5 Setup2 Tab

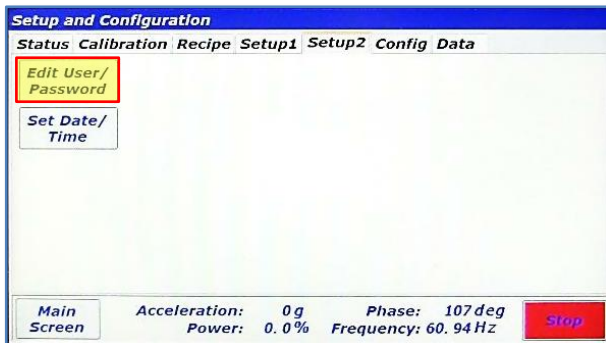
Two buttons are present on the Setup2 Tab:

- **<Edit User/Password>:** provides a user management utility to create new users, change passwords, and delete users.
- **<Set Date/Time>:** used to adjust the system date and time.

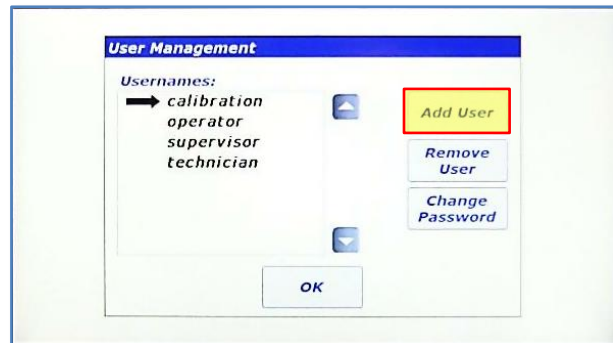


### 14.5.1 Screen Operations – User Management

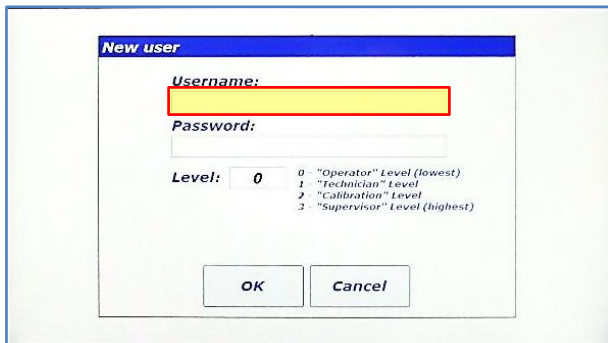
This section details how to create a new Level 2 (Calibration) user login.



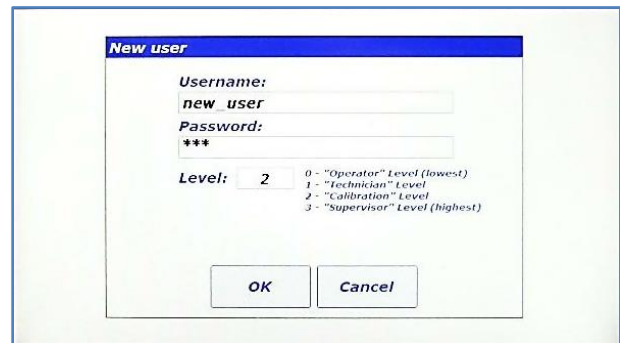
1. Touch the <Edit User/Password> button.



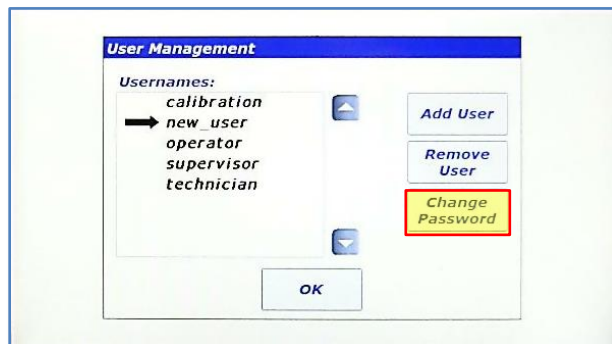
2. The "User Management" dialog appears. Touch the <Add User> button.



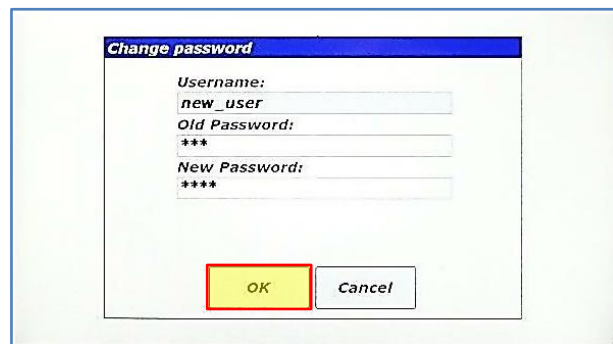
3. The "New User" dialog appears. Touch the "Username:" text box to enter a new username.



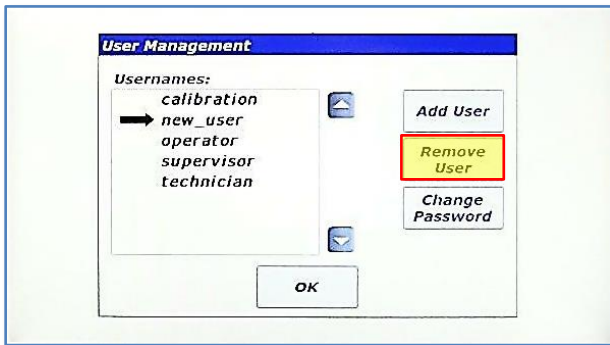
4. Enter the new username and password using the same method as initial login and set the login level number according to the description in the dialog. In this case, a Level 2 (Calibration) login will be created. Touch <OK> to create the new user.



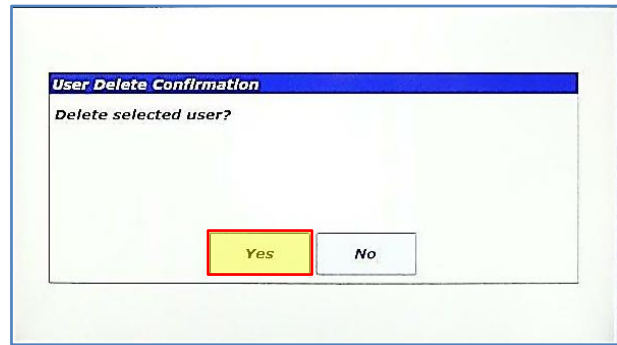
5. The new user has been created. To change the password created in Step 4, touch the <Change Password> button.



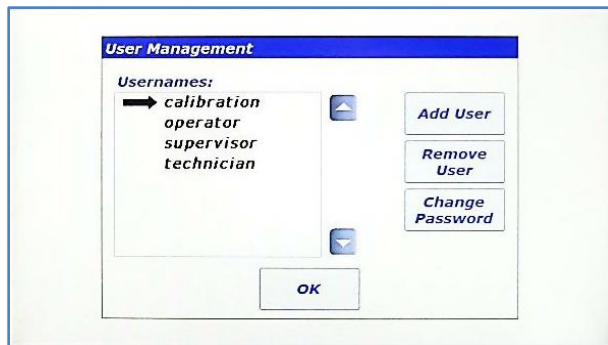
6. The "Change password" dialog will appear. Enter the old password from Step 4, and new password and then touch <OK>.



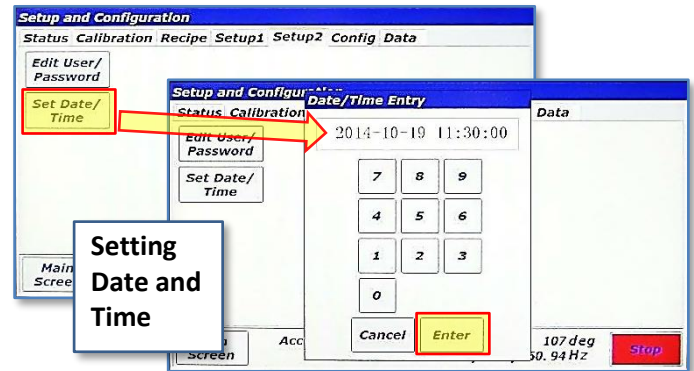
7. The password has been changed when the "User Management" dialog reappears. Otherwise, a failure dialog will notify the user of the failed password change. To delete a user, select it, and touch the <Remove User>.



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



9. The user has been deleted.



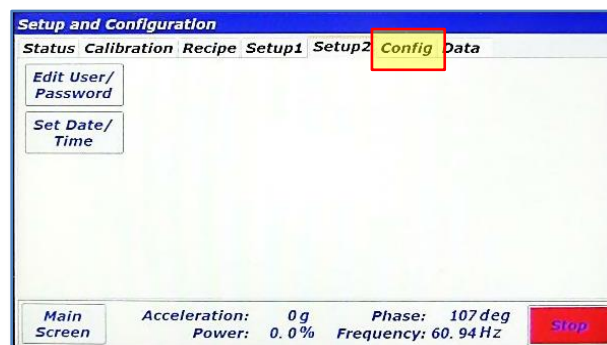
## 14.6 Setting Date and Time

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. The 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.

## 14.7 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 must be shut off.

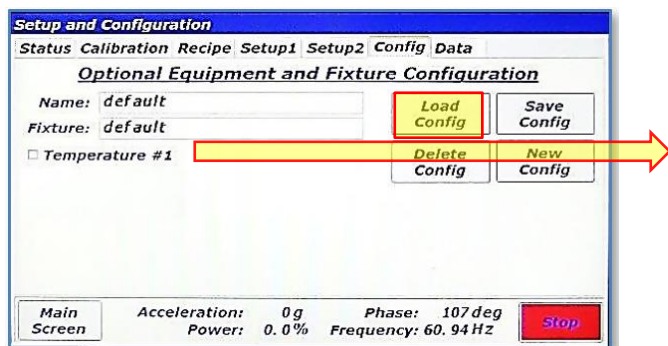
This tab also allows selection of configured fixtures (mix container and mix container holders) that provide necessary operating parameters and limitations of different fixtures.



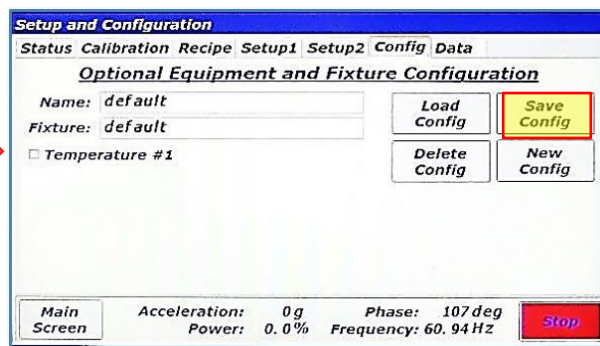
### 14.7.1 Screen Operations – Edit a Configuration

The following walk-through modifies the configuration provided with the LabRAM I 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.



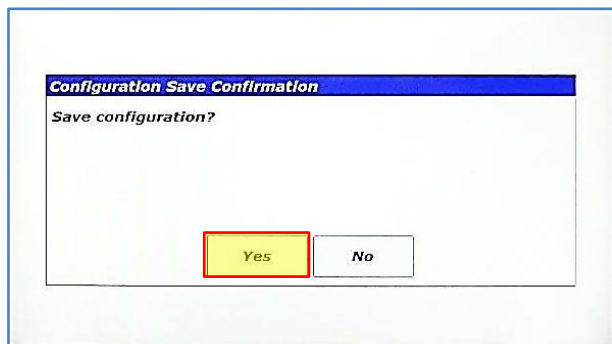
2. In the “Select Configuration” dialog, there is only one configuration defined, “default.” It is already selected. Touch <OK>.



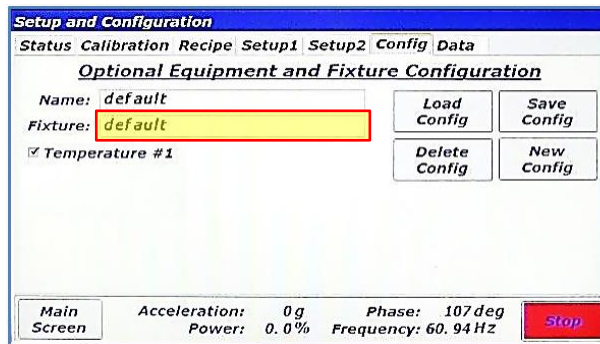
3. The “default” configuration is now loaded. Notice that the temperature checkbox is not checked. This means that in its current state, no temperature alarming would be active and the temperature would read “0.” Turn on temperature #1 by touching it.

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

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

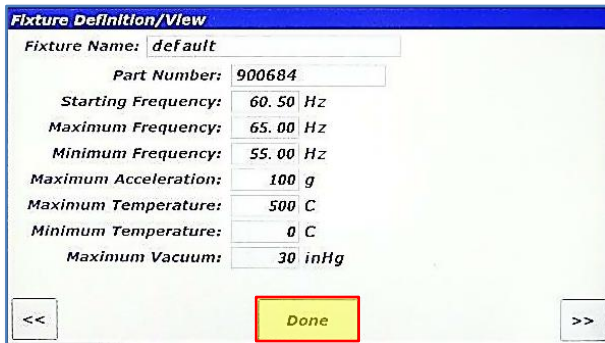


5. Touch <Yes> on the “Configuration Save Confirmation” dialog box.



6. Now that temperature #1 is checked and the default configuration saved, Temperature Channel #1 will be monitored and displayed. Additionally, all fixture and user temperature alarm limits will be activated.

The name given to the standard fixture shipped with the LabRAM I is also referred to as “default.” A fixture contains operational parameters associated with a mix container holder and mix container. The fixture files that define these parameters are created by Resodyn Acoustic Mixers and cannot be modified, but they are viewable. Touch the textbox next to “Fixture:”.



**Fixture Definition/View**

Fixture Name: default

Part Number: 900684

Starting Frequency: 60.50 Hz

Maximum Frequency: 65.00 Hz

Minimum Frequency: 55.00 Hz

Maximum Acceleration: 100 g

Maximum Temperature: 500 C

Minimum Temperature: 0 C

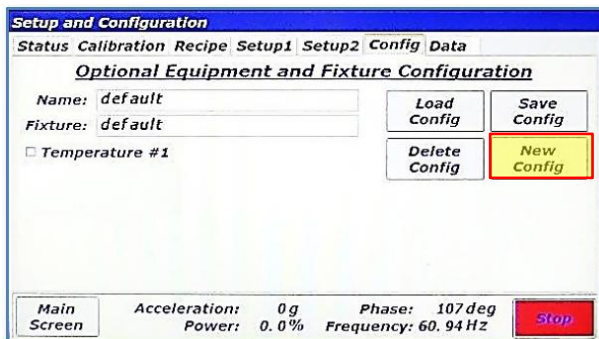
Maximum Vacuum: 30 inHg

<< Done >>

- The "Fixture Definition/View" screen will appear. The parameters for the selected fixture are displayed. When new fixtures are ordered, fixture files will need to be installed on the mixer using the procedure accompanying the fixture. If the system has more than one fixture defined, the "<<" and ">>" buttons scroll through all of the fixture files. Touch <Done>.

## 14.7.2 Screen Operations – Create a Configuration

The following details the creation of a configuration that could be used without temperature by modifying the default configuration using temperature.



**Setup and Configuration**

Status Calibration Recipe Setup1 Setup2 Config Data

**Optional Equipment and Fixture Configuration**

Name: default

Fixture: default

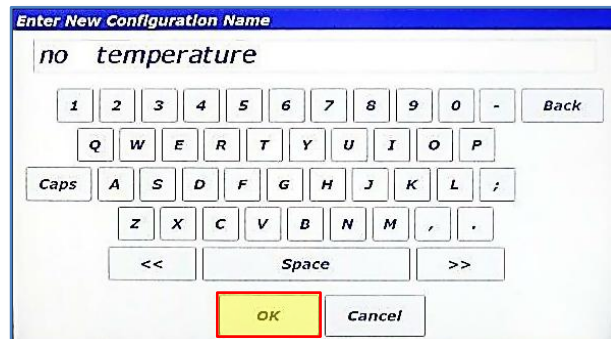
☐ Temperature #1

Load Config Save Config

Delete Config New Config

Main Screen Acceleration: 0g Phase: 107 deg Power: 0.0% Frequency: 60.94 Hz Stop

- Touch the <New Config> button.



**Enter New Configuration Name**

no temperature

1 2 3 4 5 6 7 8 9 0 - Back

Q W E R T Y U I O P

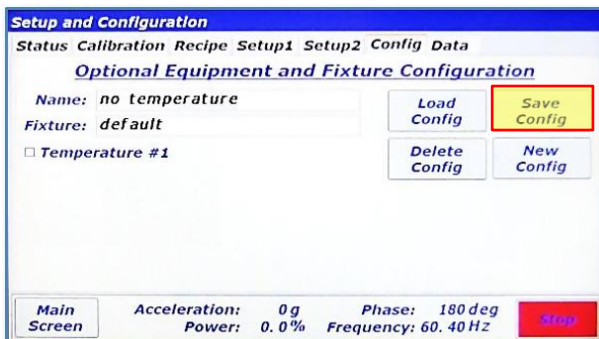
Caps A S D F G H J K L ;

Z X C V B N M , .

<< Space >>

OK Cancel

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



**Setup and Configuration**

Status Calibration Recipe Setup1 Setup2 Config Data

**Optional Equipment and Fixture Configuration**

Name: no temperature

Fixture: default

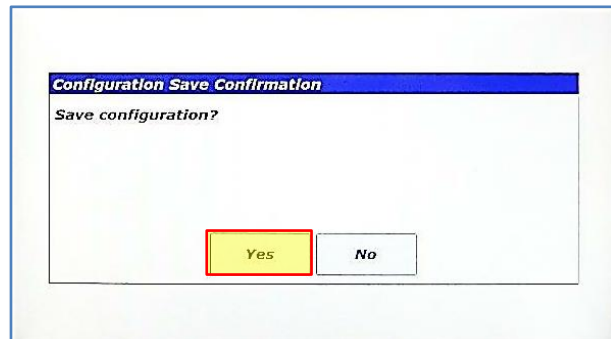
☐ Temperature #1

Load Config Save Config

Delete Config New Config

Main Screen Acceleration: 0g Phase: 180 deg Power: 0.0% Frequency: 60.40 Hz Stop

- Touch <Save Config> to save this configuration that does not use temperature monitoring.



**Configuration Save Confirmation**

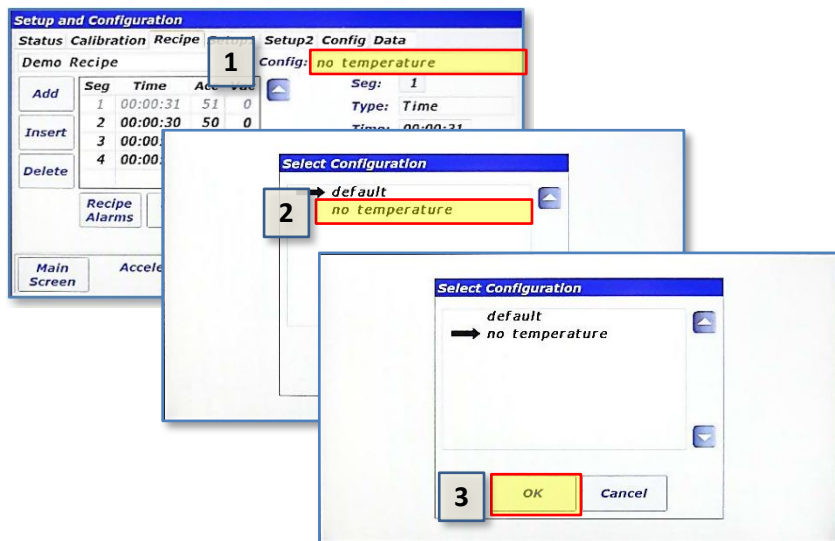
Save configuration?

Yes No

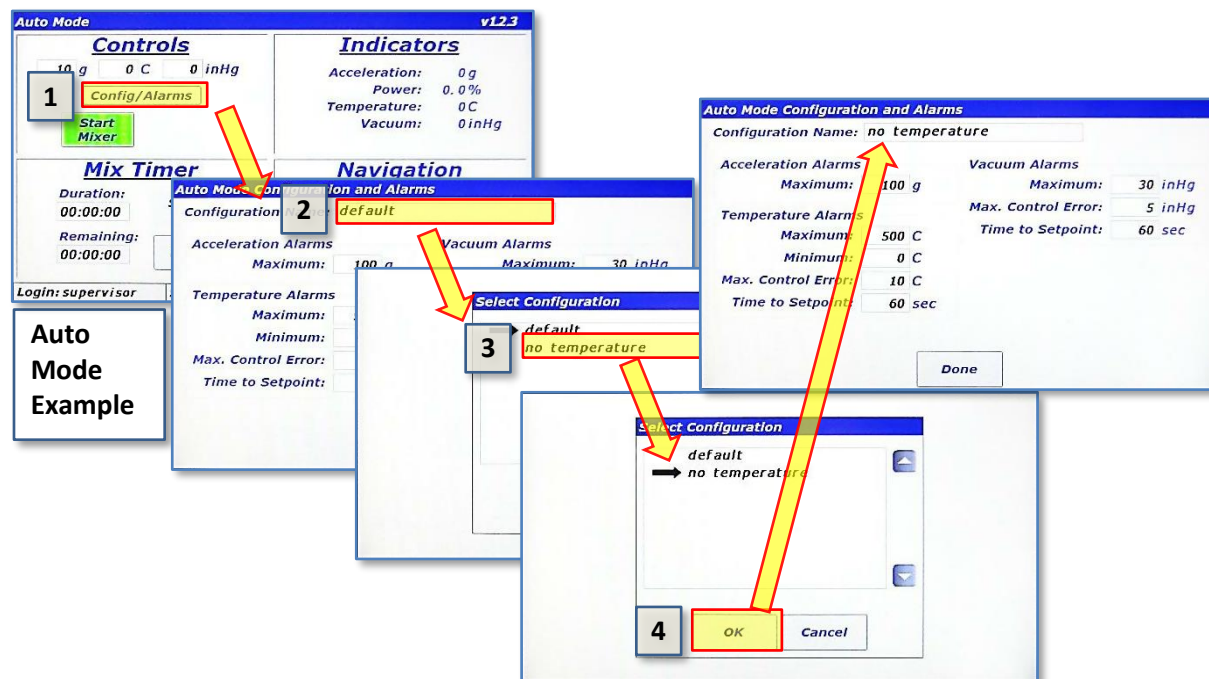
- Touch <Yes> on the "Configuration Save Confirmation" dialog box.

### 14.7.3 Configuration Usage

This section will provide a refresher of how Configurations are used. Configurations are used for both Recipe and Auto Mode. In 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 illustration.



In Auto Mode, the Configuration is selected by first touching the <Config/Alarms> button in the Controls pane and then selecting it in the “Auto Mode Configuration and Alarms” screen.

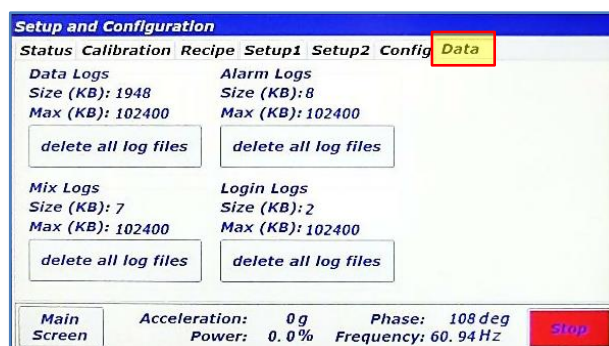


## 14.8 Data Tab

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

- **Data Logs:** Measured parameters are captured and written to data log files when the LabRAM I 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 to a login log file.

It is the user's responsibility to manage the size of the log file directories. 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 salesperson to obtain a copy of RAMTools and RAMViewer at +1-406-497-5333.

## **15 Care and Maintenance**

Resodyn Acoustic Mixers are manufactured at our corporate facilities in Montana, under a strict quality manual and an overriding corporate culture of producing world-class equipment that is built to last.

In order to help ensure a long life, it is important to perform regular preventive maintenance and cleaning as indicated below.

### ***15.1 Preventive Maintenance***

The bellows can prematurely wear and become damaged if materials are allowed to be free in the resonator area. Cleaning of the upper resonator and bellows ensures a long life of the bellows. If necessary, use a small hand vacuum to clear debris from the bellows area, making sure not to create a vacuum between the device and the bellows material. Use a soft, non-abrasive cloth and water to complete cleaning the bellows.

### ***15.2 Cleaning Procedures***

#### **Molded Plastic Acoustic Enclosure**

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 spirits that are free of aromatic compounds.

Rinse with damp, cold water after every cleaning process to remove any remnants of the cleaning process.

Do not use solvents or similar containing esters, ketones, aromatics, or halogenated hydrocarbons. Do not use strong acids, alkaline detergents, or abrasives. Rinse with cold water after every cleaning process.

### ***15.3 Accelerometer Calibration***

The LabRAM I acceleration should be calibrated once a year, or per the end, user's specified preventive maintenance schedule, or when the accelerometer is replaced.

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


### ***15.4 Maintenance***

The LabRAM I is designed with few serviceable replaceable parts.

#### **15.4.1 Major Repairs**

All repairs inside the enclosure should be diagnosed and performed 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 remove the acoustic enclosure. Electrical shock hazards may cause personal injury.
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### 15.4.2 Recommended Maintenance Schedule

The recommended preventive maintenance intervals for the LabRAM I only involve the bellows. The bellows are to be visually inspected weekly and replaced as necessary.

Recommended spare parts to have on hand are listed in Table 15-1 as well as their quantities.

**Table 15-1. Spare Parts List.**

Description	Part Number	Quantity
Bellows Replacement Kit	904131	1
*Fuses, 6.3A, Time Lag (For 100-120 VAC)	004481	2
*Fuses, 3A, Time Lag (For 200-240 VAC)	003059	2

\*Note – only select one fuse type based on VAC of Machine

## 15.5 Replacement of Serviceable Parts

Common client serviceable replacement parts are identified below in Table 15-2.


**Table 15-2. Customer Replaceable Parts List.**

Description	Part Number	Quantity
Accelerometer & Integrated Cable Assembly	904132	1
Bellows Replacement Kit	904131	1
*Fuses, 6.3A, Time Lag (For 100-120 VAC)	004481	2
*Fuses, 3A, Time Lag (For 200-240 VAC)	003059	2

\*Note – only select one fuse type based on VAC of Machine

### 15.5.1 Fuse Replacement

The fuse should only be replaced when power is being delivered to the machine, but the machine does not power up. If this occurs, please call your Resodyn Acoustic Mixers representative for further instructions.

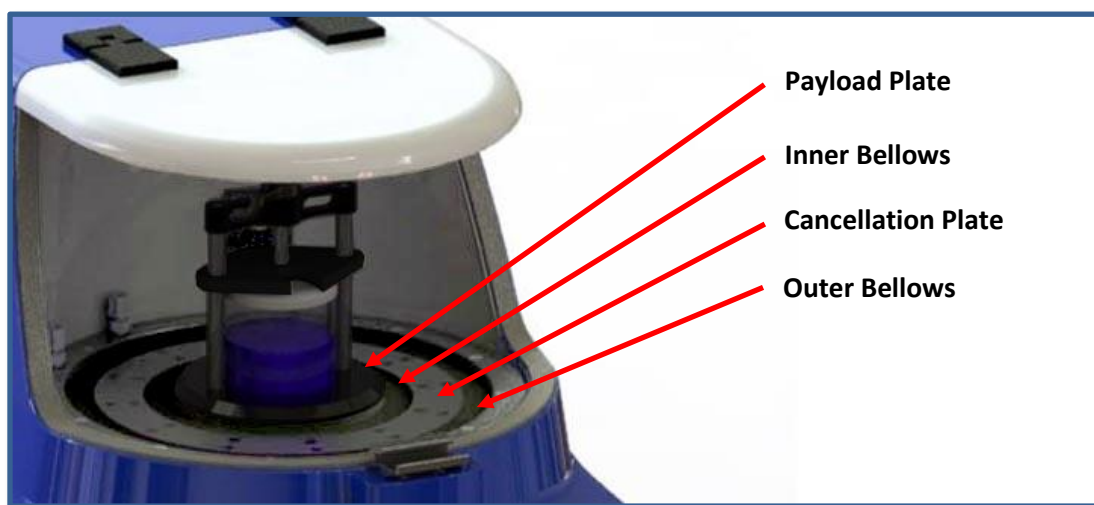
	Do NOT remove the fuse without first unplugging the AC power cord from its power source.
---	--

Fuse access is located on the lower-left area of the back of the LabRAM I, shown in Section 15.5.1 Fuse Replacement. Turn the fuse cap counterclockwise to remove the fuse.

Insert new fuse into cap and turn cap clockwise until secure. If the LabRAM I does not power up, please call Resodyn service at +1-406-497-5333 or email [service@resodyn.com](mailto:service@resodyn.com).

### 15.5.2 Bellows Replacement

The LabRAM I is equipped with a sealed inner enclosure that houses the Resonator. The interior of the machine is sealed with Inner and Outer Bellows between the moving plates and the enclosure. These bellows keep contaminants like dust and mixing media from getting into the Resonator. The Bellows are designed for operational life greater than 2000 hours with proper maintenance. Should a replacement be required, instructions are provided with the replacement parts.



### 15.5.3 Accelerometer Replacement

The LabRAM I is equipped with an accelerometer that is mounted to the underside of the mixing platform, shown above. The accelerometer is designed for an operational life greater than 2,000 hours. Should a replacement be required, instructions are provided with the replacement part.

When an accelerometer is replaced, the LabRAM I must be calibrated or damage to the machine may occur. Calibration Kits are available through Resodyn Acoustic Mixers.

## 16 Troubleshooting and Service

The LabRAM I 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.

Some straightforward solutions to resolve common operational events are shown below. Please review the chart before contacting your Resodyn Acoustic Mixers. If your problem is not suitably addressed by the table below, contact Resodyn Acoustic Mixers customer service for technical support at +1-406-497-5333 or email [service@resodyn.com](mailto:service@resodyn.com).

**Table 16-1. Troubleshooting Table.**

Description of Problem or HMI Screen Readout	Potential Problem	Solution
<b>The mixer will not power up.</b>	Power cord unplugged.  Power switch off.  Breaker blew.  Mixer main fuses are blown.	Ensure that the power cord is plugged into the mixer and a wall outlet. Ensure that the power switch (located on the back of the machine above power cord socket) is in the on position, "I."  Check breaker to ensure that the electrical socket is delivering power.  Contact Resodyn Acoustic Mixers for replacement fuses.
<b>Mixer Stopped During Operation.</b>	Door opened during operation, before mixer stopped.	Do not open the door while the mixer screen shows "Running" in the status bar.
<b>Broken Accelerometer</b>	Accelerometer cable or accelerometer has failed.	Accelerometer and cable assembly must be replaced. Contact Resodyn.
<b>Amplifier Over Temperature</b>	Mixer amplifier is too hot.	Ensure adequate ventilation on the backside of the mixer.  Ensure room temperature is within the specified range.
<b>Enclosure Over Temperature</b>	Mixer enclosure is too hot.	Ensure adequate ventilation on the backside of the mixer, at least 1" – 2".  Ensure room temperature is within the specified range.
<b>Amplifier Error</b>	Vessel overloaded.  Shorted wire.  Broken wire.	Remove mix material until it is within the maximum specified load limits, no more than 500 grams.  Contact Resodyn Acoustic Mixers.  Contact Resodyn Acoustic Mixers.

Description of Problem	Potential Problem	Solution
<b>Amplifier Over Current</b>	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 fixture on the LabRAM I.
<b>Over Acceleration (g)</b>	Mixer exceeded the maximum acceleration.	Contact Resodyn Acoustic Mixers.
<b>HMI Comms Error</b>	The HMI has ceased to communicate with the main controller.	Contact Resodyn Acoustic Mixers.
<b>Vacuum Module Comms Failure</b>	Communication Cable unplugged.	Ensure that the communication cable between the LabRAM I and the vacuum module is connected.
	Vacuum module turned off.	Ensure that the vacuum module is plugged in and turned on.
<b>Fixture Limit, High Accel. or User Limit, High Accel.</b>	Accelerometer cable or accelerometer has failed.	Accelerometer and cable assembly must be replaced.
	Incorrect user limit.	Verify user limits are correct.
<b>Fixture Limit, High Temp. or Fixture Limit, Low Temp. or User Limit, High Temp. or User Limit, Low Temp.</b>	RTD is 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 an accelerating portion of RTD cable.
	Bad RTD calibration.	Verify RTD calibration.
	Incorrect user limit.	Verify user limits are correct.
<b>Fixture Limit, High Vac. or User Limit, High Vac.</b>	Bad vacuum calibration.	Verify vacuum calibration.
	Incorrect user limit.	Verify user limits are correct.
<b>User Limit, Vac. Ctl. Error or User Limit, Vac. Ctl. Time</b>	Vacuum leak.	Check the system for a vacuum leak.
	Disconnected vacuum line.	Ensure all vacuum lines are connected correctly.
<b>Over Accel. at Low Frequ.</b>	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 fixture on the LabRAM I.

