

Model 480 and 481

Orbital Shaker*

Operating and Maintenance Manual 7020480 Rev. 3



- * Triple counter-balanced, single eccentric drive mechanism (U.S. Patent #5,558,437)
- * Horizontal, HEPA-filtered airflow design (U.S. Patent #5,577,837)
- * Test Tube Rack (U.S. Patent #5,632,388)

MANUAL NUMBER 7020480

3	26178	7/23/10	Removed CSA from Model 481 as N/A for 50hz units	ccs
2	25244/OS-340	2/13/09	Corrected stray line on 480-70-0-D to Rev. 2	ccs
1	24855	8/7/08	Re-inserted platform installation instructions	ccs
0	19233/SI-9436	10/5/05	Condensing unit P/N from 205064 to 205142, unit to Release 12	ccs
REV	ECR/ECN	DATE	DESCRIPTION	BY



Important Read this instruction manual. Failure to read, understand and follow the instructions in this manual may result in damage to the unit, injury to operating personnel, and poor equipment performance.

Caution All internal adjustments and maintenance must be performed by qualified service personnel.

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Section 1 Installation

The following materials are supplied with Model 480/481 Console Shaker:

- 2 - Keys for the lid lock (packaged and attached to outside of unit)
- 1 - T-handle 5/32" hex socket wrench
- 2 - Platform alignment studs 1/4-20
- 1 - Shaker Platform
- 6 - Grade 8, 5/32" hex socket flat head screws (provided with platform)
- 1 - 3/4" open end wrench
- 2 - 1/4-20 x 7" stand-off bolts with rubber caps
- 1 - Screwdriver for flask clip installation and removal

Pallet Hold-down Shipping Bracket

To secure the console shaker to the shipping pallet, hold-down brackets are attached to slots in both sides of the cabinet. The brackets are fastened to the wood pallet with lag screws (Figure 1-1).

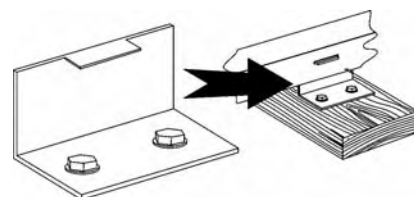


Figure 1-1. Bracket

Location

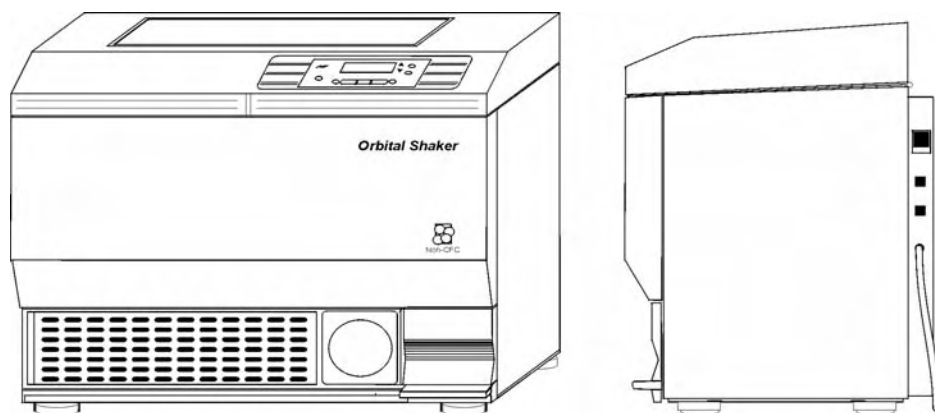
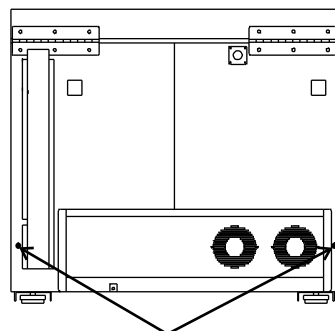


Figure 1-2. Front and Side View

Locate the shaker on a firm, level surface in an area free of dust and dirt. To allow for lid opening, the back of the shaker must be at least 4½ inches from the wall. Allow 6 inches clearance on both sides for ventilation purposes.

Installing the Cabinet Stand-off Bolts

The 480/481 console shaker features front-to-back air circulation for cooler compressor temperatures, increased performance and reliability and longer compressor life. Therefore, the fan area on the back of the cabinet must be at least 4 inches from the back wall or other obstruction. To maintain this distance, two 1/4-20 x 7" bolts are included in the parts bag.



Threaded holes for
stand-off bolts

Figure 1-2. Bolt Locations

Screw the bolts in the threaded holes on the back of the shaker cabinet (Figure 1-2). The bolts should be screwed in by hand to the limit of the threads. Further tightening is unnecessary. Put the protective rubber caps also supplied in the parts bag over the heads of the bolts.

Chamber Drain

A drain is provided in the bottom of the chamber for convenience when cleaning or removing spills. (Figure 1-3) A clear vinyl hose and plastic valve is connected to the drain and is accessed by removing the front grille assembly and the lower front panel. The grille is removed by gently pulling it off. It is held in place by six push-in type retainers.

To remove the cabinet panel located in back of the grille, remove six Phillips screws, three on the top and three on the bottom. It may also be necessary to loosen the two left side Phillips screws holding the kick panel assembly to the shaker frame.

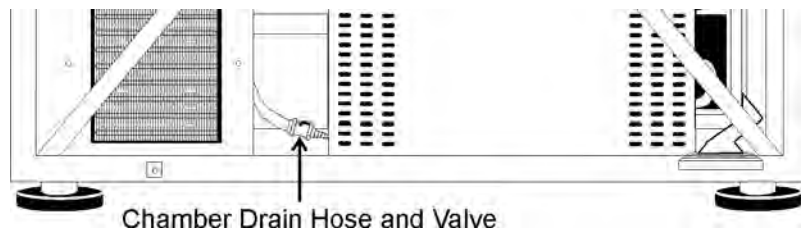


Figure 1-3. Chamber Drain Hose Location

Condensate Drain

A 3/8" O.D. stainless steel condensate drain is located on the back of the shaker to remove any water which may collect in the air duct work. Refer to Figure 1-4.

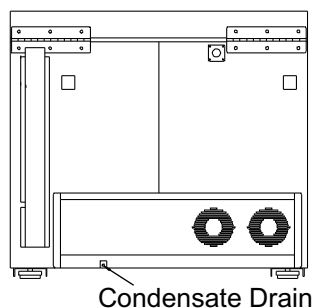


Figure 1-4. Drain Location

Installing the Platform

Note If your platform is already installed, skip this section and continue to next section. s

Caution Remove the shipping bracket and install the shaker platform before plugging in or attempting to operate the unit. s

After removing the orbital mechanism shipping bracket and installing the platform, remove this protective decal from the control panel to begin shaker operation.



Figure 1-5. Warning Decal

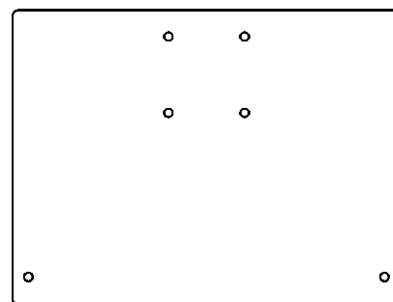


Figure 1-6. Shipping Bracket

To protect the shaker's orbital mechanism during shipment, a sheet metal shipping bracket (Figure 1-6) is installed and must be removed before the unit can be operated. Using a 7/16" and 9/16" hex wrench, remove the three 1/4" and the single 3/8" screws. Retain this hardware for future shipping.

Installing the Platform (continued)

This shaker accommodates either a 5/16" heavy-duty, 29.5" wide x 18" front-to-back platform.

Note If installing the larger platform, RPM is limited to 400. The 194012 counterweight kit must also be installed by qualified service personnel. s

All shaker platforms are attached to their orbital mechanisms with six 1/4-20 hex socket flathead screws Grade 8. These screws are hardened and should not be exchanged with any other screw type. The 5/32" hex socket wrench, included with the shaker, must be used when attaching the platform. Refer to Figure 1-7.

Caution Do not attempt to use a Phillips head screwdriver. s

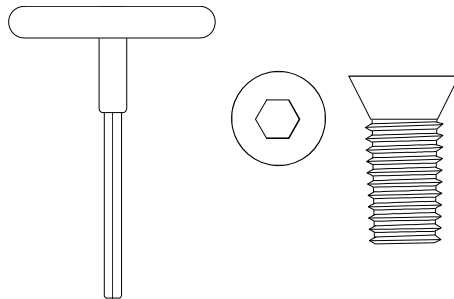
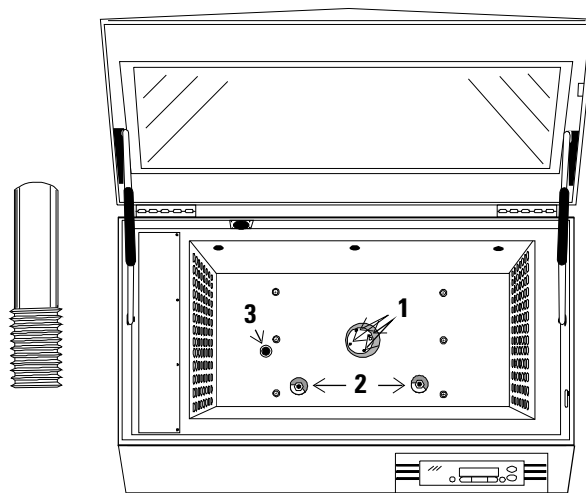


Figure 1-7. T-Handle Wrench and Hex Socket Head Screw



1) Platform mounting holes on drive mechanism (4)

2) Platform mounting studs (2). Insert alignment pins.

3) Chamber drain

Figure 1-8. Hole Locations

Installing the Platform (continued)

1. Insert the two 1/4-20 alignment pins into the two mounting holes identified in Figures 1-8 and 1-9.

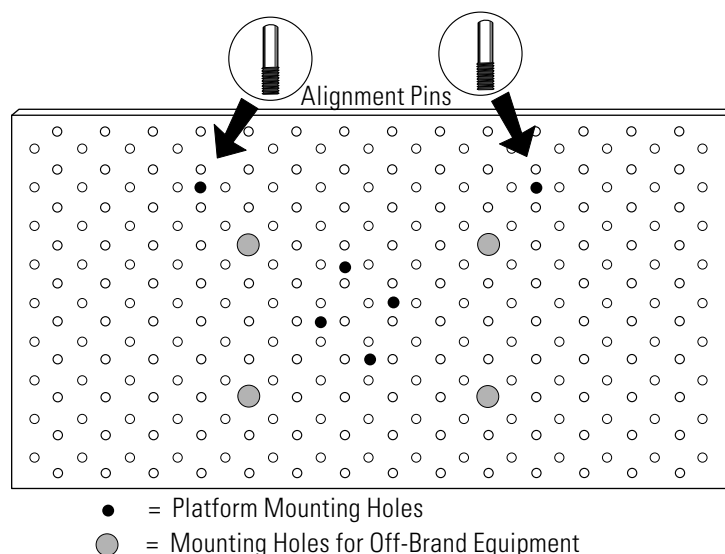


Figure 1-9. Hole Locations

2. Rotate the drive mechanism until the four mounting holes generally match the holes in the platform.
3. Place the platform onto the shaker and over the alignment pins.
4. Move the platform in an orbital motion until one or more of the center mounting holes are located.
5. Insert the hex socket head screws as the four holes are located. Do not tighten the screws.
6. Remove the 1/4-20 alignment pins and replace them with the remaining two hex socket screws.
7. Tighten all screws using the T-handle wrench.

Caution Use only the hex socket flat screws to fasten the platform, and only the T-handle wrench to tighten the screws. Torque these screws to 10 ft/lbs. Check these screws monthly if the unit is operated at or near maximum RPM (525 RPM).

Foot Pedal

The lid of the console shaker is counterbalanced for ease of opening and closing. A foot pedal on the lower right of the front of the cabinet is also provided for operator convenience and ready access to the chamber.

Assembling Flask Clips

Each flask clip up to 6.0 liters in size includes a metal spring which must be installed onto the clip. For flask clips through 500 ml, insert the end of each spring into the holes on the top of the clip leg (Figure 1-10).

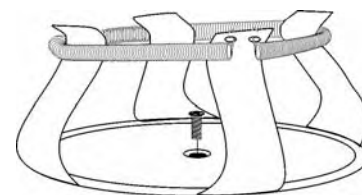


Figure 1-10. Insert Springs

The 2 liter, 2.8 liter, 4 liter, 5 liter, and 6 liter flask clips include two metal springs and rubber spring tubes. On these larger clips, the springs are installed by hooking their ends together as illustrated in Figure 1-6. The upper spring and spring tubes should be installed prior to mounting the clip to the platform. The lower spring and spring tubes, however, are placed around the bottom of the clip legs after the flask clip is fastened to the platform.

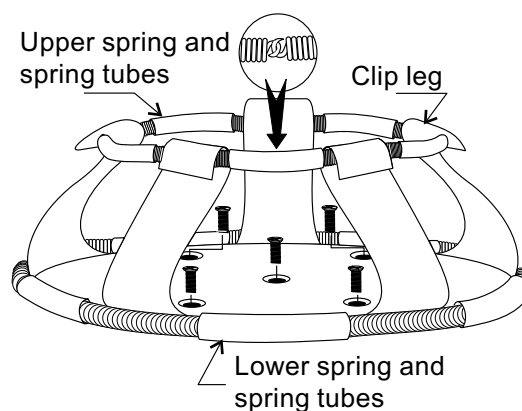


Figure 1-11. Spring Installation

Note that the rubber spring tubes are placed between the clip legs.

Installing the Flask Clips

The Model 480/481 accommodates glassware in numbers and sizes from ninety-one 25 ml flasks to four 6 liter flasks. All Thermo platforms have mounting holes for flask clips and test tube racks made by other manufacturers.

Installing the Flask Clips (continued)

Table 1-1 lists the flask clip assemblies and kits available for Thermo shakers.

Table 1-1. Flask Clip Capacity and Kit Assemblies Dedicated Platform

Dedicated platform no.	No. of Clips	Flask Size	Springs per Clip	Screws per Clip
238017	91	25ml	1	1
238018	91	50ml	1	1
238019	40	125ml	1	1
238020	40	250/300ml	1 w/ lg pad	1
238021	24	500ml	1	1
238022	15	1l	1	5
238023	12	2l	1	5
238024	6	4l	2 w/10 tubes	5
238025	4	6l	2 w/12 tubes	5
238026	6	2.8l	2 w/10 tubes	5

Flask clips can be attached anywhere on the shaker platform. The counter-balanced design of these shakers accommodates the worst unbalanced load.

The flask clips are supplied with the proper screws and are attached to the platform with a standard Phillips screwdriver or with the screwdriver provided with the unit.

Figures 1-10 and 1-11 illustrate the installation of the flask clips. Note that clips for 1, 2, 2.8, 4, 5, and 6 liter flasks use five screws. The 250/300l flask clip has an adhesive-backed flask cushion pad which is installed on the flat base of the clip body. A hole is provided in the pad for the mounting screw.

Installing the Test Tube Holders

The accessory test tube racks and test tube rack holders are available in four sizes and are listed in Table 1-2. All the test tube rack holders are adjustable in seven positions, swinging and locking at 15°, 30° and 45° in either direction. Figure 1-12 illustrates the Test Tube Rack Holder with the rack in place.

Figure 1-2. Racks and Holders

Part No.	Description
950040	Test tube rack 10-13mm size
950060	Test tube rack 16-20mm size
600074	Test tube rack 21-25mm size
600075	Test tube rack 26-33mm size
600076	Adjustable-angle test tube rack holder w/rack 10-13mm
600077	Adjustable-angle test tube holder w/rack 16-20mm
600078	Adjustable-angle test tube holder w/rack 21-25mm
600079	Adjustable-angle test tube holder w/rack 26-30mm
600089	2 tier microplate rack
600090	3 tier microplate rack
194024	#10-24 Pan head Phillips screws for mounting test tube holders to Thermo orbital shaker platforms
185062	Pan head Phillips screws, washers and nuts for mounting test tube holders to Thermo 2568 and 2569 shaker baths

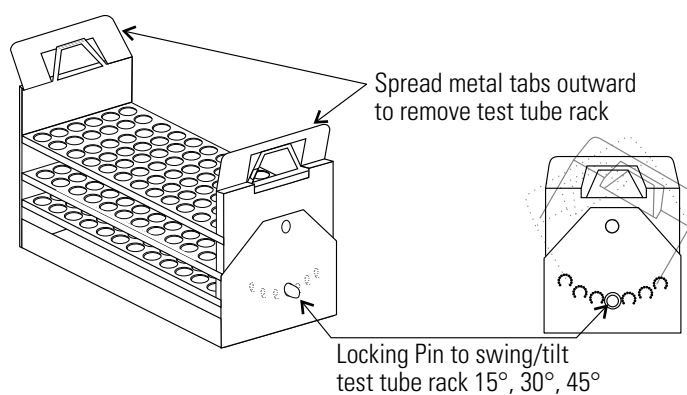


Figure 1-12. Holder with Rack

To remove the rack, spread the metal tabs on either end of the holder and lift it out.

Installing the Test Tube Holders (cont.)

To install the Test Tube Rack Holder onto the shaker platform, remove the rack and rotate the swing-bed of the holder 90° by pulling the knobs of the locking pins on either end of the holder outward. The pins are locked in the outward position by turning the knobs 1/4-turn (Figure 1-13).

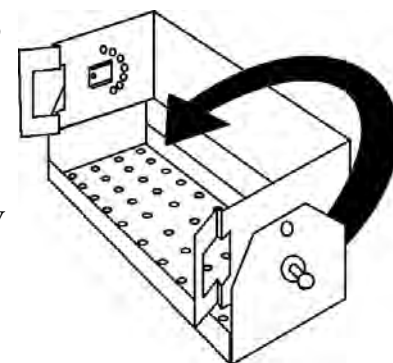


Figure 1-13. Rotate Bed

RS-232 Interface Connector

The Model 480/481 Orbital Shaker is equipped with an RS-232 Serial Communication Interface for the remote transmission of data. An RJ-11 telephone style connector is located on the back of the incubator. A cable with RJ-11 plugs and an RJ-11 to DB-25 adapter are required. Refer to Figure 1-15 for connector locations on the shaker back panel. Figure 1-14 identifies the pin connections.

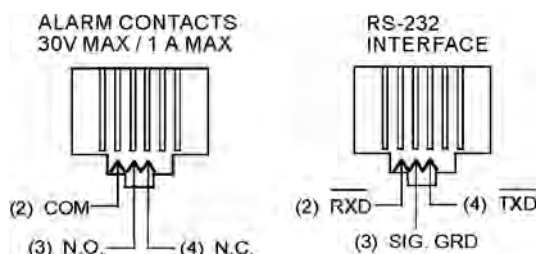


Figure 1-14. RS-232 and Remote Alarm Connectors

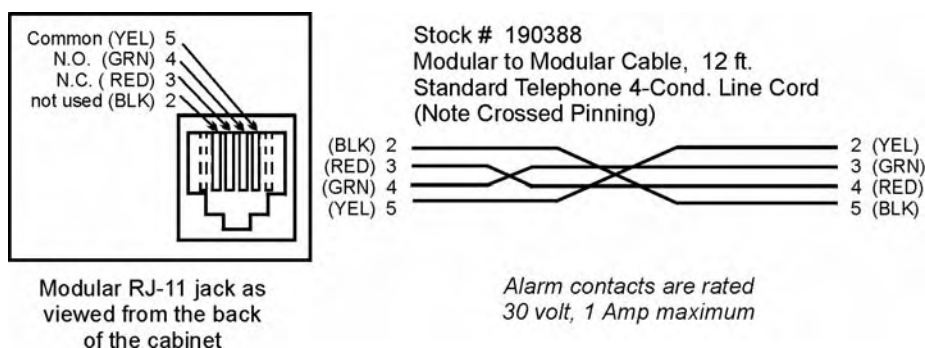


Figure 1-15. Pins

RS-232 Interface Connector (cont.)

The data is “dumb terminal” formatted, which permits interfacing with either a computer or a serial printer.

Three wires are used for the RS-232 interface:

1. Transmit data (/TXD) - pin 2 DB-25 connections
2. Receive data (/RXD) - pin 3 DB-25 connections
3. Signal ground (GND) - pin 7 DB-25 connections

The data format is:

Baud 1200 (9600 baud w/ jumper at J2 on Main Control Board)
Data bits 8 (7 bit ASCII with leading zero)
Start bits 1
Stop bits 1
Parity none

The data transfer sequence is transmitted in the following format. X refers to the numerical time, RPM and temperature.

(NUL)XX.XX(H)(SP)(SP)XXXRPM(SP)(SP)XX.XC(SP)(LF)(CR)(EOT)

NUL - Null character (0)

SP - Space

LF - Line feed

CR - Carriage return

EOT - End of text (4)

H - Hold Mode

The Model 480/481 transmits time, RPM and temperature information one minute after power is first applied to the unit and then every 60 minutes.

The shaker’s microprocessor responds to two ASCII commands from the remote: DC1 (XON), and DC3 (XOFF)

DC1 (17, 11 Hexadecimal)

The shaker will transmit Time, Temperature and RPM data upon receiving “DC1” (XON) and will restart 60 minute interval transmissions unless inhibited by a “DC3” (XOFF).

DC3 (19, 13 Hexadecimal)

Receiving a “DC3” (XOFF) from the remote inhibits the shaker from sending serial data indefinitely until a “DC1” (XON) is received.

Connecting the Remote Alarm

IMPORTANT USER INFORMATION

Caution! Stored product should be protected by a redundant 24 hour/day monitoring system with alarm capability. An interconnect jack and thermocouple are installed for centralized monitoring, should on-board system fail.

An internal, remote alarm SPDT relay is provided to monitor alarms and is connected by an RJ-11 (telephone style) jack located on the rear of the cabinet. The relay provides NO (normally open) and NC (normally closed) output and may be wired to a central remote alarm location or to an independent alarm system.

Figure 1-14 identifies the pin contacts. Figure 1-16 shows the location of the Remote Alarm Connector.

A modular to modular cable, Stock No. 190388 and an RJ-11 telephone style terminal converter, Stock No. 190392 or equivalent may be used to convert to a screw terminal connection. Refer to Figures 1-15 and 1-16.

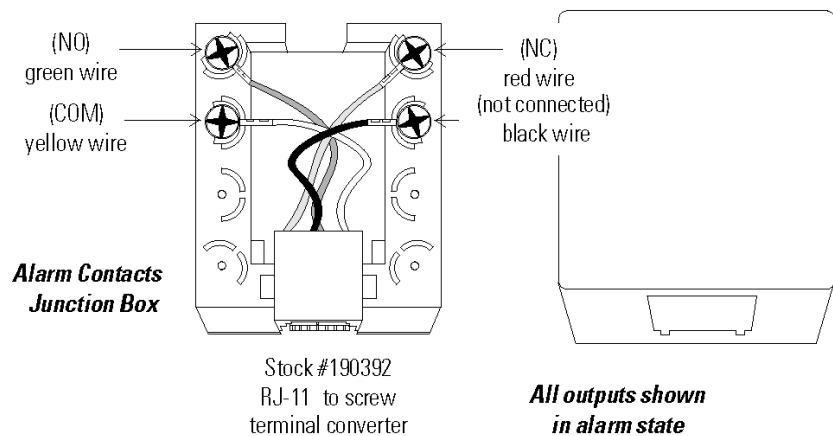


Figure 1-16. Junction Box

Lid Security Lock

To protect the contents of the shaker or prevent tampering or unauthorized access, a security lock is located on the right side of the lid. See the illustration below. Two keys for this lock are in the parts package attached to the outside of this unit when shipped.

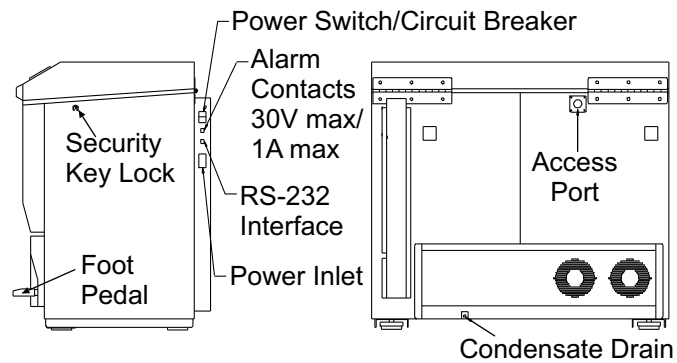


Figure 1-17. Rear and Side Panels

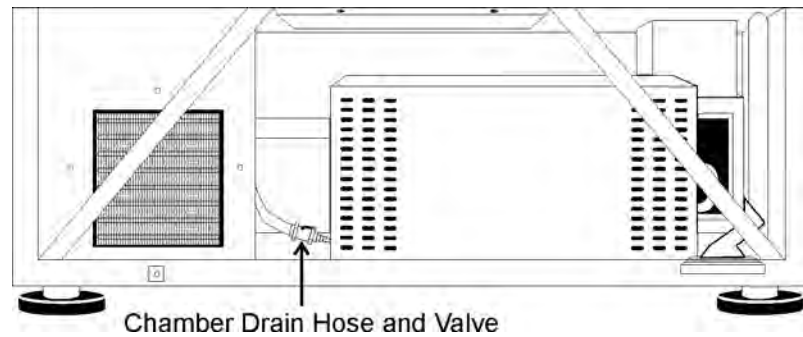


Figure 1-18. Front View with Grille and Kick Plate Removed

Connecting the Unit to Electrical Power

See the serial tag on the side of the unit for electrical specifications or refer to the electrical schematics at the end of this manual.

Caution Connect the orbital shaker to a grounded, dedicated circuit. The power ON/OFF switch is the mains disconnect device for the orbital shaker. Position the shaker so the switch is easily accessible.

Section 2 Operation

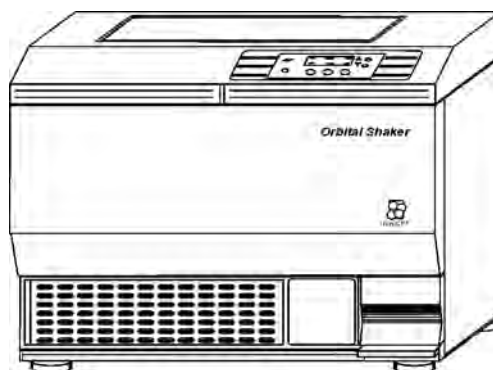


Figure 2-1. Front View

The Console Model 480/481 is a microprocessor controlled, incubator/refrigerated orbital shaker designed to accommodate a wide variety of flasks, test tubes and other glassware. The control system is easily programmed and stores the user-defined time, temperature and speed settings which remain in memory even when the shaker is turned off and unplugged.

The computer-based speed controller continuously adjusts for line voltage fluctuations and provides smooth start-ups and consistent RPM control. The circuitry is designed to slowly bring the platform up to speed and down to a stop to prevent liquid splashing from flasks or test tubes.

The insulated lid with viewing port is counter-balanced for easy opening by hand or foot pedal. A convenience interlock requires that the lid be closed for the drive motor, circulating fans and refrigeration system to operate.

Caution The microprocessor speed control system may take up to one minute to bring the platform up to speed. Never leave the shaker unattended when starting. Make sure all flasks and test tube racks are firmly seated in the clips and check the security of the flask clip and platform attachment screws monthly. Air circulating fans will only operate with the lid closed. Do not operate the shaker at maximum RPM without a load.

Operating the Control Panel

The Model 480 control panel has a liquid crystal display and eight operating keys or buttons which are identified by word and symbol. During programming activities, the up and down arrows increase and decrease the numerical values of time, platform speed, or temperature. Pressing and holding either arrow will cause the values to scroll in that direction. Pressing and holding for about five seconds will increase the scrolling speed.

When programming the system configuration, the Up arrow returns the display to the system's Operating Screen showing the Time, RPM and Temperature, while the Down arrow advances the display to the next programming screen.

The alarm indicator and alarm silence button complete the shaker control panel. When in alarm, the unit sounds an audible warning and flashes the three red indicators. Pressing the Silence button turns off the audible portion of the alarm. However, the three flashing indicators continue to flash until the alarm condition is corrected. The audible warning will sound again in about fifteen minutes if the condition continues.

The alarm features are discussed in detail later in this section.

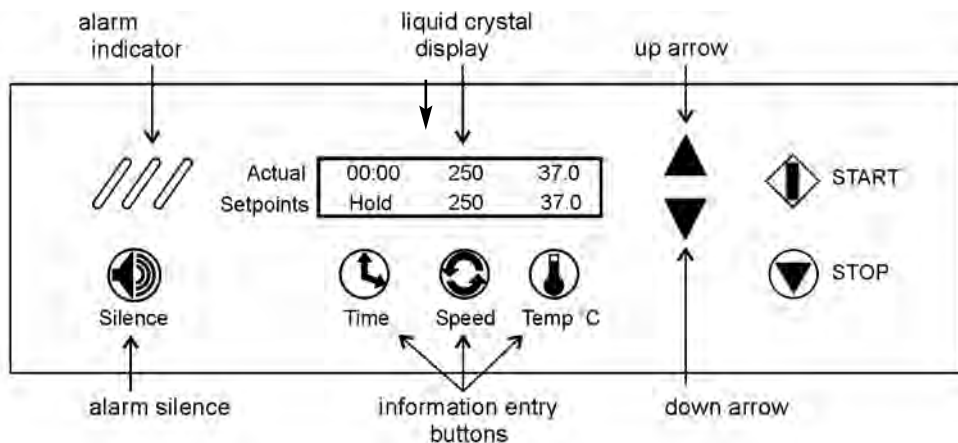


Figure 2-2. Control Panel

Quick Start-Up

The Model 480 Orbital Shaker may be operated as soon as the platform is installed, the unit is plugged in, and turned on.

Note At power up, the screen at the right will briefly appear. s



Pressing Start and Stop will operate the shaker at the factory settings shown in Figure 2-2. When starting, the Actual numbers along the top of the liquid crystal display will differ from the Setpoint values shown along the bottom. These numbers will change as the unit begins to operate.

Time - With the time set at Hold, the time display in the upper left portion of the screen will begin to count upward, showing the total operating hours and minutes. The system will reset to 00:00 whenever the unit is stopped and restarted, using the Stop and Start buttons. The unit will not reset if the unit is turned off and on using the power switch, or if the console lid is repeatedly opened and closed.

Speed - The Actual speed will display zero RPM's and will gradually rise to the setpoint as the platform begins its motion.

Temperature - The temperature, shown in the upper right portion of the liquid crystal display, will indicate the actual ambient temperature inside the cabinet and will gradually move toward the 37° setpoint.

The values shown in Figure 2-2 are set at the factory and are considered default values. Other factory settings are shown in the table below.

Factory Settings

The Model 480/481 Shaker has been shipped from the factory with the following default settings:

Time: When the shaker is turned on for the first time, the liquid crystal display will show 00:00H. (Hold time) This means the unit is set to record accumulated operating time. Any programming changes in the Time settings are made in increments of five minutes.

RPM: The display shows the unit ready to operate at 100 RPM. Programming changes in the RPM are made in increments of 1 RPM. However, if the Up or Down buttons are held for about two seconds, the display will scroll in that direction.

Temperature: The display shows the operating temperature set at 37°C. Changes to the Temperature program settings are made in increments of 0.1°C. However, if the Up or Down buttons are held for about two seconds, the display will scroll in that direction.

Other Factory Defaults

Function	Default
Audible Alarm	ON
RPM Tracking Limit (fixed)	5
Temperature Tracking Limit	10°C
Over Temperature Shut-down	63°C to 65°C
Under Temperature Shut-down	-1°C to +2°C
All Remote Alarms	ON

To get the most from the shaker's microprocessor-based technology, the Model 480 can be easily programmed to meet the most demanding laboratory requirements. The following sections outline the procedures for changing the settings and for programming the shaker control system.

Changing Temp, Speed & Time Settings

When the unit is turned on or when the shaker is operating, Temperature, Time and RPM values are displayed on the LCD. A typical screen is illustrated in Figure 2-2. For convenience, this is called the Operating Screen throughout the operating manual. All programming or setting changes start from this screen.

The instructions to program the Model 480 are written in a step-by-step format. For convenience, these instructions begin and end at the Operating Screen.

Caution At any time during programming or changing settings, if no control panel buttons are pressed for about fifteen seconds, the display will automatically return to the Operating Screen, storing any settings made. New settings are stored immediately when either arrow key is pressed.

Changing the Temperature

Press the button beneath temperature setpoint (Temp°C). The temperature value will begin to flash.

Press the up or down arrows to set the new temperature in 0.1°C increments. Hold either button to scroll.

Press the temperature button twice again to return to the Operating Screen.

Changing the RPM

Press the button beneath the Speed setpoint. RPM value begins to flash.

Press the up or down arrows to set the new speed in 1 RPM increments. Hold either button to scroll.

Press the Speed button again to return to the Operating Screen.

Changing the Time

The Model 480 manages operating time in two ways:

Hold - When Time is set to Hold, the value shown in the Actual portion of the display represents total operating time and may be reset at the operator's convenience. The shaker will continue to count upwards even if the console lid has been repeatedly opened and closed, or turned off and on with the power switch. The Time will, however, reset to 00:00 when the Stop button is pressed and the unit then restarted by pressing the Start button.

Countdown - When the Hold setpoint is changed to Countdown, entering a time value in hours and minutes programs the shaker to operate for that period of time and automatically shut down. The display will show the total time in the Setpoint segment and the operating time remaining in the Actual part of the display, as the microprocessor counts down to zero. An additional feature of the Model 480 is Hold Temperature. This allows the operator to program the shaker to operate at one temperature and then hold the cabinet at another temperature when the countdown reaches zero. The platform will stop, but the fans and the temperature control systems will continue to operate.

Changing from Hold to Countdown

1. Press the button beneath the Time setpoint. Hold will begin to flash.
2. Press either arrow to access the Countdown Time setpoint. The preset time setpoint will begin to flash.
3. Press the up or down arrows to set the desired operating time in five minute increments. Hold either arrow to scroll in that direction.
4. When the desired elapsed time is set (6 hours, 30 minutes in this example), press the Time button to return to the Operating Screen. Pressing the Start button will start the shaker and begin the countdown sequence. As it counts down, the Actual time shown will decrease. When 00:00 is reached, the shaker will automatically shut off and the Cycle Complete alarm will sound.

Actual	00:00	250	37.0
Setpoints	Hold	250	37.0

Actual	00:00	250	37.0
Setpoints	06:30	250	37.0

Shaker Alarms

The Model 480 Orbital Shaker control system monitors and provides alarms for nine operating parameters.

Parameter	Alarm Message
Overtemp Setpoint Status	Overtemp Shutdown
Cycle Status	Cycle Complete
Loss of Input Power	Power Failure*
RPM versus Setpoint	RPM Tracking
Drive Belt Integrity	Check Belt
Temp Sensor Integrity	Sensor Fault
Temp Control Status	Temp High/Low
Platform Movement Status	Platform Stalled
Motor Fuse Integrity	Check Fuse

Both audible and visual alarm warnings for these nine parameters are provided by the orbital shaker. Visual flashing of the three diagonal indicator lights on the control panel, a progression of text messages on the display, and an audible tone alerts the operator that an alarm condition has occurred or currently exists.

For convenience, the audible tone is silenced by pressing the Silence button, but will ring back in about 15 minutes. However, the alarm warning indicator lights and alarm messages continue until the alarm condition is corrected by the operator. Then, pressing the Silence button clears the message from the display. (The Check Belt and Check Fuse alarm messages clear from the display when the unit is turned back on after correcting the alarm condition.)

As discussed in 'Changing the Shaker Configuration' in this section, the audible alarm feature may be turned off to suit operator or laboratory needs. Refer also to the alarms and corrective actions chart in the Service section of this manual.

If power is interrupted for two hours or more while the Shaker is turned on but not shaking, a Power Fail alarm will occur. The purpose of the alarm in this case is to alert the user that an extended duration power failure occurred during the Hold interval after a timed shaking operation, or during a period of incubation only. This alarm will also occur any time the Shaker is turned on after an extended off period greater than 2 hours (such as when the unit is shipped from the factory, or when it is returned to use after a period of storage).

** The alarm will not occur if the power failure is less than 15 seconds in duration.*

Overtemp Shutdown

Overtemp Shutdown alerts the operator that the overtemp setpoint has been exceeded by a few tenths of a degree.

Actual	08:41	250	37.0
Setpoints	Overtemp Shutdown		

The Overtemp Shutdown message will be displayed and the heaters turned off, but the platform and blowers continue to operate.

In the alarm state, the audible alarm is silenced by pressing the Silence button, but will ring back in about 15 minutes. The screen message and warning lights, however, will continue until the fault is corrected. Then the alarm message is cleared by pressing the Silence button.

Undertemp Shutdown

Undertemp Shutdown alerts the operator that the chamber temperature has gone below the Undertemp setpoint by a few tenths of a degree.

Actual	08:41	250	37.0
Setpoints	Undertemp Shutdown		

The Undertemp Shutdown message will be displayed and the refrigeration will be turned off, but the platform and blowers continue to operate.

In the alarm state, the audible alarm is silenced by pressing the Silence button, but ring back in about 15 minutes. The screen message and warning lights, however, continue until the fault is corrected. Then the alarm message is cleared by pressing the Silence button.

Cycle Complete

Cycle Complete alerts the operator that the end of the count-down running time has been reached.

Actual	00:00	0	37.0
Setpoints	Cycle Complete		

The Cycle Complete message shown is displayed and the shaker stops. Pressing the Silence button clears the message from the display screen.

Power Failure

Power Failure alerts the operator that electrical power to the shaker has been interrupted, then restored during shaking.

Actual	00:00	0	37.0
Setpoints	Power Failure		

The system will return to normal operation when power is restored, however, the alarm message and audible tone continue to alert the operator. Both the display and audible tone are cleared by pressing Silence.

RPM Tracking

RPM Tracking alerts the operator by either alarm message shown below that the platform speed has varied ± 5 RPM.

Actual	08:41	255	37.0
Setpoints	RPM is High		
Actual	08:41	245	37.0
Setpoints	RPM is Low		

Note A two minute alarm delay is built into the software.

In the alarm state, the audible alarm is muted by pressing the Silence button, but rings back in about 15 minutes. The screen message and warning lights, however, continue until the fault is corrected. Then, the alarm message can be cleared by pressing the Silence button.

Check Belt

Check Belt alerts the operator that the drive belt may have broken or something is slowing or preventing platform movement.

Actual	08:41	0	37.0
Setpoints	Check Belt		

In the alarm state, the audible alarm is muted by pressing the Silence button, but rings back in about 30 minutes. The screen message and warning lights, however, continue until the fault is corrected. The alarm message is cleared by cycling power to the unit OFF, then ON.

Sensor Fault

Sensor Fault alerts the operator that either of the shaker's two temperature sensors have failed. An alarm message similar to those shown at right indicates which sensor has failed.

Actual	08:41	250	37.0
Setpoints	Main Temp Sensor		
Actual	08:41	250	37.0
Setpoints	Over Temp Sensor		

When in the alarm state, the audible alarm is muted by pressing the Silence button, but rings back in about 15 minutes if the fault condition persists. The screen message and warning lights continue until the fault is corrected.

When the sensor problem is corrected, the alarm message is cleared by pressing the Silence button.

Temperature High or Low

Temperature High or Temperature Low alerts the operator that the operating temperature of the shaker has risen above or fallen below the programmed temperature tracking limit control point. Therefore, either of the alarm messages shown at the right are displayed.

Actual	08:41	250	47.0
Setpoints	Temperature is High		
Actual	08:41	250	27.0
Setpoints	Temperature is Low		

In the alarm state, the audible alarm is muted by pressing the Silence button, but rings back in about 15 minutes if the fault condition persists. The screen message and warning lights continue until the fault is corrected.

When the temperature problem is corrected, the alarm message is cleared by pressing the Silence button.

Platform Stalled

Platform Stalled alerts the operator that something is preventing free platform movement. The motor automatically shuts off and the audible alarm, screen message and warning lights are initiated. The motor will attempt restart after approximately 15-20 seconds. The motor will continue to cycle on and off until the obstruction is removed, or the unit is turned off. On motor restart, the audible alarm and warning lights are automatically cleared. The screen message will remain until cleared by the operator.

Actual	08:41	0	23.7
Setpoints	Platform Stalled		

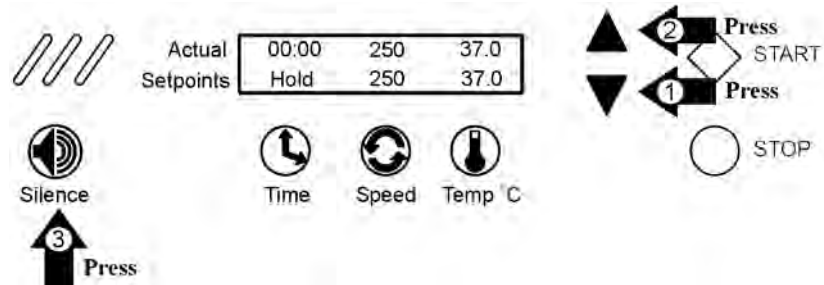
Check Fuse

Check Fuse alerts the operator that primary drive motor fuse has blown. The audible alarm, screen message and warning lights are initiated. When the unit is turned on after fuse replacement, all alarm indicators are automatically cleared.

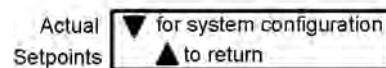
Actual	08:41	0	23.7
Setpoints	Check Fuse		

Changing the Shaker Configuration

To access the system Configuration menu, press the down arrow, the up arrow, and the Silence button in that sequence.

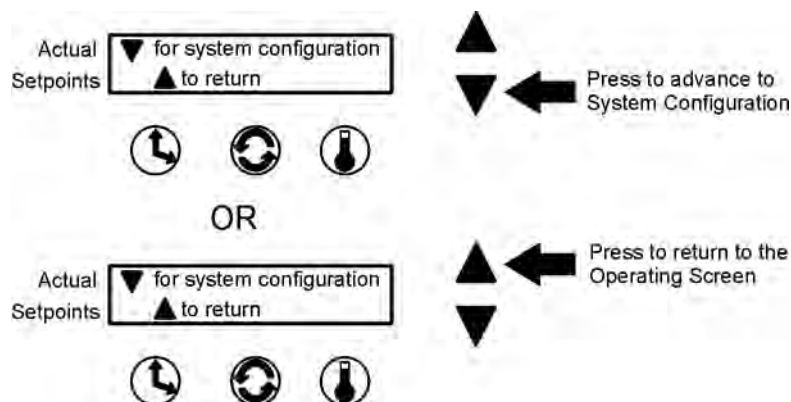


This screen will appear on the display.



Pressing the down arrow continues with system configuration.

Pressing the up arrow returns to the Operating Screen.

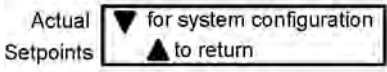
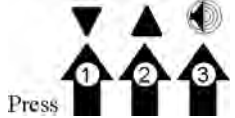


Note During the following configuring procedures, menu options are given to either modify a setting as it appears in sequence or scroll past to the next item. If no selection is made by pressing a button or arrow, the display will revert to the Operating Screen in about fifteen seconds. The complete configuration menu is shown in the chart at the end of this section.

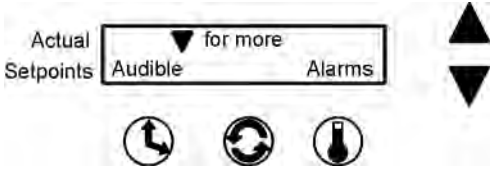
Note In these procedures, values and settings for time, temperature, speeds, alarms, and so forth are shown on the display screens. These numbers are for example only and may not be the values encountered when programming your shaker.

Turning the Audible Alarm On and Off

Begin by pressing the down arrow, the up arrow, and the Silence button. The screen following will appear on the display:

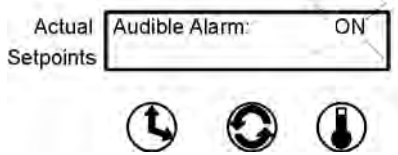


When this screen opens, press the down arrow once.

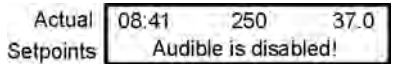


At this screen (above), press the Time button beneath Audible. The following screen will appear and the current setting will flash.

Press the up or down arrow to turn the audible alarm function on or off. Pressing any of the three buttons (Time, Speed, or Temp) will return the display to the previous screen. Not pressing anything for about fifteen seconds returns the display to the Operating Screen.



When the audible alarm is disabled, a warning message is placed in the Setpoint portion of the Operating Screen display as illustrated at right.

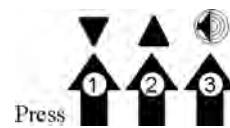


Setting Alarm Limits

Three temperature alarms are programmed into Model 480 Orbital Shaker; Overtemperature, Undertemperature, and Tracking Limits.

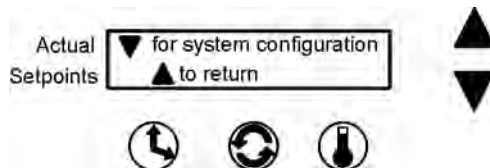
Setting the Overtemperature Alarm

The Overtemperature alarm activates whenever the operating temperature goes above the Overtemp setpoint temperature by a few tenths of °C. This adjustable limit is set at the factory at approximately 64°C. To change this value, open the Configuration menu by pressing the down arrow, up arrow, and the Silence button in the sequence shown at the right.

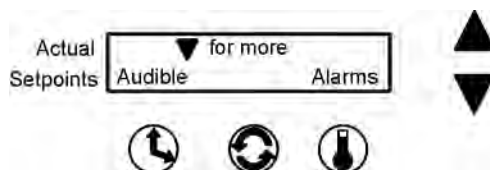


When this screen (below) opens....

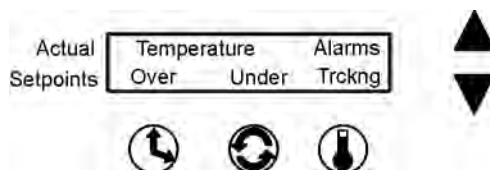
Press the down arrow once



And then press the Temperature button beneath Alarms.



To change the overtemperature alarm setting, press the Time button beneath Over. The following screen will appear and the current over-temperature alarm setting will flash.



Change the temperature setting by pressing the up or down arrow. When set, press the Temperature button to return to the previous screen or press nothing for about fifteen seconds. The display will change to the Operating Screen, saving the new settings into memory.



Setting the Overtemperature Alarm (continued)

When the overtemperature setpoint is exceeded by a few tenths of a degree, the control system will shut the heating system do wn by turning off the heaters.

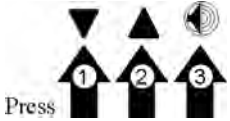
The Overtemp Shutdown warning shown above will be displayed, the warning lights will flash and the audible warning (if not turned off) will sound.

Pressing the Silence button will turn off the audible alarm. H owever, the warning lights will continue to flash and the alarm message will continue to be displayed until the over-temperature condition is corrected. The audible warning will also sound again in about 15 minutes if the overtemperature condition persists.

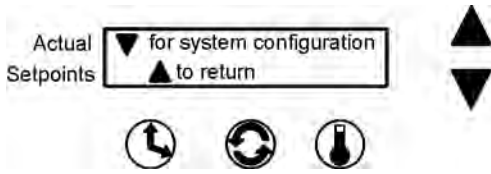
When the fault is corrected, press the Silence button to clear the alarm message from the display.

Setting the Undertemperature Alarm

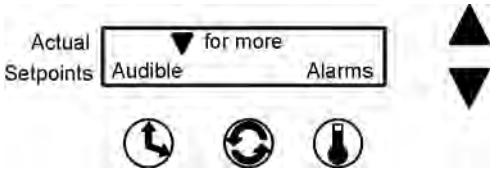
The Undertemperature alarm activates whenever the operating temperature goes below the undertemp setpoint temperature by a few tenths of a °C. This adjustable limit is set at the factory at approximately -1°C. To change this value, open the Configuration menu by pressing the down arrow, up arrow, and the Silence button in the sequence shown at the right.



When this screen (below) opens...
Press the down arrow once

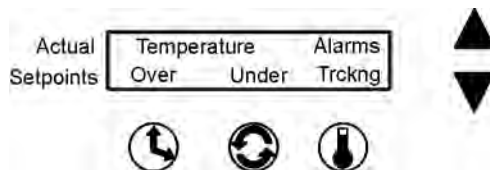


And then press the temperature button beneath Alarms.



Setting the Undertemperature Alarm (continued)

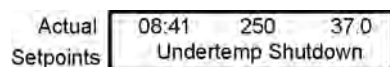
To change the undertemperature alarm setting, press the Speed button beneath Under. The following screen will appear and the current undertemperature alarm setting will flash.



Change the temperature setting by pressing the up or down arrow. When set, press the Temperature button to return to the previous screen or press nothing for about fifteen seconds. The display will change to the Operating Screen, saving the new settings into memory.



When the undertemperature setpoint is exceeded by a few tenths of a degree, the control system will shut the cooling system down by turning off the refrigeration system.



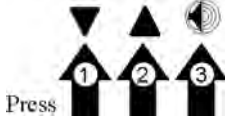
The Undertemp Shutdown warning shown above will be displayed, the warning lights will flash and the audible warning (if not turned off) will sound.

Pressing the Silence button will turn off the audible alarm. However, the warning lights continue to flash and the alarm message remains until the undertemperature condition is corrected. The audible warning will sound again in about 15 minutes if the undertemperature condition persists.

When the fault is corrected, press the Silence button to clear the alarm message from the display.

Setting the Temperature Alarm Tracking Limit

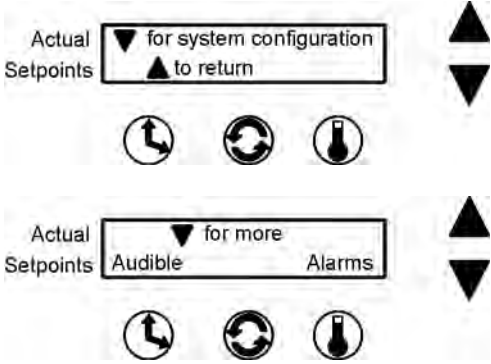
The Temperature Tracking alarm activates whenever the operating temperature goes above or below the setpoint temperature by a predetermined value. This adjustable limit is set at the factory as 10° above and below the temperature setpoint.



Note The above and below limits are always the same value.

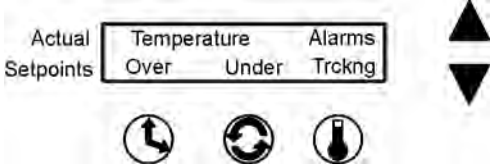
To change this limit, open the configuration menu as in the previous alarm procedures, by pressing the buttons in the sequence shown.

When this screen (below) opens, press the down arrow once

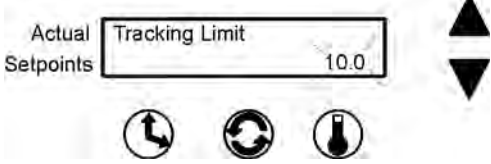


then press the temperature button beneath Alarms.

Then, from the screen below, press the temperature button beneath Tracking.



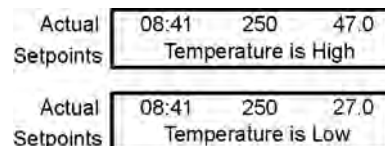
The following screen will appear and the present temperature tracking alarm limit setting will flash.



Change the temperature tracking limit by pressing the up or down arrow. When set, press the Temperature button to save the setting and return to the previous screen. If no buttons are pressed for about fifteen seconds, the display will change to the Operating Screen, saving the new setting to memory.

Setting the Temperature Alarm Tracking Limit (continued)

When the chamber temperature rises above, or falls below, the temperature tracking limit, the appropriate message is displayed, the warning lights flash and the audible warning (if not turned off) sounds.

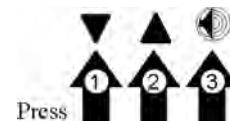


Pressing the Silence button turns off the audible alarm. However, the warning lights continue to flash and the alarm message remains until the high or low temperature condition is corrected. The audible warning sounds again in about fifteen minutes if the over or under temperature tracking condition persists.

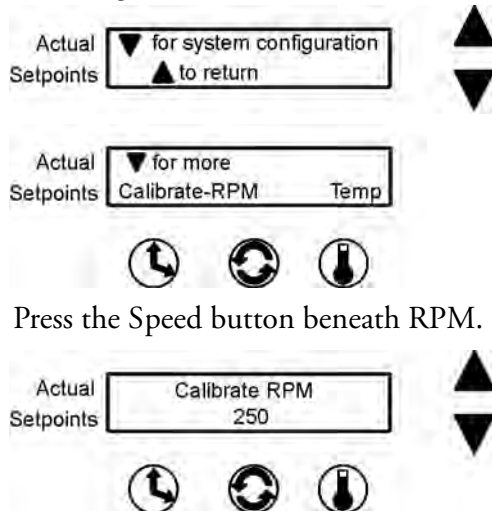
When the fault is corrected, press the Silence button to clear the alarm message from the display.

Calibrating the RPM

From the Operating screen, press the down arrow, up arrow and Silence button in that sequence (shown at the right) to open the Configuration menu.



From the screen below, press the down arrow twice to bring up the following screen.



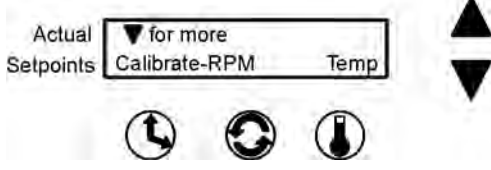
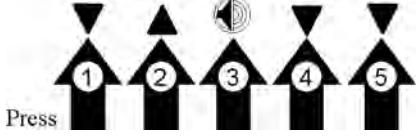
Press the Speed button beneath RPM.

The value shown on this screen is the present speed setpoint. Using the up and down arrows, increase or decrease the platform speed until the reading on an independent, accurate speed measuring device matches the shaker speed setpoint.

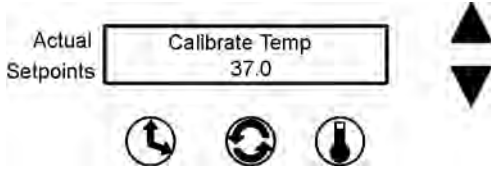
When finished, press the Speed button to save the setting. The display will return to the Calibrate - RPM Temp screen. Or, if nothing is pressed for about fifteen seconds, the display will revert to the Operating Screen and the setting will be automatically saved to memory.

Calibrating the Temperature

Begin by pressing the down arrow, the up arrow, the Silence button, and then the down arrow twice. The screen below will appear on the display:



Press the Temperature button beneath Temp.



Using the up and down arrows, increase or decrease the temperature value to match an independent, accurate temperature measuring device. When selected, press the Time, Speed, or Temp button to save the setting. The display will return to the Calibrate - RPM Temp screen. (Or, if nothing is pressed for about fifteen seconds, the display will revert to the Operating Screen and the setting will be automatically saved to memory.)

Remote Alarm System

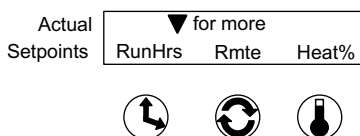
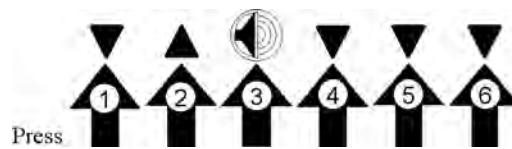
Any of the alarm states described previously can alert a remote alarm monitoring system through an internal SPDT relay connected to an RJ-11 jack on the rear of the shaker cabinet. For the convenience of the laboratory, these remote alarms can be individually turned on or off. Any or all of the remote alarms which are set to On will activate the internal relay.

If no buttons are pressed, the display will automatically return to the Operating Screen after about fifteen seconds, saving the selection to memory.

Note The Remote Overtemp Shutdown and Check Fuse alarms cannot be deactivated.

Remote Alarm System (continued)

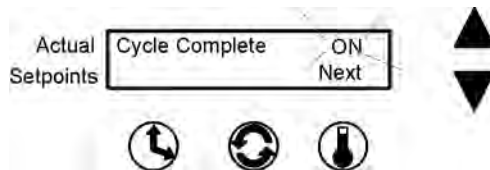
To set the remote alarms to On or Off, open the Remote Alarm Configuration menu by pressing the down arrow, up arrow, and silence buttons in that sequence. Then, press the down arrow three times until the screen below is showing.



Press Rmte (remote). The alarms will be shown in the sequence following.

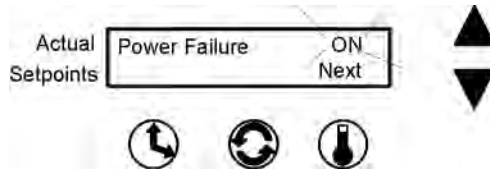
Cycle Complete

Toggle the Cycle Complete alarm with either the up (On) arrow or the down (Off) arrow. Pressing the Next (temperature) button advances the display to the next alarm, saving the shown Cycle Complete alarm setting to memory.



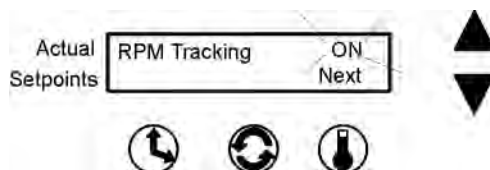
Power Failure

Toggle the Power Failure alarm with either the up (ON) arrow or the down (OFF) arrow. Pressing the Next (temperature) button advances the display to the next alarm, saving the Power Failure setting to memory.



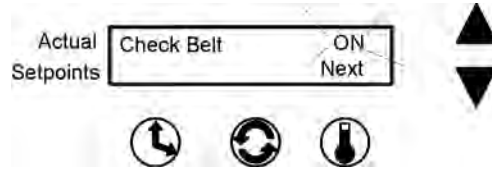
RPM Tracking

Toggle the RPM Tracking alarm with either the up arrow (ON) or the down arrow (OFF). Pressing the Next (temperature) button advances the display to the next alarm, saving the RPM Tracking setting to memory.



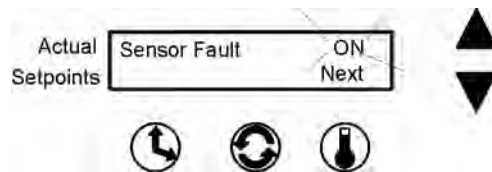
Check Belt

Toggle the Check Belt alarm with either the up (on) arrow or the down (off) arrow. Pressing the Next (temperature) button advances the display to the next alarm, saving the Check Belt setting to memory.



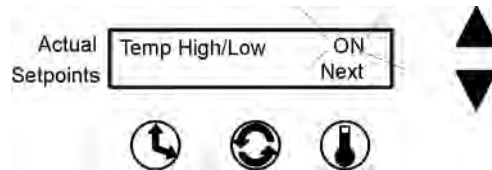
Sensor Fault

Toggle the Sensor Fault alarm with either the up (ON) arrow or the down (OFF) arrow. Pressing the Next (temperature) button advances the display to the next alarm, saving the on/off setting to memory.



Temperature High or Low

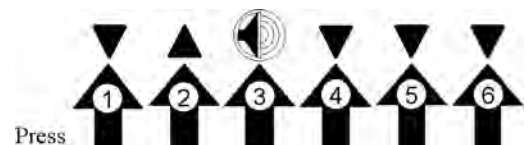
Toggle the Temperature High/Low alarm with either the up (ON) arrow or the down (OFF) arrow. Pressing the Return (temperature) button returns the display to the previous screen.



Viewing the Total Operating Hours

Whether the shaker has been operated in the Hold or Countdown modes and/or has been turned off and unplugged many times, the microprocessor control system maintains a running total operating hours.

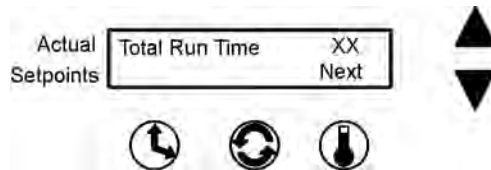
To view this information, access the Configuration menu by pressing the down and up arrows and the Silence button in sequence, then pressing the down arrow three times.



Viewing the Total Operating Hours (cont.)



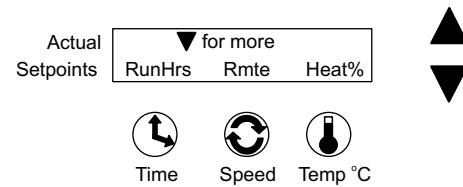
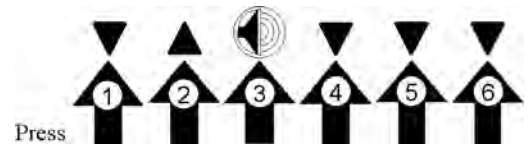
Pressing RunHrs shows the total accumulated run hours as displayed in the illustration below. In about fifteen seconds, the display will return to the Operating Screen.



Heat %

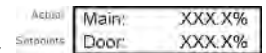
Caution Heat percentages are intended for factory use only, and can be helpful in troubleshooting the heat control systems.

To view this information, press Heat % from the previous screen or access the Configuration menu by pressing the down arrow, the up arrow and the Silence button in that sequence, then press the down arrow three times.



Press Heat %.

Main Heat % is the percentage of time that the temperature control system's heaters are turned on during a five second period. **Example:** If the heaters are being cycled on for two seconds and off for three seconds, the Heat % value is 40 percent.



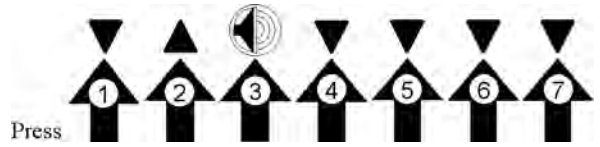
Refrig Heat % is the percentage of time that the refrigeration system capillary tube heater is operating during a five second period.

Return to the RunHrs Rmte Heat% screen by pressing any of the three buttons beneath the display. If no buttons are pressed, the display will automatically return to the Operating Screen in about fifteen seconds.

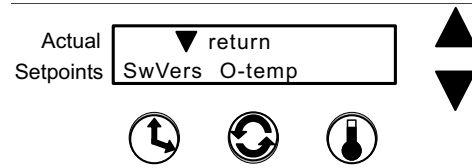
Software Version

Software Version is for factory use only and will be important if troubleshooting the microprocessor programming is ever necessary.

To access this screen, press the down arrow, the up arrow, the Silence button, and then the down arrow button four more times.

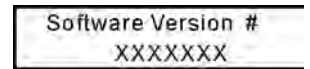


The screen below will appear on the display:



Press the Time button beneath SwVers and the following screen will appear showing the Model 480 software version in the control system memory.

To return to the previous screen, press the Time button. To return to the Operating Screen, wait about fifteen seconds.

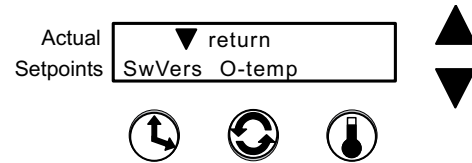
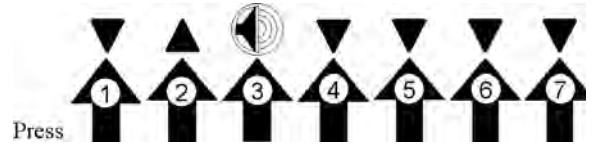


Temperature Sensor Readings

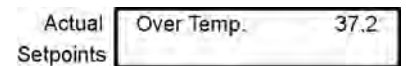
Temperature Sensor Readings is for factory use only and will be important if troubleshooting the microprocessor programming is ever necessary.

Overtemp Sensor

To access this screen, press the down arrow, the up arrow, the Silence button, then the down arrow button four more times. The screen below appears on the display:



Press the Speed button beneath O-temp and the screen at the right will appear, showing the temperatures being measured or read by the Overtemperature sensor.

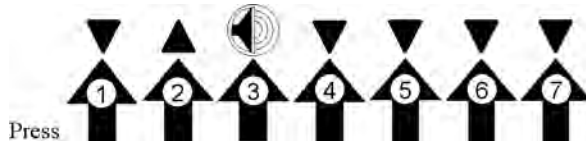


To return to the previous screen, press the Time, Speed, or Temperature button. To return to the Operating Screen, wait about fifteen seconds.

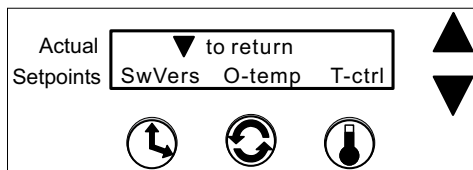
Temperature Control

This control allows the shaker to be operated without heat or refrigeration.

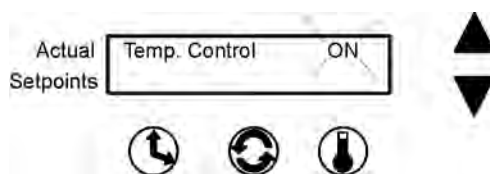
To access this screen, press the down arrow, the up arrow, the Silence button, then the down arrow four more times.



The screen shown below will appear on the display:



Press the temperature button beneath T-ctrl and the screen shown below will appear.



Toggle the Temperature Control with either the up (ON) arrow or the down (OFF) arrow.

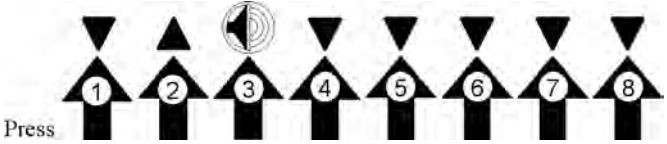
Pressing the Time, Speed, or Temp buttons returns the screen to the previous (SwVers O-temp T-ctrl) display. If no buttons are pressed, the display will automatically return to the Operating Screen after about fifteen seconds, saving selection to memory.

Defrost Control

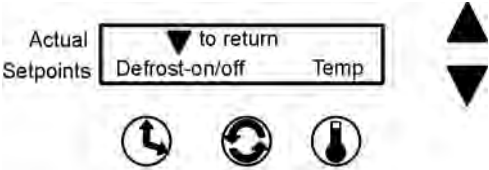
Defrosting of this shaker automatically takes place about every eight hours. When turned on, the system increases the cabinet temperature until it reaches the 12°C or 14°C defrost setpoint. At that time, the defrost continues for about three minutes, then shuts off.

Turning the Defrost System On and Off

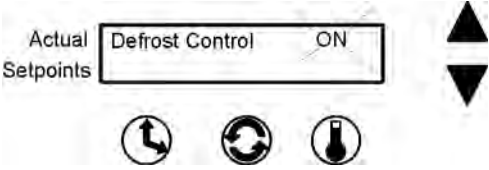
To turn the defrost system on and off, press the down arrow, the up arrow, the Silence button, then the down arrow button five more times.



The screen shown below will appear on the display:



Press the Speed button beneath On/Off and the following screen will appear:



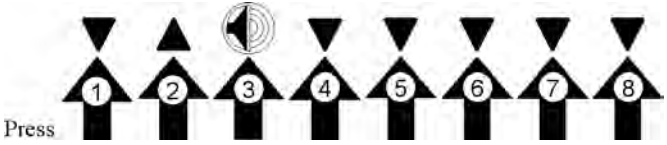
Toggle the Defrost Control with either the up (ON) arrow or the down (OFF) arrow.

Pressing the Time, Speed or Temp buttons will return the screen to the previous (Defrost on/off, Temp) display.

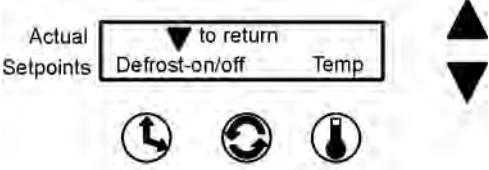
If no buttons are pressed, the display will automatically return to the Operating Screen after about fifteen seconds, saving selection to memory.

Setting the Defrost Temperature

To toggle the defrost temperature between 12°C and 14°C, press the down arrow, the up arrow, the Silence button, then the down arrow button five more times.

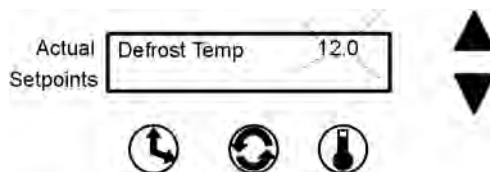


The screen shown below will appear on the display:



Setting the Defrost Temperature (continued)

Press the temperature button beneath Temp and the following screen will appear:



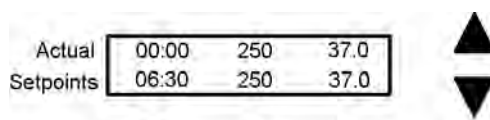
Toggle between the two defrost temperatures using the up and down arrows.

Press Time, Speed, or Temp to return to the previous screen or press nothing and the display will automatically return to the Operating Screen after about fifteen seconds, also saving the setpoint to memory.

Hold Temperature Control

Another useful feature of the Model 480 Series Shaker is the ability to hold the product at a specific temperature after operating for a predetermined time.

A typical scenario is shown below. The illustration shows the shaker operating at 250 RPM with the cabinet temperature at 37°C. The 06:30 time value in the lower left corner of the screen indicates that the shaker is counting down and will stop in 6 hours and 30 minutes.

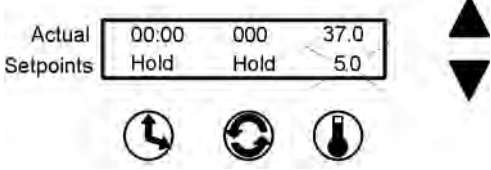


The next illustration shows that the time has counted down to zero and the shaker has stopped orbiting (zero RPM's). The temperature value of 5.0° in the lower right corner of the screen is the temperature at which the product is being held. This hold will continue at this temperature until the Start button is pressed or a new hold or operating temperature is entered.



Hold Temperature Control (continued)

To set a new hold temperature, press the temperature button twice. The screen below will appear. The Hold temperature will flash.



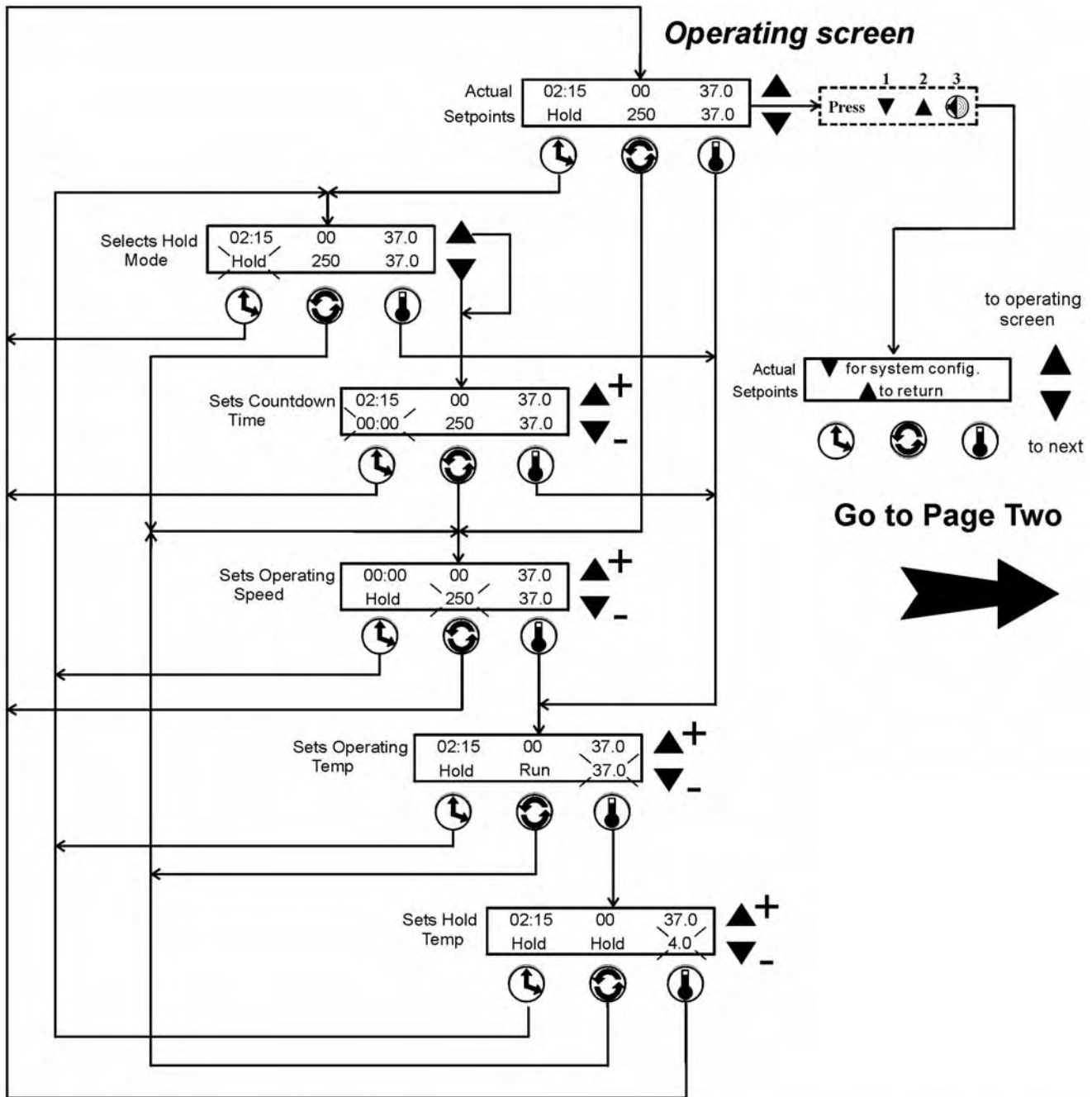
Using the up and down arrows, program a new hold temperature. Press the temperature button to save the new setting and return to the Operating Screen.

- Selecting Hold or Countdown Time
- Setting Operating Speed
- Setting Operating Temperature
- Setting Hold Temperature

Models 480 and 481

Orbital Shaker

Menu Map

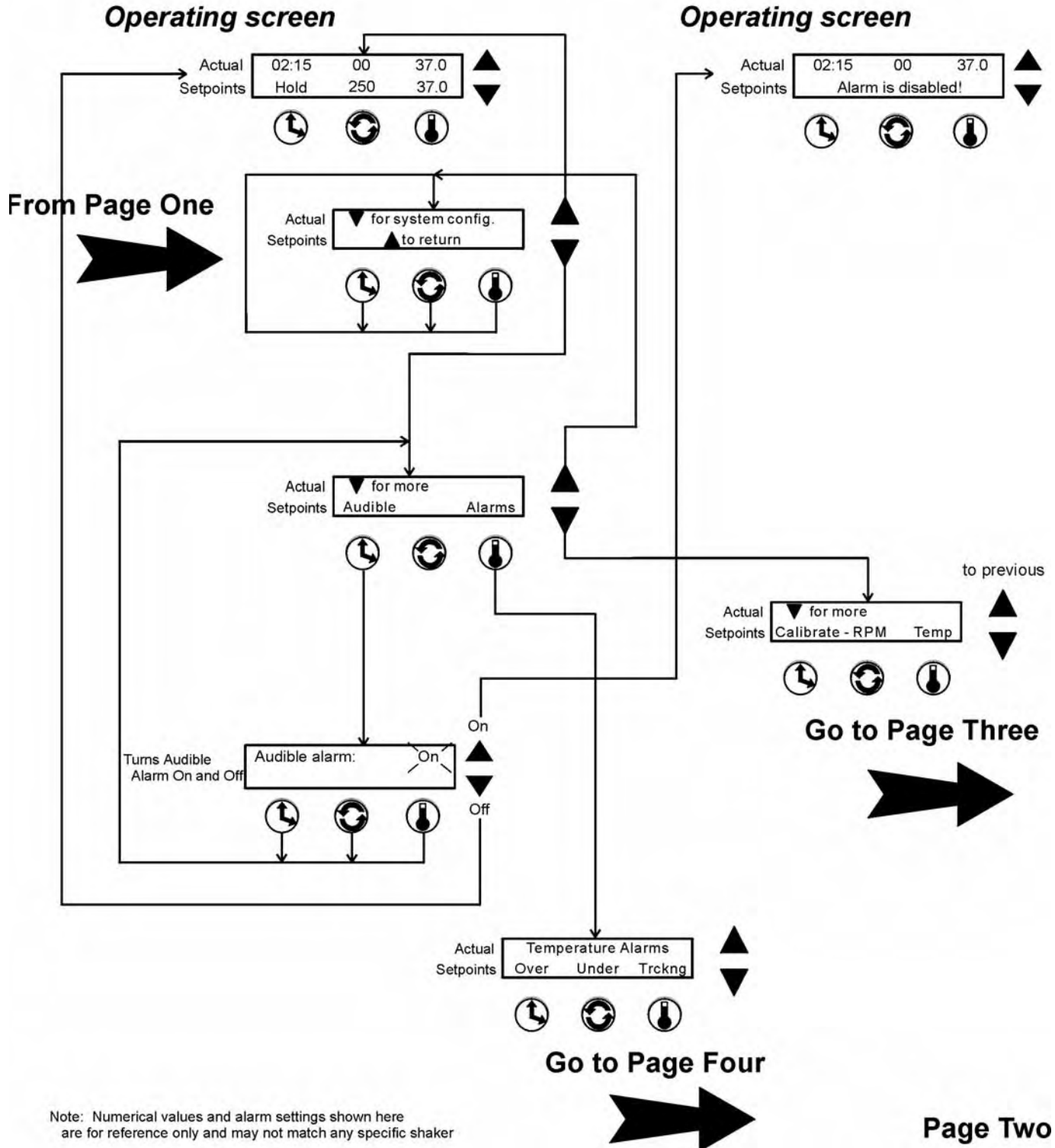


Note: Numerical values and alarm settings shown here are for reference only and may not match any specific shaker

Page One

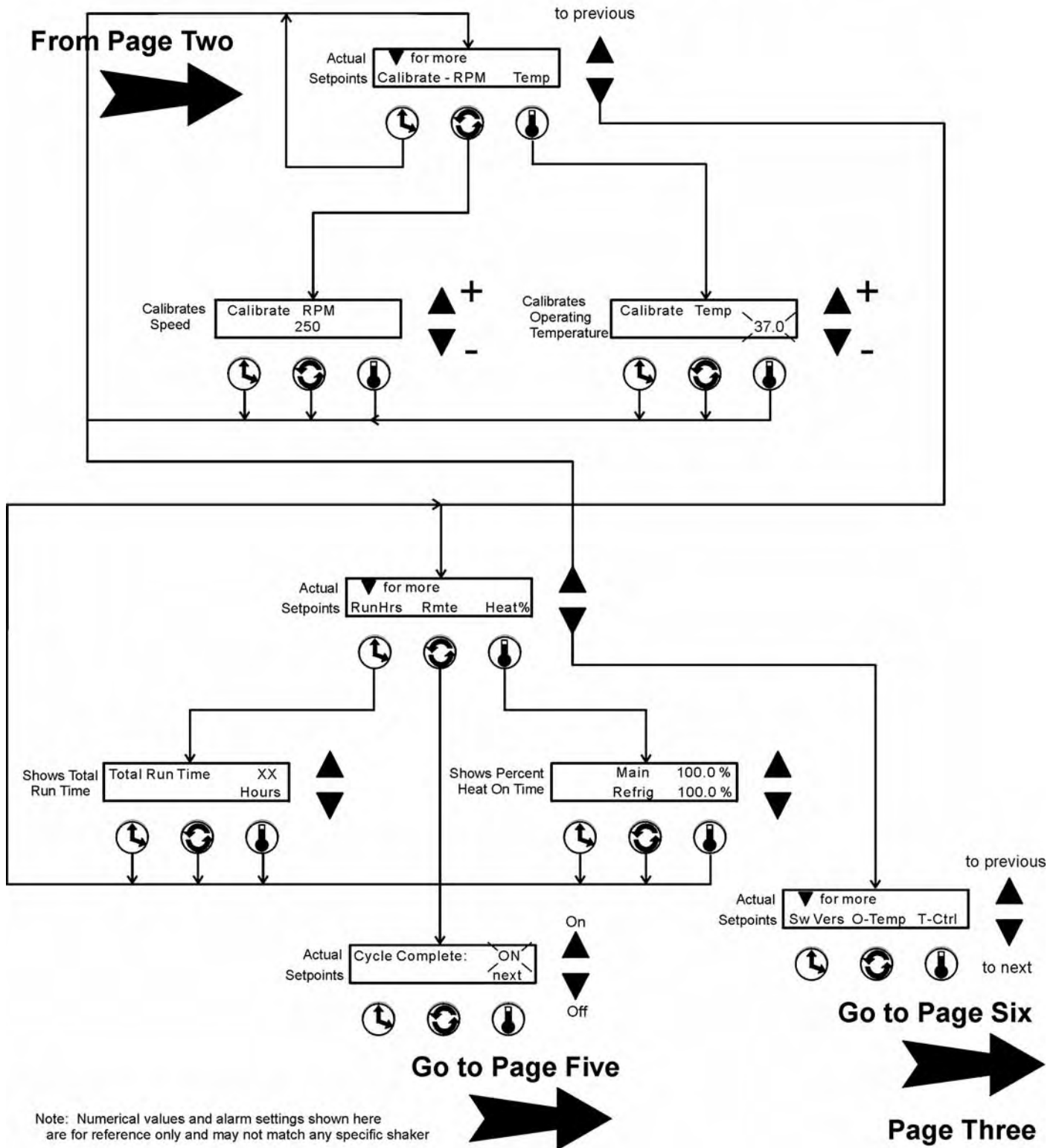
Models 480 and 481 Orbital Shaker Menu Map

Turning the Audible Alarm On and Off



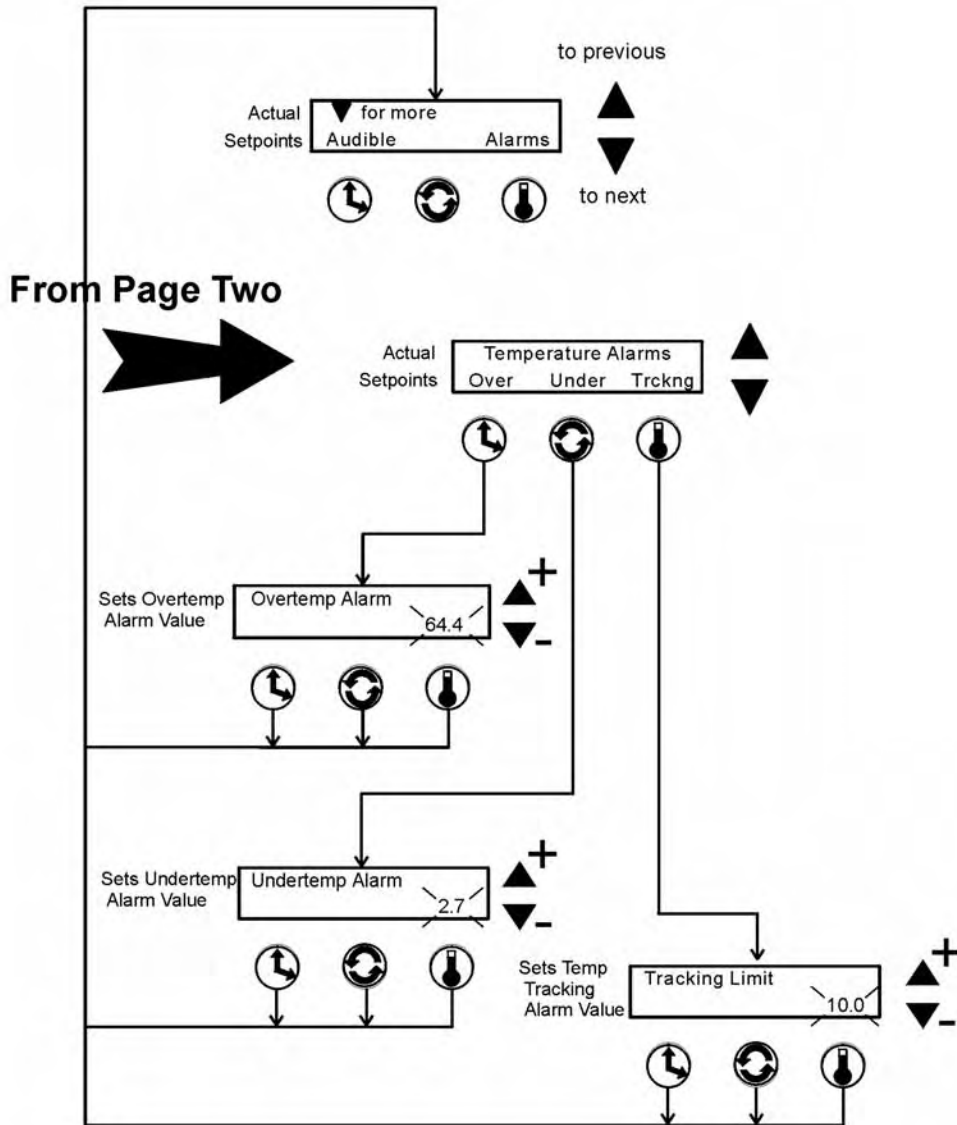
Calibrating Speed
 Calibrating Temperature
 Viewing Total Unit's Running Time
 Viewing Percent Heat

Models 480 and 481 Orbital Shaker Menu Map



Models 480 and 481 Orbital Shaker Menu Map

Setting Overtemperature Alarm Value
Setting Undertemperature Alarm Value
Setting Temperature Tracking Limit Value



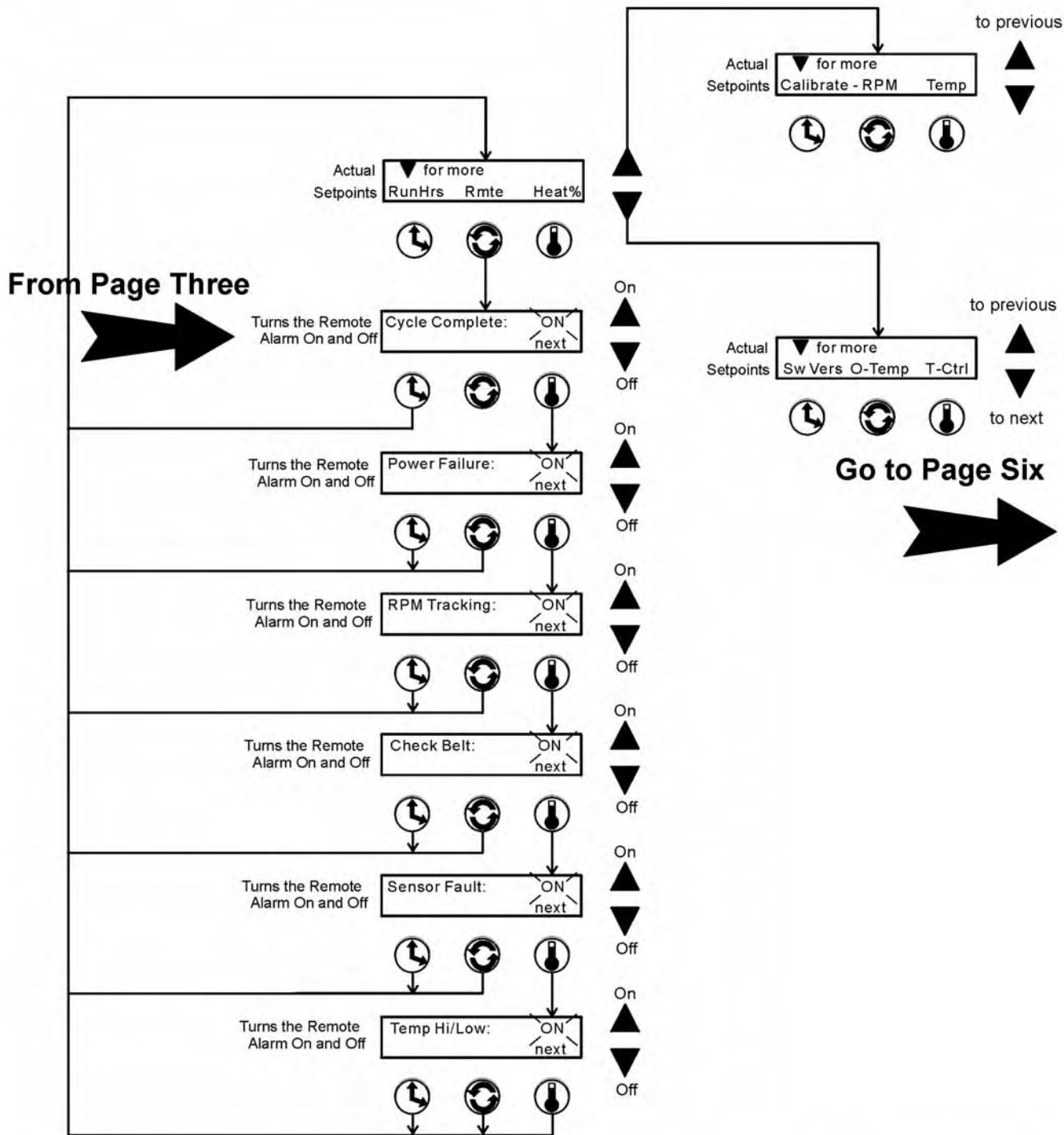
Note: Numerical values and alarm settings shown here are for reference only and may not match any specific shaker

Models 480 and 481

Orbital Shaker

Menu Map

Turning the Individual Remote Alarms
On and Off

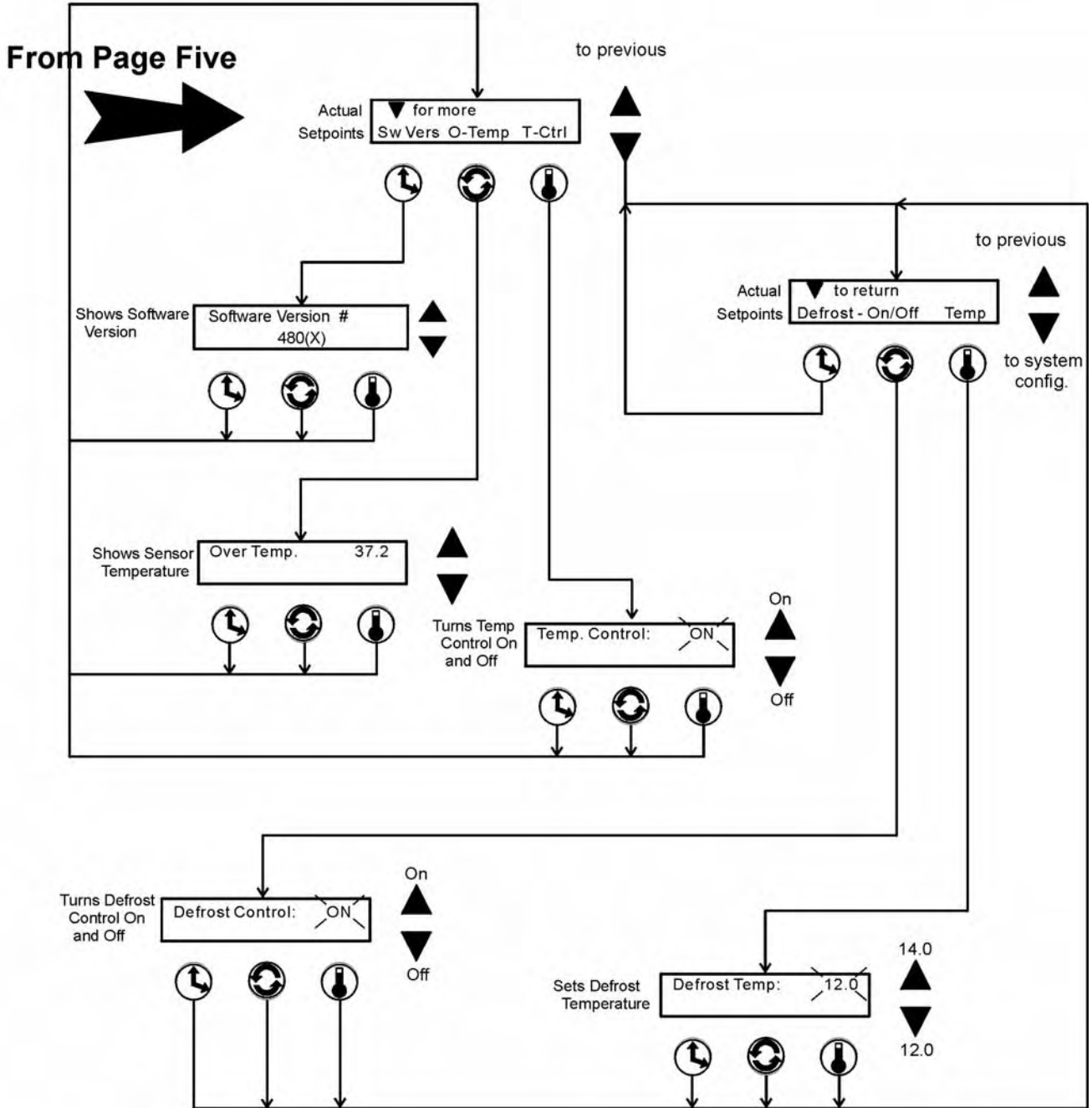


Note: Numerical values and alarm settings shown here are for reference only and may not match any specific shaker

Page Five

Models 480 and 481 Orbital Shaker Menu Map

- Viewing Software Version
- Viewing Overtemperature Sensor Reading
- Turning Temperature Control On and Off
- Turning Defrost Control On and Off
- Setting Defrost Temperature (12.0° or 14.0°)



Note: Numerical values and alarm settings shown here are for reference only and may not match any specific shaker

Section 3 Maintenance

The Model 480/481 Shaker uses a brushless DC motor and oversized, permanently lubricated bearings which require no maintenance.

Shaker Platform and Cabinet

The anodized brushed aluminum platform and powder-coated steel cabinet surfaces can be cleaned with common laboratory materials. However, liquids should not be allowed to enter the shaker cabinet from under the platform. All spills should be cleaned up immediately. If necessary, remove the platform. Follow 'Installing the Platform' procedure in Section 1 when re-installing the platform.

Control Panel

The microprocessor control panel uses sealed push buttons and liquid crystal display and may be cleaned with laboratory detergents and dried with a soft cloth.

Cleaning/Replacing the Cabinet Air Filter

The air filter (9.5" x 23.625") is located behind the grille on the front of the cabinet. The grille is held in place by six press-in type retainers and is easily removed by grasping it by its edges and pulling it off.

The air filter is held in place by four retaining springs (Figure 3-1) and is easily removed. It may be washed in water with a mild detergent and dried between two lint-free towels.

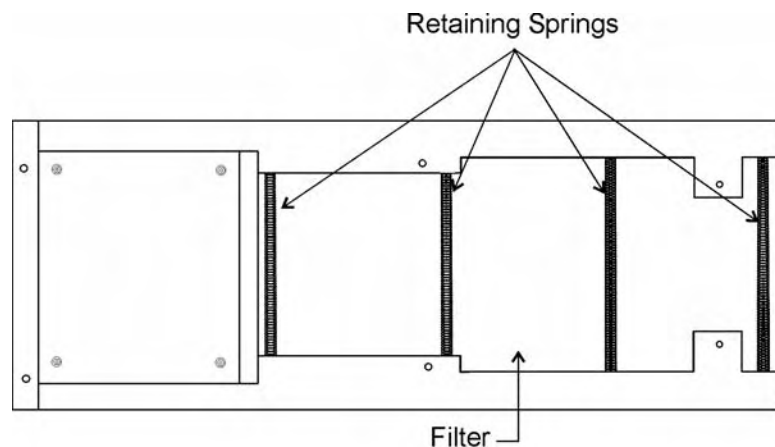


Figure 3-1. Interior View of Front Grille with Filter

Servicing the Drive Belt

The motor drive pulley, the large mechanism pulley, belt and motor mounting bolts will be visible, after removing the grille (Figure 3-2).

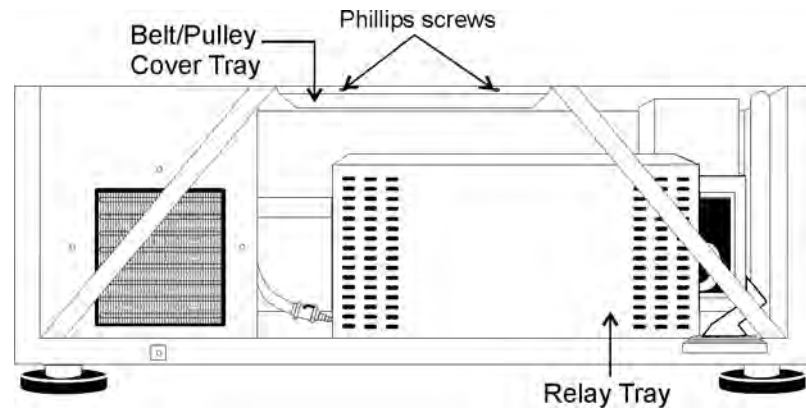


Figure 3-2. Front View of Cabinet with Grille Removed

Loosening the three 1/4-20 bolts at the base of the drive motor allows the belt to be changed or tension applied to the belt. Tighten the three bolts and torque to 120 in/lbs.

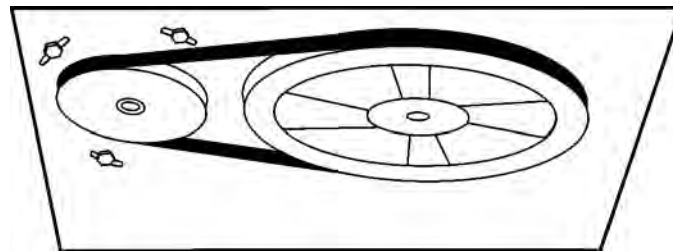


Figure 3-3. Motor/Belt Drive System

To remove the pulleys from their shafts, use a 1/8" Allen wrench to remove two set screws from the belt groove of the larger pulley; use a 5/32" Allen wrench to remove the single set screw from the belt groove of the smaller pulley.

When replacing the pulleys, seat the larger pulley completely against the shoulder of the mechanism drive shaft. The smaller pulley, however, is installed with 0.300" space between it and the baseplate.

PREVENTIVE MAINTENANCE Shakers

Your equipment has been thoroughly tested and calibrated before shipment. Regular preventive maintenance is important to keep your unit functioning properly. The operator should perform routine cleaning and maintenance on a regular basis. For maximum performance and efficiency, it is recommended that the unit be checked and calibrated periodically by a qualified service technician.

The following is a condensed list of preventive maintenance requirements. See the specified section of the instruction manual for further details.

We have qualified service technicians, using NIST traceable instruments, available in many areas. For more information on Preventive Maintenance or Extended Warranties, please contact us at the number below.

Cleaning and calibration adjustment intervals are dependent upon use, environmental conditions and accuracy required.

Tips for all shakers:

- Use only Thermo standard flat-head screws for flask clips.
- Use only Thermo standard round-head screws for test tube racks, holders and utility trays.

Preventive Maintenance for Models 480 and 481 Shakers

Refer to Manual Section	Action	Daily	Monthly	Yearly
--	Clean the unit with mild detergent and wipe dry as needed.		p	
--	Clean the window with a mild detergent and wipe dry.		p	
--	Check under the platform for broken glass or other debris.		p	
--	Inspect and/or clean the condenser.		p	
4.1c	Inspect air filter. Clean as needed.		p	
3.8	* Check and document calibration of temperature, alarms, speed and time, as applicable.			p
--	* Verify operation of circulation fan motor.			p
5.2	Change the HEPA filter as needed.			p

* Qualified service technicians only

Section 4 Service

Warning The procedures outlined in this section should be carried out only by qualified service personnel or people trained and certified in electrical/ mechanical repair of laboratory equipment. s

With the exception of the HEPA filter, the Model 480/481 Orbital Shaker contains no user-serviceable components. The following table lists display messages which may help diagnose abnormal conditions.

Alarms and Alarm Conditions

If the microprocessor control system senses a fault, malfunction or abnormal operating condition, alarm messages will appear on the liquid crystal display. These messages will be helpful should service or repair assistance be necessary. Refer to the table below and to the alarm matrix following in this section.

Table 4-1. Alarm Messages and Fault Conditions

Alarm Message	Fault Condition
Overtemp Shutdown	System shutdown due to overtemp condition
Main Temp Sensor	Temperature sensor has failed
Over Temp Sensor	Temperature sensor has failed
Temperature is High	Temp tracking has sensed higher temperature than setting
Temperature is Low	Temp tracking has sensed lower temperature than setting
RPM High	RPM tracking has sensed shaker speed higher than setting
RPM Low	RPM tracking has sensed shaker speed lower than setting
Power Failure	Power has failed during shaker operation
Cycle Complete	End of countdown cycle has been reached
Check Belt	Motor V-belt has broken or slipped
Audible is Disabled!	Continuously notifies operator that audible alarm has been disabled
Platform Stalled	Free movement of the platform is obstructed
Check Fuse	Primary drive motor fuse has blown

Changing the HEPA Filter

The HEPA filter (P/N 760164) is located on the left side of the chamber and is accessed by pulling up on the four, black press-in fasteners and sliding the cover off. Refer to the illustration below.

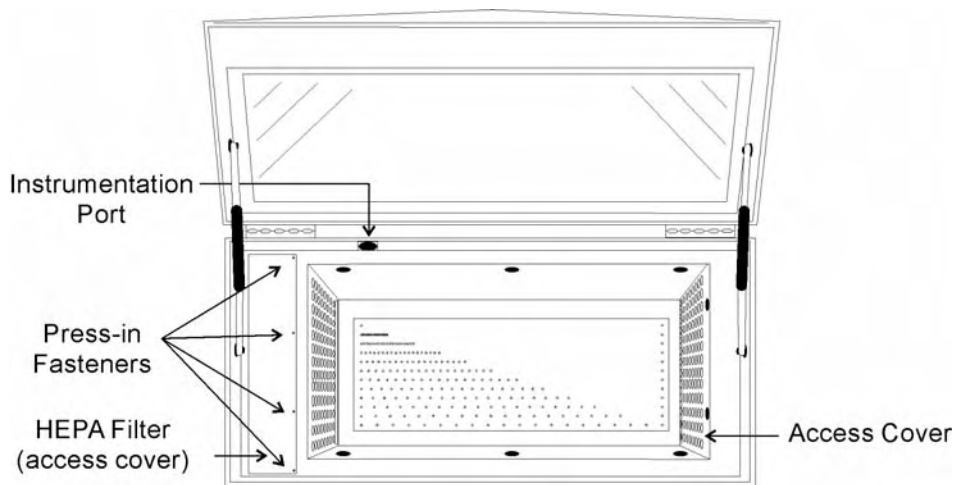


Figure 4-1. Lid Open Showing Locations

If the Shaker Will Not Operate

If the shaker platform will not operate with the unit plugged in and the power switch turned on, the following conditions may be present:

- The lid may be open - Lower the lid to its fully closed position.
- Time countdown reached - Reset the time or change to a pre-set program.

Fuses

Three fuses are located on the left side of the relay tray located in the lower part of the console cabinet. Figure 4-2 shows the location of the fuses.

Access to the relay tray is made by removing the grille on the front of the cabinet. It is held in place by six press-in type retainers and is easily removed by grasping the edges of the grille and pulling.

To remove the panel beneath the grille, remove six Phillips screws; three on the bottom of the panel and three on the top. The two Phillips screws on the left side of the foot pedal will need to be loosened to allow the panel to be slid outward.

Fuses (continued)

Table 5-2. Fuses

Fuses, Model 480		
Rating	Application	Part Number
0.25 amp	Main Power Relay Board	230144
1.6 amp	Drive Motor	230145
0.1 amp	Recorder (opt.)	30107

Fuses, Model 481		
Rating	Application	Part Number
0.15 amp	Main Power Relay Board	230142
0.8 amp	Drive Motor	230141
0.1 amp	Optional Recorder	230107

Caution Do not substitute! Replace these fuses with fuses of identical electrical ratings only. s

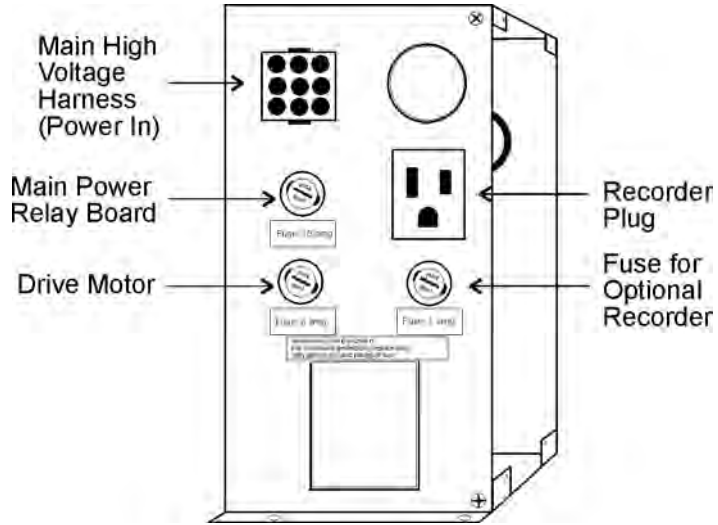


Figure 5-2. Fuse and Connector Locations

Warning Never use the recorder plug-in outlet with the grounding conductor disconnected. s

Circuit Boards

Five circuit boards control the Orbital Console Shaker. Four boards are located in the relay tray compartment, the fifth is behind the liquid crystal display. Figure 4-3 identifies the circuit boards and other major components in the relay tray.

Refer also to the relay tray illustrations on Page 4-7 & 4-8.

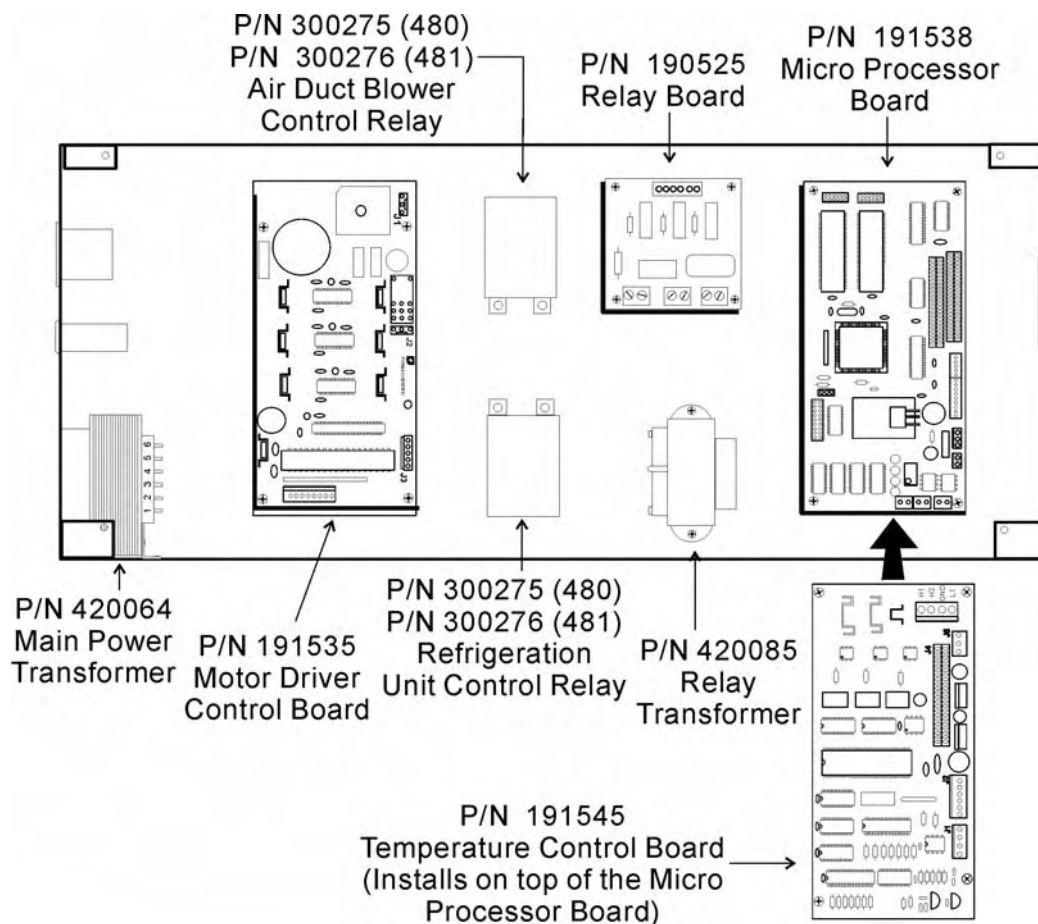


Figure 4-3. Electrical Component Locations, Relay Tray Compartment

Temperature Sensors

Two temperature sensors are located behind a perforated cover plate on the right side of the chamber (refer to Figure 4-4). To access these sensors, pull outward on the two black press-in fasteners on the top edge of the cover and lift the cover upward. The cover is held in place by four metal clips.

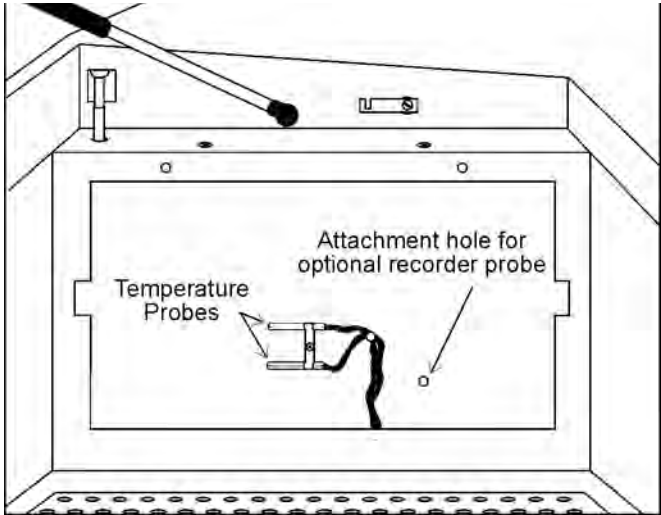


Figure 4-4. Right Side Chamber - Temperature Sensor Cover Plate Removed

To replace the cover, make sure all four clips engage the metal edges of the chamber and the two fasteners are firmly seated in their holes. Press the top of the fastener inward until a “click” is heard. (Refer to Figure 4-5.)

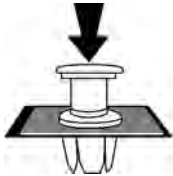


Figure 4-5. Press-in Sheet Metal Fastener

Blower Fan Motors and Heating Elements

Locations of the blower motor and ambient fan motor are shown in Figure 4-6 (refrigeration unit removed).

Removal of the relay tray is necessary to service the blower motor or the heating elements.

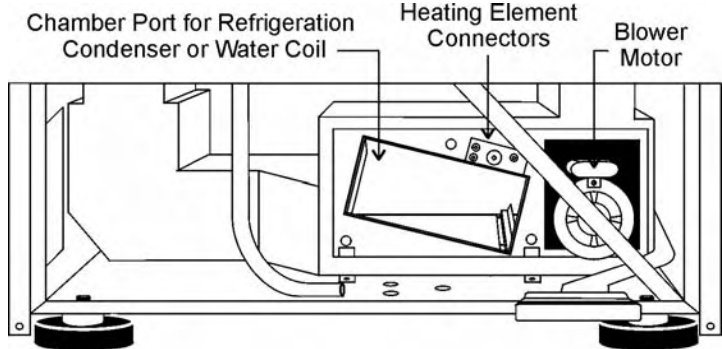


Figure 5-6. Air Plenum with Heating and Air Moving Components

Heater Element Circuit Breaker

A manual reset circuit breaker is located between the heating element electrical connectors on the side of the air plenum. (Figures 4-6 and 4-7) To access this circuit breaker, remove the front grille and remove the four Phillips screws securing the relay tray. Move or tip the relay tray far enough away from the air plenum to reach the reset button.

Warning Disconnect and lock-out electrical power when working on or near the relay control tray and heating element connectors. Allow sufficient time for the heating elements to cool before reaching into that area.

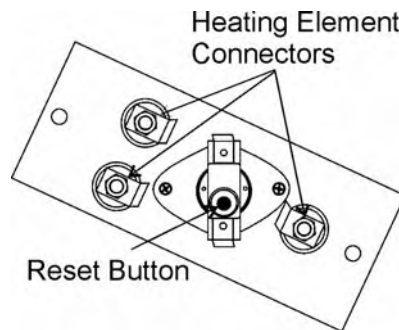


Figure 4-7. Heating Element Connectors and Manual Reset Circuit Breaker

Tuning the Cabinet

After the console cabinet is in place, leveled and the platform installed, turn the unit on and set the RPM to 300. Kneeling in front of the console, lightly touch the lower left and right corners of the cabinet. If one side seems to vibrate more than the other, raise or lower the corner support leg using the 3/4" open end wrench supplied in the parts bag. Continue this "fine tuning" until the vibrations are lowered as far as possible.

Alarm Message	Alarm Criteria	Alarm Delay*	Alarm Ringback*	System State	Corrective Action
Over Temp Shutdown	Temperature at the over temp sensor is a few tenths of a degree over the shut down set point	None	15 min.	Alarm light on Audible alarm on Blower fans on Shaker motor on Heaters off	Press SILENCE to silence the audible alarm Air intake blockage Over temperature probe malfunction Sensor connector unplugged Heater circuit not cycling Main circuit board failure Call the Thermo Forma Service Department
Under Temp Shutdown	Temperature at the over temp sensor is a few tenths of a degree under the shut down set point	None	15 min.	Alarm light on Audible alarm on Blower fans on Shaker motor on Refrig Compressor off	Press SILENCE to silence the audible alarm Over temperature probe malfunction Sensor connector unplugged Heater circuit not cycling Refrigeration system stuck on Main circuit board failure Call the Thermo Forma Service Department
Main Temp Sensor	Sensor circuit is open or shorted beyond the expected resistance range in either direction	30 sec.	15 min.	Alarm light on Audible alarm on Blower fans on Shaker motor on Heaters off	Press SILENCE to silence the audible alarm Check board connector Check sensor circuit Replace sensor Call the Thermo Forma Service Department
Over Temp Sensor	Sensor circuit is open or shorted beyond the expected resistance range in either direction.	30 sec.	15 min.	Alarm light on Audible alarm on Blower fans on Shaker motor on Heaters on	Press SILENCE to silence the audible alarm Check board connector Check sensor circuit Replace sensor Call the Thermo Forma Service Department
Temperature is High	Temperature is above the control system's temperature tracking limit	**	15 min.	Alarm light on Audible alarm on Blower fans on Shaker motor on Heaters on	Press SILENCE to silence the audible alarm Check temperature tracking limit Check sensor circuit Replace main temperature sensor Call the Thermo Forma Service Department

* Alarm Delay and Ringback times are approximate

** A 3.5 hour time delay is built into the system to allow the shaker to reach the temperature setpoint. When this point is reached, a 20 minute delay becomes effective. When the lid is opened, a 15 minute interval is added to allow the system to recover to the set temperature. (Note: all of these times are approximate)

Alarm Message	Alarm Criteria	Alarm Delay*	Alarm Ringback*	System State	Corrective Action
Temperature is Low	Temperature is above the control system's temperature tracking limit	**	15 min.	Alarm light on Audible alarm on Blower fans on Shaker motor on Heaters on	Press SILENCE to silence the audible alarm Check if lid is completely closed Check temperature tracking limit Check sensor circuit Replace main temperature sensor Call the Thermo Forma Service Department
Power Failure	Electrical power has been disrupted	Upon power up	None	Not affected	Warning notice only Press SILENCE to silence the audible alarm
Cycle Complete	Count-down time has reached zero	None	None	Alarm light on Audible alarm on Blower fans on Shaker motor off Heaters on	Advisory notice only Press SILENCE to silence the alarm
RPM High	RPM is above control set point by tracking limit	2 min.	15 min.	Alarm light on Audible alarm on Blower fans on Shaker motor on Heaters on	Press SILENCE to silence the audible alarm Check platform loading Check RPM tracking limit setting Shut the unit off and call the Thermo Forma Service Department
RPM Low	RPM is below control set point by tracking limit	2 min.	15 min.	Alarm light on Audible alarm on Blower fans on Shaker motor on Heaters on	Press SILENCE to silence the audible alarm Check for overloaded platform Check for obstruction to edges of platform Shut the unit off and call the Thermo Forma Service Department

* Alarm Delay and Ringback times are approximate

** A 3.5 hour time delay is built into the system to allow the shaker to reach the temperature setpoint. When this point is reached, a 20 minute delay becomes effective. When the lid is opened, a 15 minute interval is added to allow the system to recover to the set temperature. (Note: all of these times are approximate)

Alarm Message	Alarm Criteria	Alarm Delay*	Alarm Ringback*	System State	Corrective Action
Check Belt	Rotation sensor circuit sees no mechanical rotation or receives unusual signals	None	15 min.	Alarm light on Audible alarm on Blower fans on Shaker motor off Heaters off	Press SILENCE to silence the audible alarm Shut the unit off and check the belt If the alarm persists, call the Thermo Forma Service Department
Audible is Disabled!	Operator has turned off the audible alarm	None	None	Normal operation	The lower half of the display will show this warning as long as the audible alarm remains turned off

* Alarm Delay and Ringback times are approximate

Section 5 Specifications

Shaking

Range	25-525 RPM
Accuracy	1 RPM
Motion	One inch/orbital
Indicator	LCD in 1 RPM increments

Temperature

Range	4°C (39°F) to 60°C (140°F)
Control	0.1°C
Uniformity	±0.2°C (in flask)
Indicator	LCD, in 0.1°C increments

Timer

Periods	Programmable from 5 minutes to 200 hours or continuous operation
Indicator	LCD in 5 minute increments
Run Time.	Display counts down for a timed run or counts up when in “hold” function

Alarms

Temperature	Adjustable tracking high/low temps
RPM	Adjustable tracking high/low RPM
Time	Run complete
Power Fail	Message displayed on LCD screen

Safety

Temperature	Independent over and under temp
RPM	Independent platform motion

LCD Display

Run Time, RPM, Temperature, User Program, Alarm
Conditions and Power Failure indicated by messages

Mechanical Drive System

Triple counterbalanced. Handles unbalanced platform loads regardless of
flask placement

Drive Motor

1/3 HP brushless DC, permanently lubricated ball bearing

Lid

Counterbalanced, hand or foot operated, with tempered thermal pane
window and key lock.

Automatic Restart

Microprocessor retains all programming in non-volatile memory. In the
event of a power outage, the shaker restarts automatically.

Construction

InteriorStainless steel with coved corners
ExteriorCold rolled steel
Finish. . .Powder coated for a durable, easily maintained sur face
PlatformAnodized brushed aluminum

Dimensions

Exterior45.0” W x 39.0” H x 30.0” F-B
.(114.3cm x 99.1cm x 76.2cm)
Exterior (lid open). . 45.0” W x 39.0” H x 30.5” F-B
.(114.3cm x 99.1cm x 77.5cm)
Interior34.3” W x 18.8” H x 21.1” F-B
.(87.1cm x 47.8cm x 53.6cm)

Electrical

480 . .Nominal 120 VAC, 60 Hz, 1 PH, 15.6 FLA

.....Operating Range: 108-125 VAC

481 . .Nominal 230 VAC, 50 Hz, 1 PH, 8.0 FLA

.....Operating Range: 207-253 VAC

Data OutputRS-232 standard

Remote Alarm Contacts . . .Time, RPM, Temperature and Loss of Power Alarms

Certifications

480:UL Standard No. 61010A-1

CSAStandard C22.2 No. 1010.1

481: CE Mark Electromagnetic and Low Voltage Directives

Capacity

FlasksFrom (91) 25ml up to (4) 6L

Weights

Net568 lbs. (257.9kg)

Shipping645 lbs. (292kg)

Optional Platforms

Size29.5" x 18" (74.9cm x 45.7cm)

Clips . . 25ml, 50ml, 125ml, 250/300ml, 500ml, 1L, 2L, 4L, 5L, 6L,
and 2800ml Fernbach sizes available

Racks . . Adjustable angle test tube holder with rack, 10-30mm

Filter

HEPARated efficient at 0.3 microns

Size . . .18" x 16" x 2" (45.7cm x 40.6cm x 5.1cm)

Ambient Operating Conditions

Indoor use only

Temperature 18°C (64°F) to 40°C (104°F)

Humidity . .80% RH at or below 31°C, decreasing linearly to 50% RH at 40°C

Sound Level - Not to exceed 85db

Safety Specifications

Altitude 2,000 meters

Temperature 5°C to 40°C

Humidity . . 80% RH at or below 31°C, decreasing linearly to 50% RH at 40°C

Mains Supply Fluctuations Operating Voltage Range

Installation Category II ¹

Pollution Degree 2 ²

Class of Equipment I

Climatic Condition - ST (EN 60335, S subtropical)

1 Installation category (overvoltage category) defines the level of transient overvoltage which the instrument is designed to withstand safely. It depends on the nature of the electricity supply and its overvoltage protection means. For example, in CAT II which is the category used for instruments in installations supplied from a supply comparable to public mains such as hospital and research laboratories and most industrial laboratories, the expected transient overvoltage is 2500V for a 230V supply and 1500V for a 120V supply .

2 Pollution Degree describes the amount of conductive pollution present in the operating environment. Pollution Degree 2 assumes that normally only non-conductive pollution such as dust occurs with the exception of occasional conductivity caused by condensation.

Section 6 Parts List

Model 480

Part No.	Description
129024	(2) Pneumatic Spring, 80 lbs.
138009	Heater, Wirewound 450W 115/230V
156089	Motor, Brushless - DC 24V
191535	Motor Drive Board
191545	Temp Control Board
190525	Triple Outlet Relay Board
190818	LCD Display Panel
191538	Shaker Micro Board
400113	Thermostat - Opens at 200°F
420064	Transformer, 130VA
420085	Transformer, 25VA
600600	Cartridge Heater, 180W 120V
900092	.230 CFM Blower 115V 60Hz
900105	Tubeaxial Fan, 235CFM, 115V
991003*	Dryer 1/4 SAE Non-CFC, Unit Size 8
212036*	Evaporator 8-3/4 x 11-3/8
205142*	1/3 HP Condensing Unit 115V w/R134A
220309*	Access Valve Assembly, 2"
250111*	1/4 ODF NC Ref. Solenoid Valve
300275	.20A Relay, DPDT, 120V
230107	100 mA Fuse (for optional recorder) T.D. 5mm x 20mm
230144	.250 mA Fuse T.D. 5mm x 20mm
230145	1.6 A Fuse T.D. 5mm x 20mm
800040	V-Belt, 1/2" x 45"
760167	Air Filter 10.5" x 23.625"
760164	HEPA Filter
194015	Shipping Bracket
443021	3/4" Open End Wrench
435051	Screwdriver, Phillips
443020	Wrench, 5/32" Hex with T-handle
194046	Spare Parts Bag, (platform and clips)
270127	EMI Power Line Filter, 20A
107003	Lid Glass Window
990024	Lid Gasket
194580	Condensing Unit Evaporator Assy 1/3 HP

* *part of P/N 194580*

Section 6
Parts List

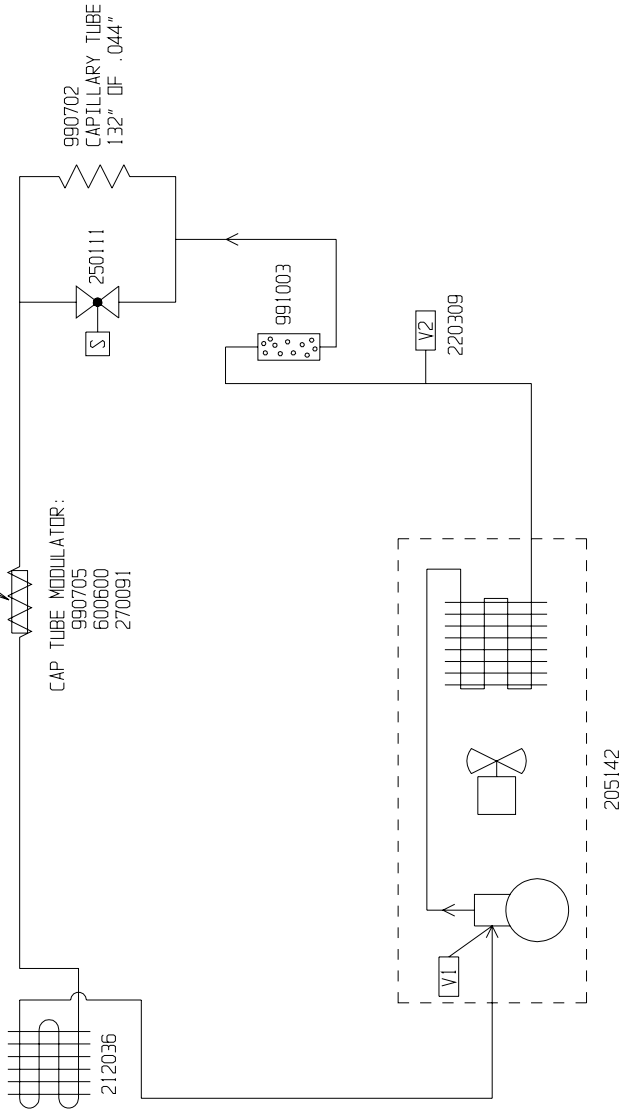
Model 481

Part No.	Description
129024	(2) Pneumatic Spring, 80 lbs.
138009	Heater, Wirewound 450W 115/230V
156089	Motor, Brushless DC 24V
191535	Motor Drive Board
191545	Temp Control Board
190525	Triple Outlet Relay Board
190818	LCD Display Panel
191538	Shaker Micro Board
400113	Thermostat - Opens at 200°F
420064	Transformer, 130VA
420085	Transformer, 25VA
133009	Cartridge Heater 200W, 240V
900093	.230 CFM Blower 220V
900107	Tubeaxial Fan, 235 CFM, 230V
991003*	Dryer 1/4 SAE Non-CFC Unit Size 8
212036*	Evaporator 8-3/4 x 11-3/8
205079*	1/3 HP Condensing Unit 220V, w/R134A
220309*	Access Valve Assembly, 2"
250115*	1/4 ODF Ref. Solenoid Valve, 220V
300276	.20A Relay, DPDT, 220V
230141	.800 mA Fuse T.D. 5mm x 20mm
230142	.150 mA Fuse T.D. 5mm x 20mm
230107	.100 mA Fuse (for optional recorder) T.D. 5mm x 20mm
800040	V-Belt, 1/2" x 45"
760167	Air Filter 10.5" x 23.625"
760164	HEPA Filter
194015	Shipping Bracket
443021	.3/4" open end wrench
435051	Screwdriver, Phillips
443020	Wrench, 5/32" Hex with T-handle
194046	Spare Parts Bag, (platform and clips)
270126	EMI Power Line Filter, 10A
107003	Lid Glass Window
990024	Lid Gasket
194582	Condensing Unit Evaporator Assy 1/3 HP

* part of PIN 194582

DRAWING NUMBER: 194580-90-0-B

REV	ECN NO.	DATE	BY	CAO	APPD	DESCRIPTION OF REVISION
0	DS-117	02-17-97	MB	PKD	LDN	RELEASED FOR PRODUCTION
1	DS-117	04-04-97	AFC	PKD	LDN	REVISED EVAPORATOR CONNECTION
2	DS-155	04-20-98	MB	MB	DHS	ADDED MODEL 480
3	DS-279	02-11-04	BDB	PKD	LDN	4580 PRODUCT ELIMINATION
4	SI-9436	08-30-05	RS	GLS	CCS	CHG. CONDENSING UNIT FROM 205064



STANDARD REFRIGERATION

REFRIGERANT R-134a: 11.0 ozs.

EVACUATION SPECIFICATION:

SYSTEM TO BE EVACUATED FROM (2) PORTS AND SOLENOID VALVE TO BE ENERGIZED DURING EVACUATION. EVACUATION TIME TO BE 6 HRS. MINIMUM. SYSTEM MUST MAINTAIN 300 MICRONS OR LESS FOR 3 MINUTES AFTER EVACUATION IS COMPLETE.

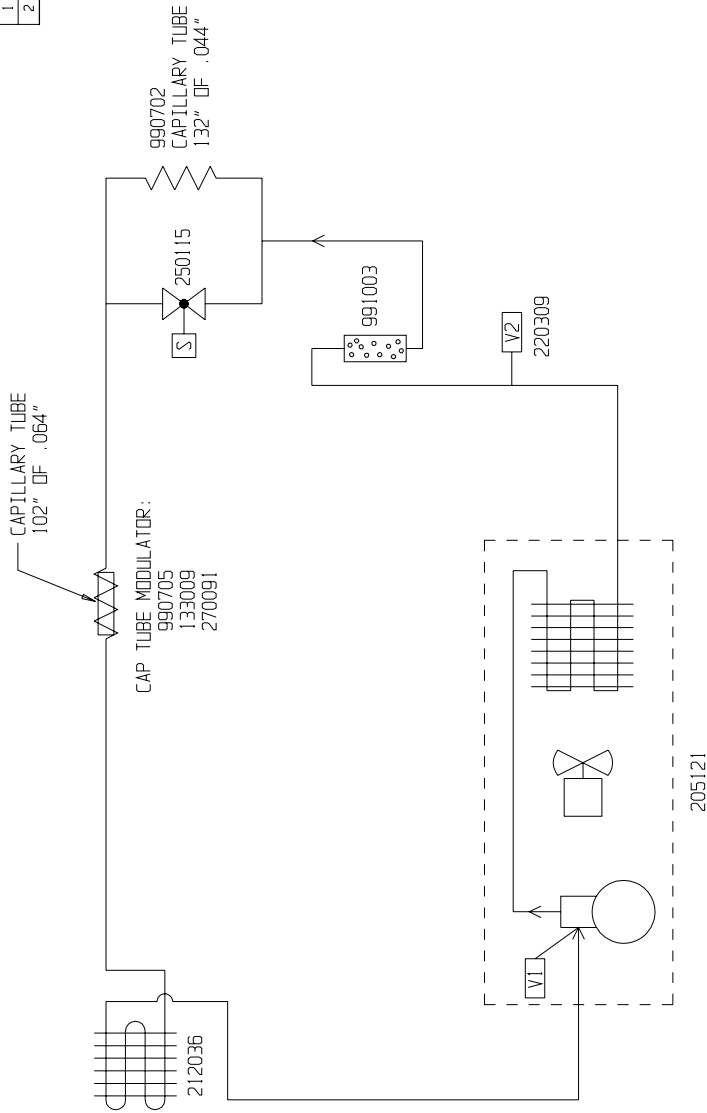
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MODEL/PART NAME: 480 CONSOLE INCUBATOR / REFRIGERATED SHAKER				
DWG TITLE: REFRIGERATION SCHEMATIC				
DWN: MB	CAD: PKD	APPD: LDN	DATE: 02-17-97	SCALE: NONE
MATERIAL: N/A				
PAINT COLOR: N/A				
TOLERANCE UNLESS OTHERWISE SPECIFIED		DRAWING NUMBER		SIZE
ANGLES: DECIMAL: .XXX±		194580-90-0		B

Thermo
ELECTRON CORPORATION
One Thermo Drive
Billerica, MA 01825
Tel: 978-666-1000
Fax: 978-666-1001

DRAWING NUMBER: 194582-90-0-B

REV	ECN NO.	DATE	BY	CAO	APPD	DESCRIPTION OF REVISION
0	DS-151	03-20-98	RTT	PKK	LON	RELEASED FOR PRODUCTION
1	DS-155	04-20-98	MB	DAS		ADDED MODEL 481
2	DS-279	02-11-04	BOB	CCS		4581 & 4586 PRODUCT ELIMINATION



STANDARD REFRIGERATION

REFRIGERANT R-134a: 11.0 ozs.

EVACUATION SPECIFICATION:

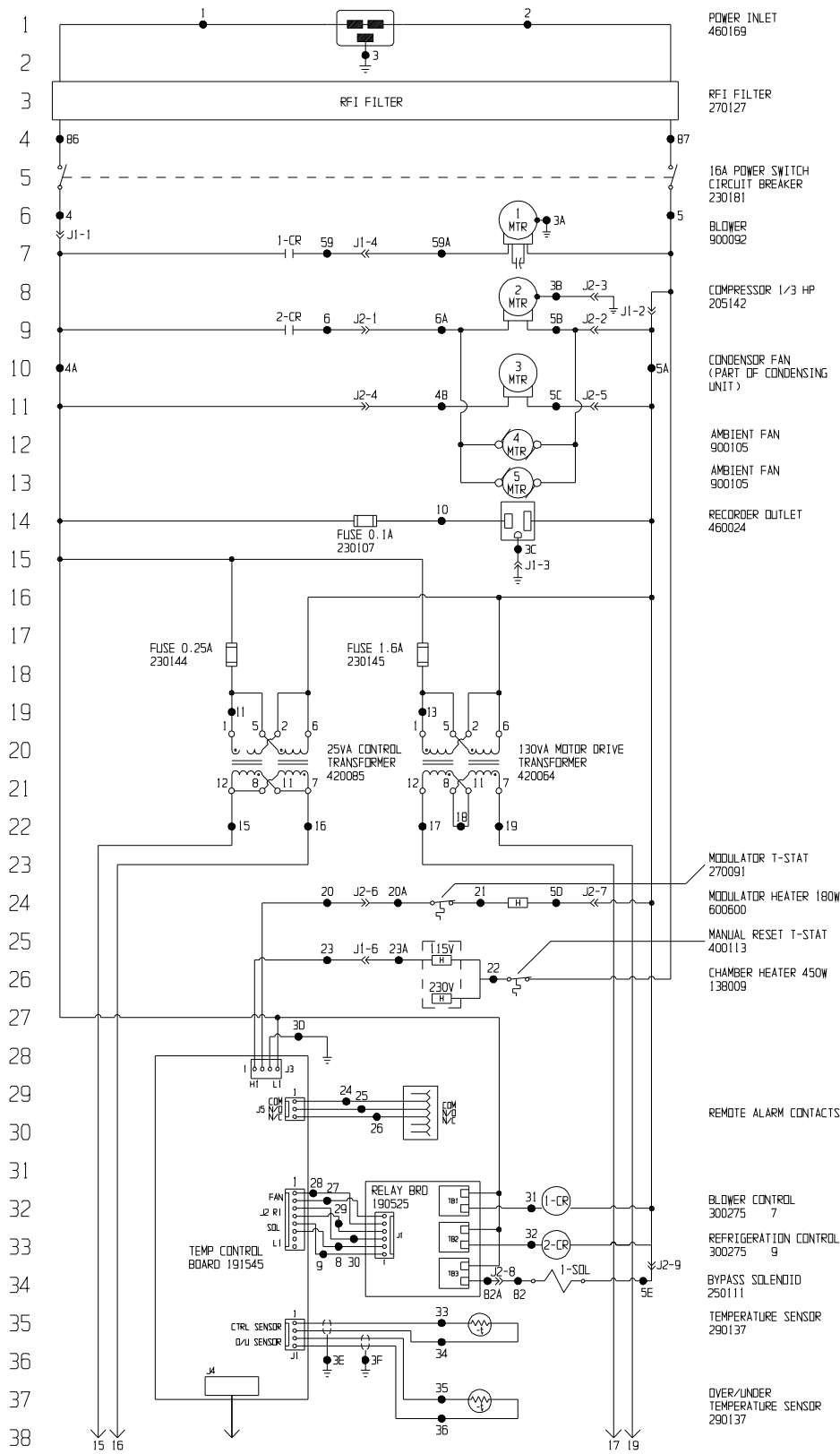
SYSTEM TO BE EVACUATED FROM (2) PORTS AND
 SOLENOID VALVE TO BE ENERGIZED DURING EVACUATION.
 EVACUATION TIME TO BE 6 HRS. MINIMUM. SYSTEM
 MUST MAINTAIN 300 MICRONS OR LESS FOR 3 MINUTES
 AFTER EVACUATION IS COMPLETE.

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MODEL/PART NAME: 481 CONSOLE INCUBATOR / REFRIGERATED SHAKER
ENG TITLE: REFRIGERATION SCHEMATIC
DWN: MB CAO: pdk APPD: LON DATE: 02-17-97 SCALE: NONE
MATERIAL: N/A
PAINT COLOR: N/A
TOLERANCE UNLESS OTHERWISE SPECIFIED: .XX±
ANGLES: DECIMAL: .XXX±
DRAWING NUMBER: 194582-90-0
SIZE: B

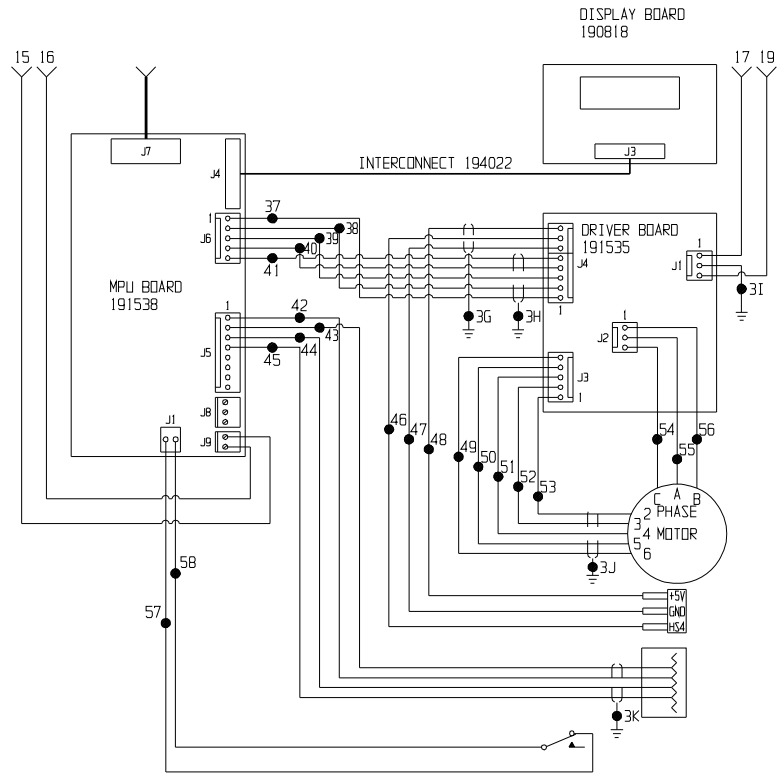
POWER CONNECTION
120VAC, 1PH, 60Hz, 15.6 FLA



Electrical Schematic
Model:
480
Console Shaker

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MOTOR
156089

BELT SENSOR
290144

RS-232	RS-485	PIN
RX DATA	-XEV	2
GND	+XEV	3
TX DATA		4
GND		5

LID SWITCH
(SHOWN LID OPEN)
285306

Electrical Schematic
Model:
480
Console Shaker

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WIRE REFERENCE CHART

WIRE #	GAUGE	COLOR	WIRE #	GAUGE	COLOR
1	14	BROWN	28	24	RED
2	14	BLUE	29	24	BLACK
3	14	GREEN	30	24	ORANGE
3A-3D	18	GRN/YEL	31	18	YELLOW
3E-3K		SHIELDS	32	18	BROWN
4	14	BLACK	33	24	RED
4A	14	BLACK	34	24	BLACK
4B	18	BLACK	35	24	RED
5	14	WHITE	36	24	BLACK
5A	14	WHITE	37	24	BLACK
5B	14	WHITE	38	24	RED
5C	18	WHITE	39	24	GREEN
5D	18	WHITE	40	24	WHITE
5E	18	WHITE	41	24	BROWN
6	14	BROWN	42	24	BLACK
6A	14	BROWN	43	24	RED
7	--	----	44	24	GREEN
8	24	BLACK	45	24	WHITE
9	24	PURPLE	46	24	GREEN
10	18	BROWN	47	24	BLACK
11	18	RED	48	24	RED
13	18	YELLOW	49	24	BLACK
15	18	BROWN	50	24	RED
17	18	BLUE	51	24	GREEN
17	18	RED	52	24	WHITE
18	18	ORANGE	53	24	BROWN
19	18	RED	54	18	RED
20	18	RED	55	18	WHITE
20A	18	RED	56	18	BLACK
21	18	BLACK	57	24	BLACK
22	18	YELLOW	58	24	BLACK
23	18	BROWN	59	18	BROWN
23A	18	BROWN	59A	18	BROWN
24	24	GREEN	82	18	PURPLE
25	24	RED	82A	18	PURPLE
26	24	BLACK	86	14	BROWN
27	24	BLACK	87	14	BLUE

2	DS-340	02/06/09	JAS	JAS	CCS	TRIM STRAY LINE AT WIRE #20
1	S1-9436	08/30/05	RS	GLS	LON	CHG CONDENSING UNIT FROM 205064
0	DS-279	02-11-04	BOB	pdk	LON	RELEASED FOR PRODUCTION
REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
MODEL/PART NAME: 480 CONSOLE INCUBATOR / REFRIGERATED SHAKER						
DWG TITLE: ELECTRICAL SCHEMATIC						
DWN: pdk CAD: pdk APPD: LON DATE: 02-11-04 SCALE: NONE						
MATERIAL: N/A						
PAINT COLOR: N/A						
TOLERANCE UNLESS OTHERWISE SPECIFIED				DRAWING NUMBER		SIZE
ANGLES: DECIMAL: .XX±				480-70-0		D
DECIMAL: .XXX±						

Electrical Schematic
Model:
480
Console Shaker

480-70-0-D REV. 2
Page 3 of 3

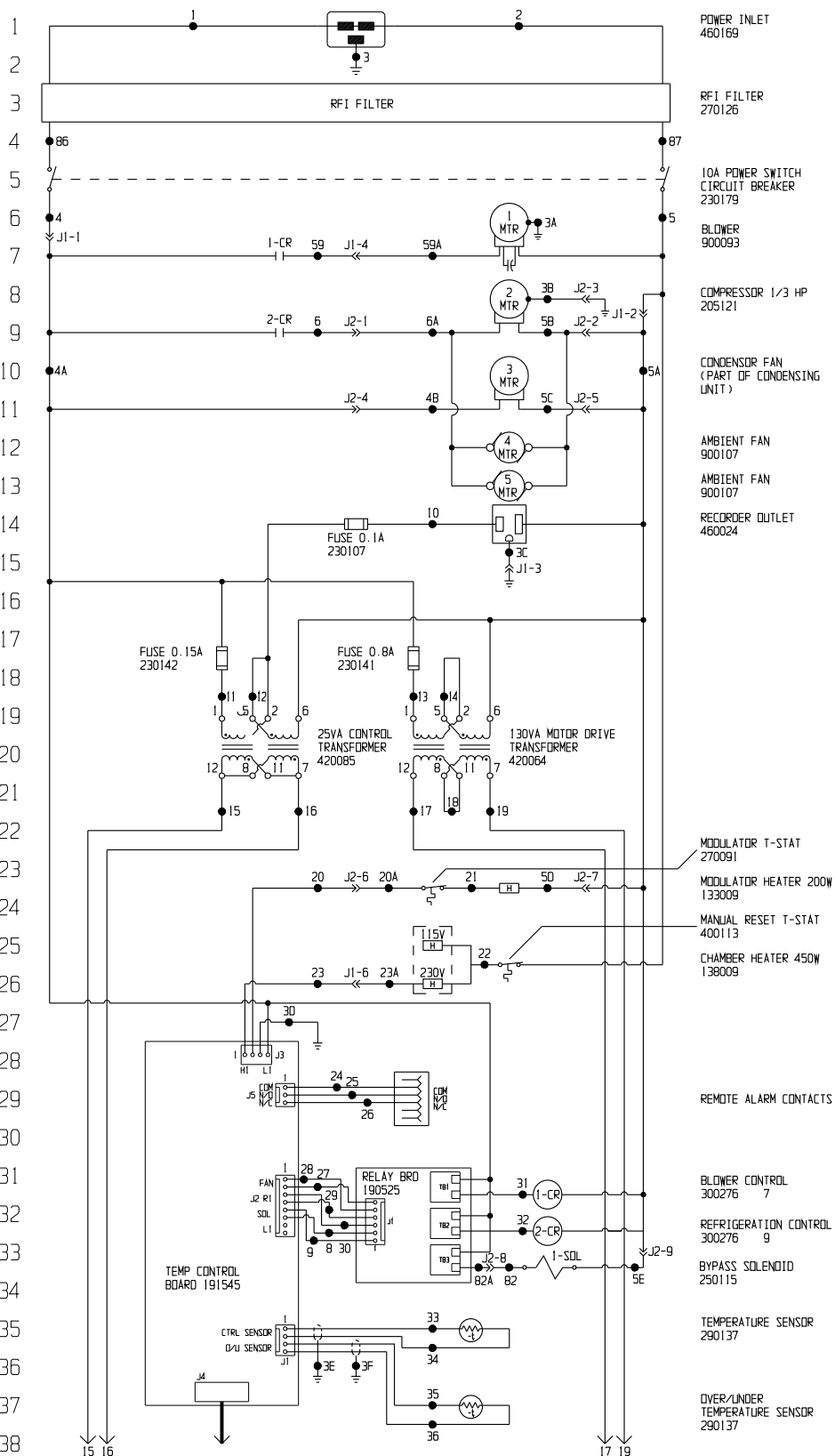
ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

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ThermoFisher
SCIENTIFIC

BOX 649, MARIETTA, OHIO 45750

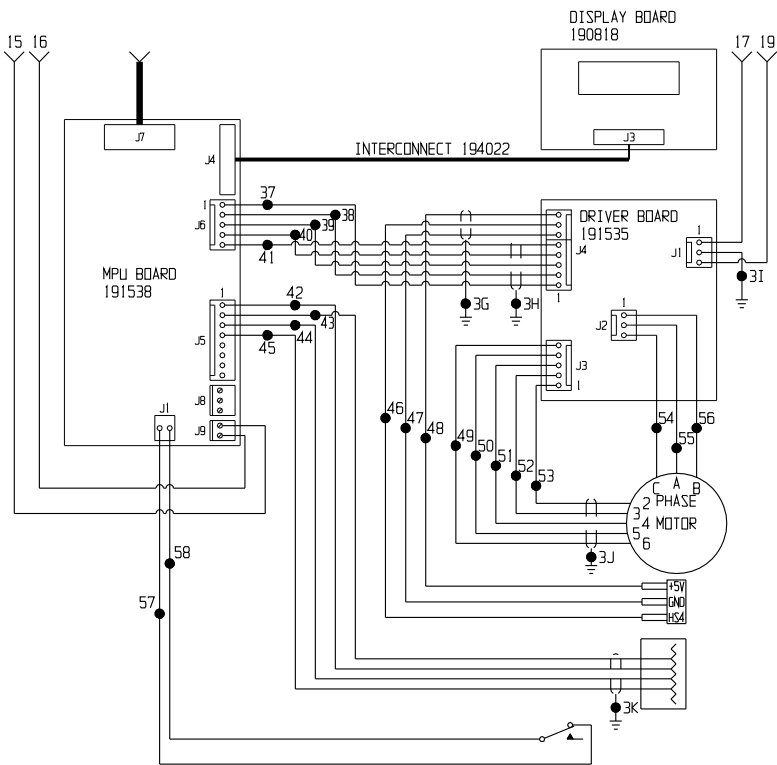
POWER CONNECTION
230VAC, 1PH, 50Hz, 8.0 FLA



Electrical Schematic
Model:
481
Console Shaker

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MOTOR
156089

BELT SENSOR
290144

RS-232	RS-485	PIN
RX DATA	-XCV	2
GND		3
TX DATA	+XCV	4
GND		5

LID SWITCH
(SHOWN LID OPEN)
285306

Electrical Schematic
Model:
481
Console Shaker

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WIRE REFERENCE CHART

WIRE #	GAUGE	COLOR	WIRE #	GAUGE	COLOR
1	14	BROWN	27	24	BLACK
2	14	BLUE	28	24	RED
3	14	GRN/YEL	29	24	BLACK
3A-3D	18	GRN/YEL	30	24	ORANGE
3E-3K		SHIELDS	31	18	YELLOW
4	14	BLACK	32	18	BROWN
4A	14	BLACK	33	24	RED
4B	18	BLACK	34	24	BLACK
5	14	WHITE	35	24	RED
5A	14	WHITE	36	24	BLACK
5B	14	WHITE	37	24	BLACK
5C	18	WHITE	38	24	RED
5D	18	WHITE	39	24	GREEN
5E	18	WHITE	40	24	WHITE
6	14	BROWN	41	24	BROWN
6A	14	BROWN	42	24	BLACK
7	--	----	43	24	RED
8	24	BLACK	44	24	GREEN
9	24	PURPLE	45	24	WHITE
10	18	BROWN	46	24	GREEN
11	18	RED	47	24	BLACK
12	18	ORANGE	48	24	RED
13	18	YELLOW	49	24	BLACK
14	18	BROWN	50	24	RED
15	18	BROWN	51	24	GREEN
16	18	BLUE	52	24	WHITE
17	18	RED	53	24	BROWN
18	18	ORANGE	54	18	RED
19	18	RED	55	18	WHITE
20	18	RED	56	18	BLACK
20A	18	RED	57	24	BLACK
21	18	BLACK	58	24	BLACK
22	18	YELLOW	59	18	BROWN
23	18	BROWN	59A	18	BROWN
23A	18	BROWN	62	18	PURPLE
24	24	GREEN	82A	18	PURPLE
25	24	RED	86	14	BROWN
26	24	BLACK	87	14	BLUE

0	DS-279	02-11-04	BOB	pdk	CCS	RELEASED FOR PRODUCTION
REV	ECN NO.	DATE	BY	CAD	APPO	DESCRIPTION OF REVISION

Electrical Schematic
Model:
481
Console Shaker



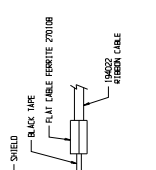
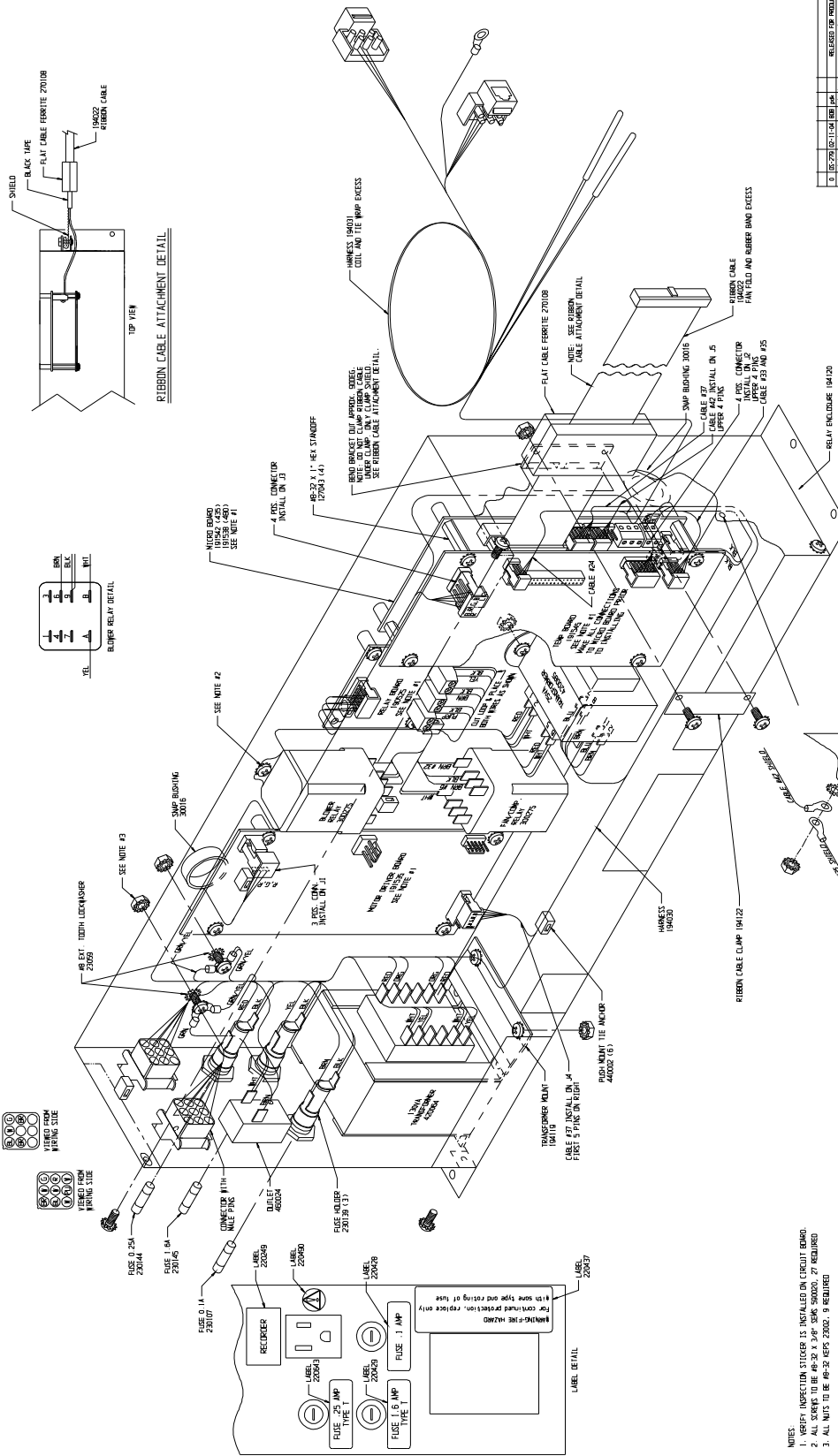
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Thermo
ELECTRON CORPORATION
Controlled Environment Equipment
Box 649, Marietta, Oh 45750

MODEL/PART NAME: 481 CONSOLE INCUBATOR / REFRIGERATED SHAKER					
DWG TITLE: ELECTRICAL SCHEMATIC					
DWG: pdk	CAD: pdk	APPO:	DATE: 02-11-04	SCALE: NONE	
MATERIAL: N/A					
PAINT COLOR: N/A					
TOLERANCE UNLESS OTHERWISE SPECIFIED			DRAWING NUMBER	SIZE	
ANGLES: DECIMAL: .XX=±			481-70-0	D	

481-70-0-D REV. 0
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TOP VIEW
RIBBON CABLE ATTACHMENT DETAIL



BUMPER RELAY DETAIL

- NOTES:**
1. VERIFY INSULATION STRIPPER IS INSTALLED ON CIRCUIT BOARD. IF NOT INSTALLED, INSTALL PART 2321 IN PLACE.
 2. ALL WIRTS TO BE RP-32 KEPS 2000, 9 REQUIRED.
 3. ALL WIRTS TO BE RP-32 KEPS 2000, 9 REQUIRED.

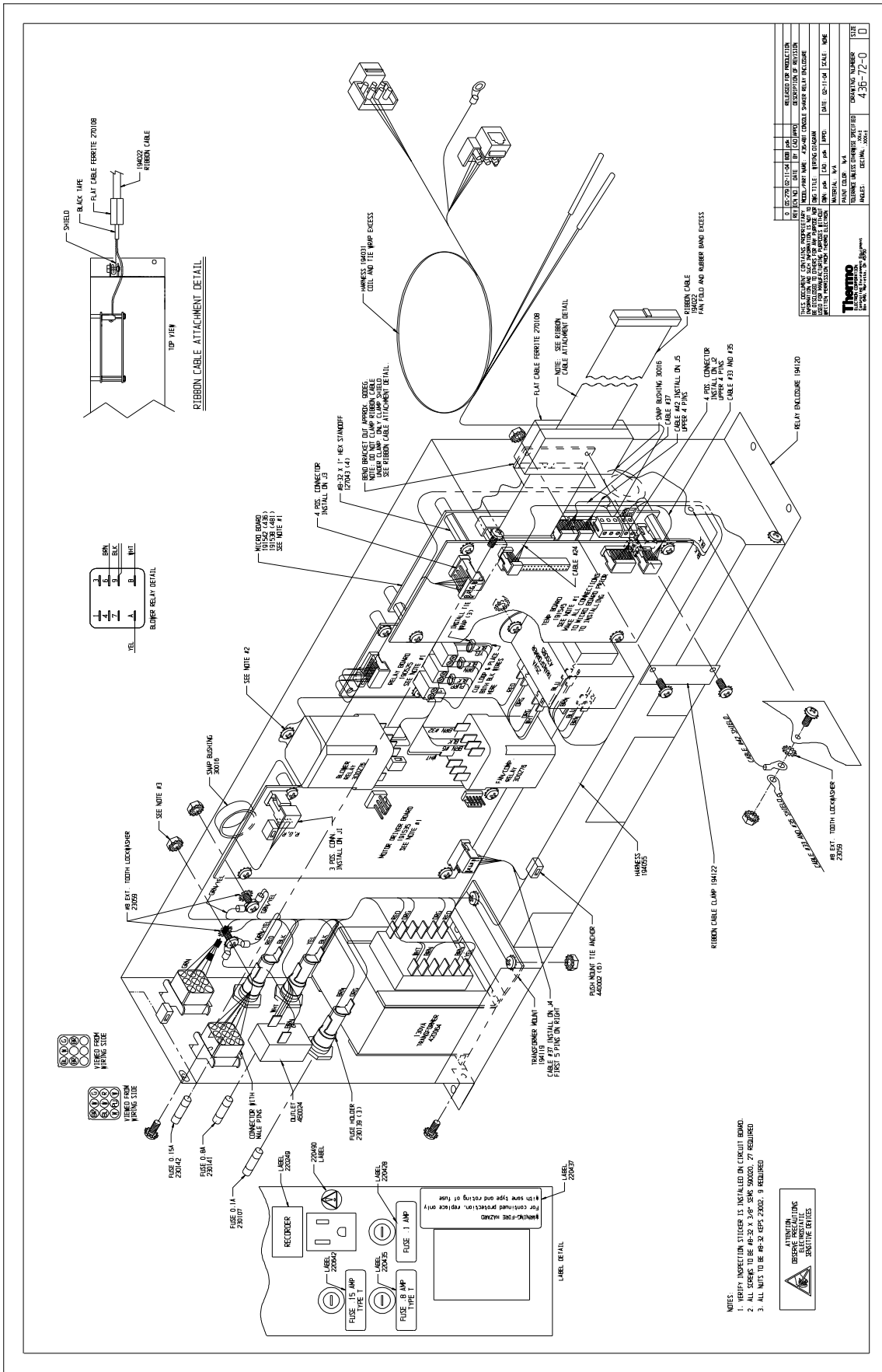


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Thermo Scientific
RELAYING MASS CURRENT SENSITIVE PARTS

REV	DATE	BY	CHKD	DESCRIPTION OF REVISION
1	10/11/01

SCALE: NONE
DATE: 02-11-01
DWG. NO.: 435-72-0



REV.	DESCRIPTION	DATE	BY	CHKD.	APPV.	SCALE	WORKING NUMBER
0	ISSUED FOR PRODUCTION						1327
1	REVISED FOR PRODUCTION						435-72-0
2	REVISED FOR PRODUCTION						
3	REVISED FOR PRODUCTION						
4	REVISED FOR PRODUCTION						
5	REVISED FOR PRODUCTION						
6	REVISED FOR PRODUCTION						
7	REVISED FOR PRODUCTION						
8	REVISED FOR PRODUCTION						
9	REVISED FOR PRODUCTION						

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Thermo
 SCIENTIFIC
 1000 UNIVERSITY AVENUE
 WILSONVILLE, NC 28095
 TEL: 704.943.0000 FAX: 704.943.0001
 WWW.THERMOFISHERSCIENTIFIC.COM

- NOTES:
1. VERIFY INSPECTION STICKER IS INSTALLED ON CIRCUIT BOARD.
 2. ALL SCREWS TO BE #8-32 X 3/4" S&S 5X4000, 27 REQUIRED.
 3. ALL NUTS TO BE #8-32 KEPS 23002, 9 REQUIRED.



THERMO FISHER SCIENTIFIC ORBITAL SHAKER WARRANTY USA

The Warranty Period starts two weeks from the date your equipment is shipped from our facility. This allows shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the warranty period.

During the first two years or 12,000 hours of use, whichever comes later, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, labor included. In addition, after the initial warranty period of two years or 12,000 hours, the Orbital Shaker mechanism is warranted for Unit Production Life, parts only, F.O.B. factory. The mechanism is defined as the bearing assemblies. Unit Production Life is defined as the period of time the current mechanism design is in production, plus seven years. The warranty will be void if the equipment is altered without written authorization from Thermo. The 12,000 hours use must be validated by the internal timer and/or objective documentation. If validation or documentation of run hours are not available, unit warranty defaults to 3 years, parts and labor. Installation and calibration is not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to performance of any repairs. Expendable items, i.e., glass, filters, light bulbs and lid gaskets are excluded from this warranty.

Replacement or repair of components parts or equipment under this warranty shall not exceed the warranty to either the equipment or to the component part beyond the original warranty period. The Technical Services Department must give prior approval for return of any components or equipment.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY.

Thermo shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation, and preventive maintenance.

If equipment service is required, please call your Technical Services Department at 1-800-438-4851 (USA and Canada) or 1-740-373-4763. We're ready to answer any questions on equipment warranty, operation, maintenance, service and special applications. Outside the USA, contact your local distributor for warranty information.



THERMO FISHER SCIENTIFIC INTERNATIONAL ORBITAL SHAKER WARRANTY

The Warranty Period starts two months from the date your equipment is shipped from our facility. This allows shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the warranty period.

During the first two years or 12,000 hours of use, whichever comes later, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, excluding labor. The orbital shaker mechanism is warranted for life, parts only, F.O.B. factory. The mechanism is defined as the bearing assemblies. Life is defined as the period of time the current mechanism design is in production, plus seven years. The warranty will be void if the equipment is altered without the written authorization from Thermo. The 12,000 hour use must be validated by the internal timer and/or objective documentation. If validation or documentation of run hours are not available, unit warranty defaults to 3 years, parts only. Installation and calibration is not covered by this warranty agreement. Expendable items, i.e., glass, filters, light bulbs and lid gaskets are excluded from this warranty.

Replacement or repair of component parts or equipment under this warranty shall not exceed the warranty to either the equipment or to the component part beyond the original warranty period. The Technical Services Department must give prior approval for return of any components or equipment.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY. Thermo shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Thermo International Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation, and preventative maintenance.

If equipment service is required, please call your Technical Services Department at 740-373-4763, or Fax 740-373-4189. We're ready to answer your questions on equipment warranty, operation, maintenance, service and special applications. Outside the USA, contact your local distributor for warranty information.



Rev. 2 2/07

Declaration of Conformity

Manufacturer's Name: Thermo Fisher Scientific (Asheville) LLC

Manufacturer's Address: 401 Millcreek Road
Marietta, Ohio 45750
U.S.A.

Product Description: Forma® Orbital Shaker

Product Designations: 481

Year of Initial Marking (CE): 1998

Affected Serial Numbers: Release 11
(Release Level [REL#] shown on Serial Tag)

This product conforms to the following European Union Directive(s):

EMC: 89/336/EEC

LVD: 73/23/EEC

This product conforms to the following Harmonized, International and National Standards:

EMC:

EN 61326-1:1997

EN 50081-1:92

EN 50082-1:97

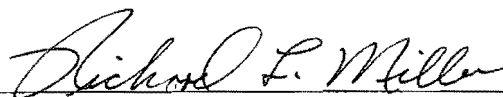
LVD:

EN 61010-1:1993

IEC 1010-1 Amendment 2

EN 60335-2-24 (applicable sections)

CSA C22.2 No. 1010.1-92



Richard L. Miller, CQE
Regulatory Compliance Manager

ThermoFisher
S C I E N T I F I C

05 February 2007

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