MaxQ High Performance Console

Incubated/Refrigerated Orbital Shaker *

Operating and Maintenance Manual 7040480 Rev. 4

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(from front cover)

* 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)

Models covered by this manual:			
Model	**Number**	**Voltage, Frequency**	**Temperature Control**
SHKE480HP	480	120VAC, 60Hz	Incubated/Refrigerated
SHKE481HP	481	230VAC, 50Hz	Incubated/Refrigerated

MANUAL NUMBER 7040480

REV	ECR/ECN	DATE	DESCRIPTION	BY
4	40722	7/10/17	Added gas springs to Maitenance	bpg
3	41343	5/1/17	Added F-Gas statement	bpg
2	40230	8/1/16	Changed 238054 platform part number in parts list to 238083 - pg 7-1	ccs
1	40139	4/15/15	Updated warranty information	ccs
0	28036/OS-751	9/8/14	Release 14 (480), Release 13 (481) - new control board	ccs

CAUTION

**Contains Parts and Assemblies
Susceptible to Damage by
Electrostatic Discharge (ESD)**

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. ▲

Warning Use MaxQ SHKE480HP/SHKE481HP Orbital Shaker to process non-flammable materials only! ▲

Warning Grounding circuit continuity is vital for safe operation of this shaker. Never operate this unit with the grounding circuit disconnected. ▲

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When this manual is translated into other languages, the US English version is binding.

Important operating and/or maintenance instructions. Read the accompanying text carefully.

Potential electrical hazards. Only qualified persons should perform procedures associated with this symbol.

Equipment being maintained or serviced must be turned off and locked off to prevent possible injury.

Hot surface(s) present which may cause burns to unprotected skin, or to materials which may be damaged by elevated temperatures.

WEEE Compliance: Thermo Fisher Scientific has contracted with companies for recycling/disposal in each EU Member State. For further information, send an email to weee.recycle@thermofisher.com.

✔   Always use the proper protective equipment (clothing, gloves, goggles, etc.)

✔   Always dissipate extreme cold or heat and wear protective clothing.

✔   Always follow good hygiene practices.

✔   Each individual is responsible for his or her own safety.

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Section 1 **Installation**

The shipping carton should be inspected upon delivery. When received, carefully examine for any shipping damage before unpacking. If damage is discovered, the delivering carrier should specify and sign for the damage on your copy of the delivery receipt.

Open the carton carefully making certain that all parts are accounted for before packaging materials are discarded. After unpacking, if damage to any of the contents is found, promptly report it to the carrier and request a formal damage inspection.

Important Failure to request an inspection of damage within a few days after receipt of shipment absolves the carrier from any liability for damage. Call for a damage inspection promptly. ▲
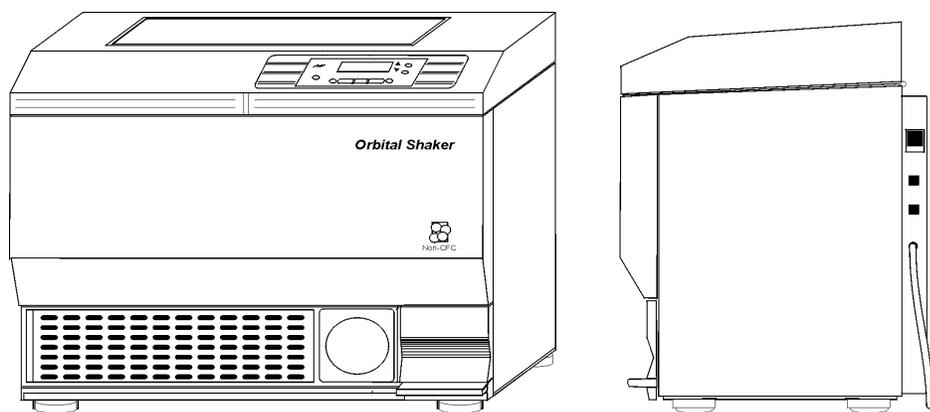
Figure 1-1. MaxQ SHKE480HP/SHKE481HP Console Incubated/Refrigerated Orbital Shaker

The MaxQ SHKE480HP/SHKE481HP Console Orbital Shaker ships with the following materials:

2 - Keys for the lid lock (packaged and attached to outside of unit)
1 - T-handle 5/32" hex wrench
2 - Platform alignment studs 1/4-20
1 - Shaker Platform
6 - Grade 8, 5/32" hex socket flat head screws (provided with platform)
2 - 3/4" open end wrench
2 - 1/4-20 x 7" stand-off bolts with rubber caps
1 - 8-¾" Phillips screwdriver for flask clip installation and removal
1 - Line cord (country of destination)

Pallet Hold-down Shipping Brackets

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 1-2).
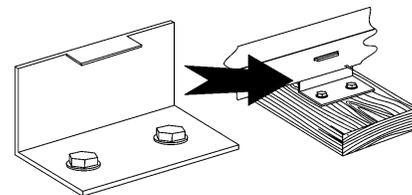
Figure 1-2. Bracket

Location

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.

As the electrical plug is the mains disconnect for the unit, the electrical wall outlet must be accessible at all times.

Installing the Cabinet Stand-off Bolts

The MaxQ 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.

Screw the bolts in the threaded holes on the back of the shaker cabinet (Figure 1-3). 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.
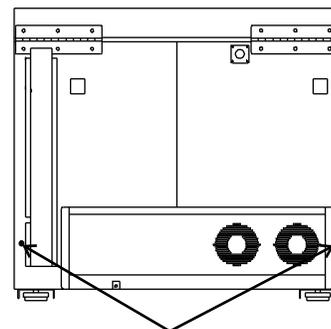
Threaded holes for stand-off bolts

Figure 1-3. Bolt Locations

Chamber Drain

A drain is provided in the bottom of the chamber for convenience when cleaning or removing spills. (Figure 1-4) 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.

Chamber Drain Hose and Valve
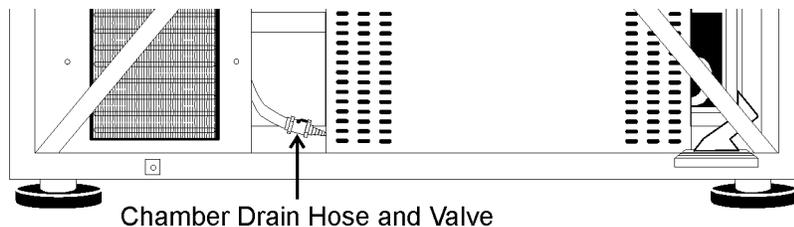
Figure 1-4. Chamber Drain Hose Location

Chamber Drain (continued)

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.

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 1-5.

Condensate Drain
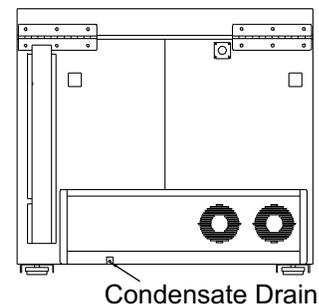
Figure 1-5. Drain Location

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.

Installing the Platform

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

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

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

IMPORTANT USER INFORMATION

WARNING: DO NOT START SHAKER W/O FIRST REMOVING THE PLATFORM HOLD DOWN BRACKET AND INSTALLING THE PLATFORM.
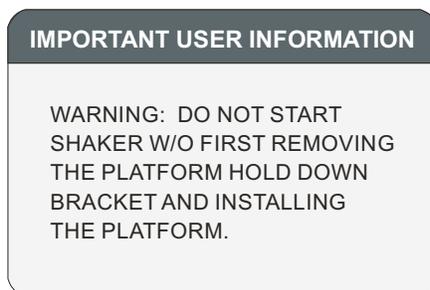
Figure 1-6. Warning Decal
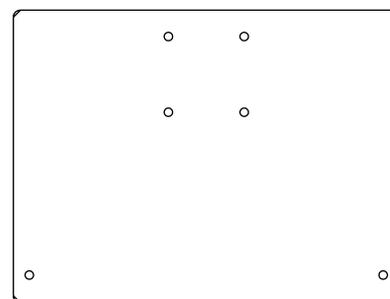
Figure 1-7. Shipping Bracket

To protect the shaker's orbital mechanism during shipment, a sheet metal shipping bracket (Figure 1-7) 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 a 5/16" nominal heavy-duty, 29.5" wide x 18" front-to-back platform.

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 1-8.

Caution Do not attempt to use a Phillips head screwdriver. ▲
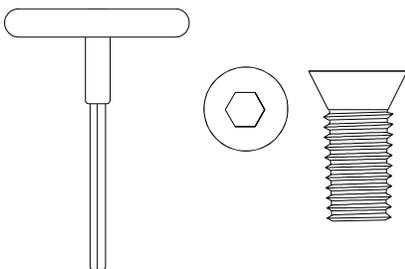
Figure 1-8. T-Handle Wrench and Hex Socket Head Screw

1. Insert the two 1/4-20 alignment pins into the two mounting holes identified in Figures 1-9 and 1-10.
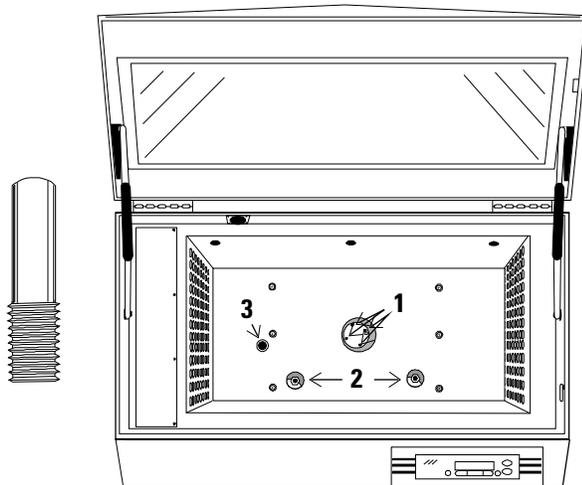
1) Platform mounting holes on drive mechanism (4)

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

3) Chamber drain

Figure 1-9. Hole Locations

Installing the Platform (continued)

2. Rotate the drive mechanism until the four mounting holes generally match the holes in the platform.

Alignment Pins

● = Platform Mounting Holes
◉ = Mounting Holes for Off-Brand Equipment
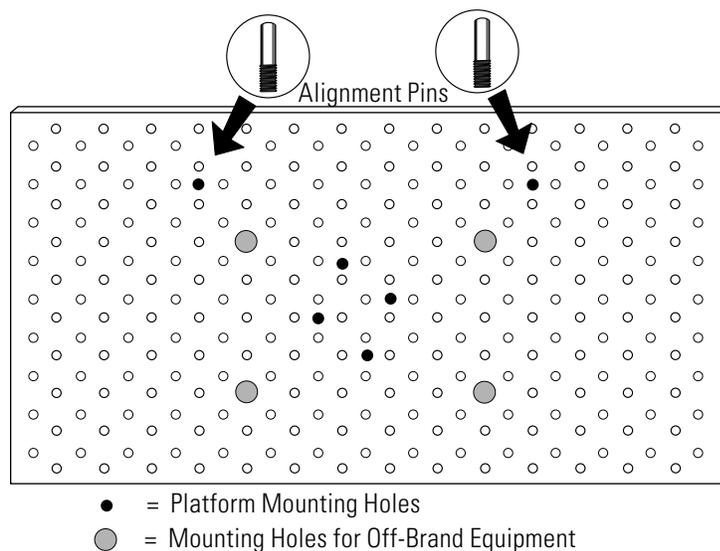
Figure 1-10. Hole Locations (Universal Shaker Platform shown)

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 speed (525 RPM). ▲

Assemble Flask Clips

Each flask clip up to 6.0 liters in size comes with a metal spring which must be installed onto the clip. For flask clips through 500 ml, insert end of each spring into the holes on the top of clip leg (Figure 1-11).
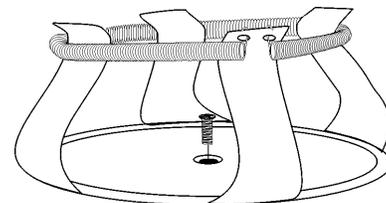
Figure 1-11. Insert Springs

The 2 liter, 2.8 liter, 4 liter, 5 liter, and 6 liter flask clips use two sets of metal springs and rubber spring tubes. On these larger clips, the springs are installed by hooking their ends together as illustrated in Figure 1-12. 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.

Upper spring and spring tubes

Clip leg

Lower spring and spring tubes
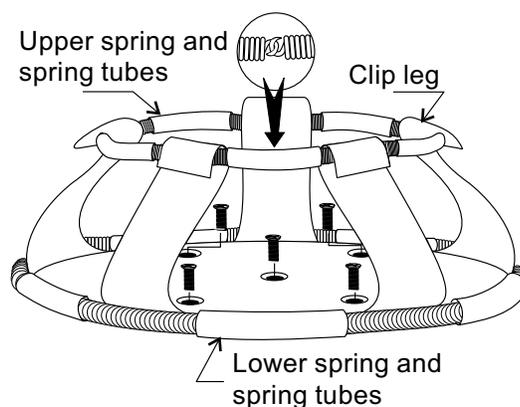
Figure 1-12. Spring Installation

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

Installing the Flask Clips

The SHKE480HP/SHKE481HP accommodates glassware in numbers and sizes from ninety-one 25 ml flasks to four 6 liter flasks. All platforms have mounting holes for flask clips and test tube racks made by other manufacturers.

Listed below are the dedicated platform kits available for these shakers.

Table 1-1. Dedicated Platform Kits

Dedicated platform number	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/ large 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
238051	30	250/300ml	1 (w/ large pad)	5
238083	5	5l	2 (w/12 tubes)	5

Flask clips can be attached anywhere on the platform and flasks can be inserted into any flask clip as the counter-balanced design of these shakers compensates for unbalanced loads.

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 1-11 and 1-12 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 250/300ml 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.

Install 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.

Table 1-2. Test Tube 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
600088	Universal adjustable-angle test tube rack holder, 10-25mm
600089	2 tier microplate rack
600090	3 tier microplate rack
194024	#10-24 Pan head Phillips screws for mounting test tube holders to orbital shaker platforms

All test tube rack holders are adjustable in seven positions, swinging and locking at 15°, 30° and 45° in either direction. Figure 1-13 shows the Test Tube Rack Holder with the rack in place.

Spread metal tabs outward to remove test tube rack

Locking Pin to swing/tilt test tube rack 15°, 30°, 45°
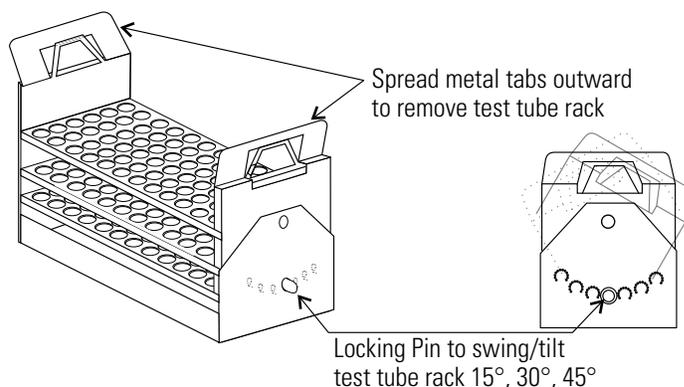
Figure 1-13. Holder with Rack

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

To install Test Tube Rack Holder onto 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 1-14). Attach tray to platform with screws provided.
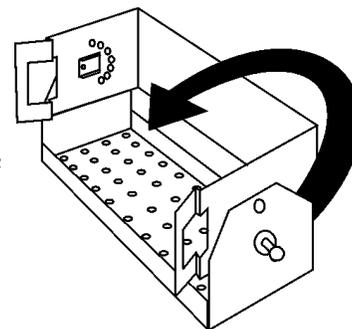
Figure 1-14. Rotate Bed

RS-232 Interface Connector

The MaxQ Console 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 unit. A cable with RJ-11 plugs and an RJ-11 to DB-25 adapter are required. Refer to Figure 1-18 for connector locations on the shaker back panel. Figure 1-15 identifies the Remote Alarm and RS-232 pin contacts.

ALARM CONTACTS
30V MAX / 1 A MAX

RS-232
INTERFACE

(2) COM

(3) N.O.   (4) N.C.

(2) $\overline{RXD}$ (4) $\overline{TXD}$

(3) SIG. GRD
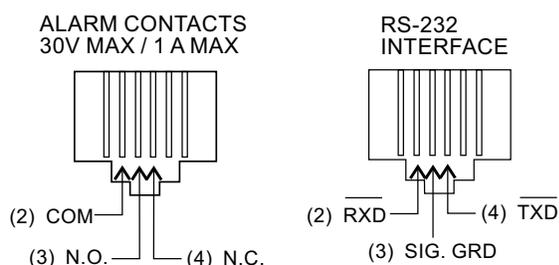
Figure 1-15. RS-232 and Remote Alarm Connectors

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 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, speed and temperature.

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

NUL   . . . . .Null character (0)

SP   . . . . .Space (32)

LF   . . . . .Line feed (10)

CR   .Carriage return (13)

EOT   . . . . .End of transmission (4)

H . . . . .H is for timer count up mode (H) or no H for timer count down mode

RS-232 Interface Connector (cont.)

The SHKE480HP/SHKE481HP transmits time, speed and temperature information one minute after power is first applied to the unit and then every 60 minutes thereafter unless the shaker receives either a <Ctrl><Q> or a <Ctrl><S>.

The shaker's microprocessor responds to two commands from the remote:

<Ctrl><Q> (XON)

The shaker will immediately transmit time, speed, and temperature data upon receiving a <CTRL><Q> and will reset the 60 minute data transmission interval timer.

<Ctrl><S> (XOFF)

The shaker will stop serial data transmission upon receiving a <Ctrl><S> until a <Ctrl><Q> is received or power is cycled.

Connect the Remote Alarm

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 1-15 identifies the pin contacts. Figure 1-18 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 1-16 and 1-17.

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.

(NO) green wire
(COM) yellow wire
(NC) red wire
(not connected) black wire

Alarm Contacts Junction Box

Stock #190392
RJ-11 to screw terminal converter

All outputs shown in alarm condition

Figure 1-17. 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 (Figure 1-18). Two keys for this lock are in the parts package attached to the outside of this unit when shipped.
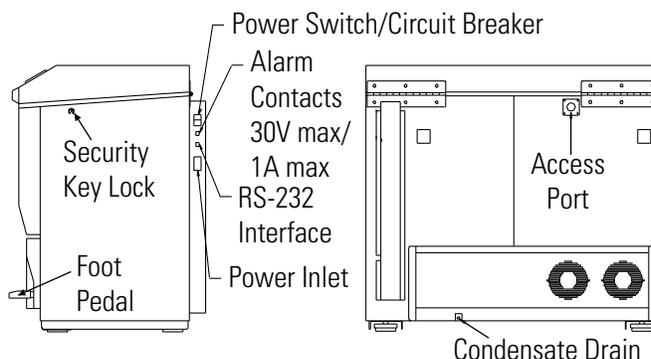
Figure 1-18. Side Panel

Connecting the Unit to Electrical Power

Connect the line cord to the power inlet on the side of the unit. 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
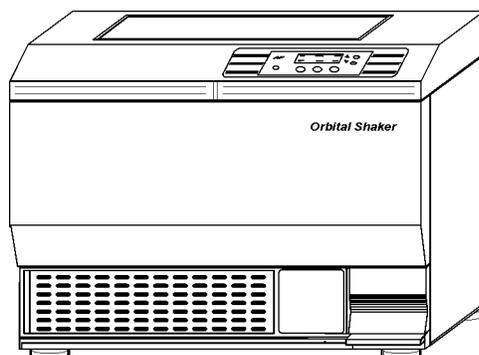
Figure 2-1. Front View

Model SHKE480HP/SHKE481HP is a microprocessor-controlled, incubated/refrigerated orbital console 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 in battery-supported memory which remain even when the shaker is turned off and unplugged.

The platform speed controller continuously adjusts for line voltage fluctuations and provides smooth transitions and consistent speed 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 safety interlock requires that the lid be closed for the drive motor, circulating fans and temperature control system to operate.

Caution It may take up to one minute to bring the platform up to full speed. Never leave the shaker unattended when starting. ▲

Caution 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. ▲

Caution Do not operate the shaker at maximum speed without a load. ▲

Operating the Control Panel

The control panel on these units has a liquid crystal display and eight operating buttons which are identified by word and symbol. During programming, the up and down arrows increase and decrease the numerical values of time, platform speed, or temperature. Press and hold either arrow to cause the values to scroll in that direction; hold for more than five seconds to increase the scrolling speed.

When changing the system configuration, the down arrow advances the display to the next screen while the up arrow returns the display to the previous screen. Pressing the Time, RPM or Temperature button selects the parameter above it to be changed, while the up and down arrows increase and decrease the numerical values, respectively, or toggle between two different options. Pressing and holding either arrow will cause the values to scroll in that direction; holding for more than five seconds will increase the scrolling speed.

The START button begins platform operation as defined by the Time and Speed setpoints, while the STOP button halts the platform. Chamber temperature control begins upon power-up as defined by the Temp setpoint.

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. Depending upon the error detected, pressing the Silence button turns off the audible alarm. However, the three red indicators continue to flash until the alarm condition is corrected. For most alarms, the audible warning will sound again in about fifteen minutes if the condition persists.
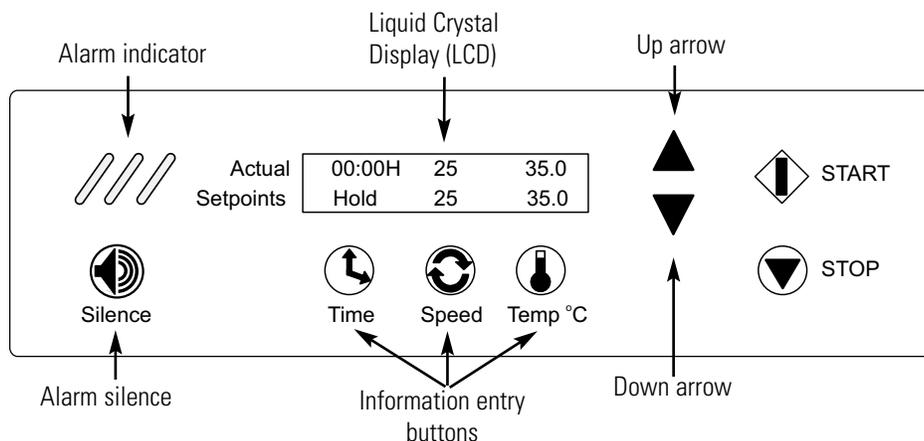
Figure 2-2. Control Panel

The alarm features are discussed in more detail in the "Shaker Alarms" section of this manual.

Quick Start-Up

Caution If the unit is shipped or stored in very cold conditions, allow the unit to warm to ambient temperatures before using. ▲

Caution This unit should be operated by trained personnel only, as described in this manual. All appropriate personal protective equipment should be worn as required. ▲

At power-up, one of the the screens at right will appear on the display for 10 seconds (where

| Software Version # |
| 480/481 REL X.XX |

X.XX is the current software revision) before it shows the Actual and Setpoint times, speeds and temperatures similar to those illustrated in Figure 2-2. For convenience, this is called the Operating Screen throughout this manual.

Initially, the Actual values along the top of the liquid crystal display will differ from the Setpoint values shown along the bottom. The Actual numbers will change as the unit continues to operate.

Time - With the time set at Hold, the time showing in the upper left portion of the LCD 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 system will not reset if the unit is turned off and on using the power switch, or if the shaker door is repeatedly opened and closed.

Speed - The speed shown in the upper center portion of the LCD will indicate the present platform speed. It will display zero RPM at rest and will gradually rise to the setpoint speed after the START button is pressed and the platform begins to rotate.

Temperature - The temperature shown in the upper right portion of the LCD will indicate the ambient temperature inside the shaker and will gradually move toward the setpoint value.

Factory Default Settings

The values shown in Figure 2-2 are factory default settings. Other factory settings are shown in Table 2-1 at right.

Table 2-1. Factory Settings

Function	Default
Audible Alarm	ON
RPM Tracking Limit (fixed)	5 RPM
Temperature Tracking Limit	10°C
Over Temperature Shutdown	63°C to 65°C
Under Temperature Shutdown	-1°C to +2°C
All Remote Alarms	ON
Defrost	ON, 12°C

Factory Default Settings (continued)

The Console Shaker has been shipped from the factory with the following default settings:

Time: When the shaker is turned on for the first time, the LCD 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.

Speed: The display shows the unit ready to operate at 25 RPM. Programming changes in the speed are made in increments of 1 RPM. However, if the up or down arrows are held for about two seconds, the display will scroll in that direction.

Temperature: The display shows the operating temperature set at 35.0°C. Changes to the Temperature program settings are made in increments of 0.1°C. However, if the up or down arrows are held for about two seconds, the display will scroll in that direction.

The Console Shaker can be easily programmed to meet the most demanding laboratory requirements using its microprocessor-based technology. The following sections outline the procedures for changing the settings and for programming the shaker control system.

Change Temperature, Speed & Time Settings

All programming or setting changes start from the Operating Screen as typically illustrated in Figure 2-2.

The instructions to program the SHKE480HP/SHKE481HP are written in a step-by-step format. For convenience, these instructions begin and end at the Operating Screen.

Note At any time during programming or changing configuration settings, if no control panel buttons are pressed for about fifteen seconds, the display will automatically return to the Operating Screen, storing and acting upon any changes made. New settings are stored and acted upon immediately when either arrow button is pressed. ▲

Change Temperature

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

Press the up or down arrows to set the new Run temperature in 0.1°C increments. Hold either arrow button to scroll. However, if the up or down arrows are held for about two seconds, the display will scroll in that direction.

Change Temperature (continued)

Press the temperature button again. The Hold temperature value will begin to flash. Press the up or down arrows to set the new Hold temperature in 1°C increments. Hold either arrow button to scroll. However, if the up or down arrows are held for about two seconds, the display will scroll in that direction.

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

Change Speed

Press the button beneath the speed setpoint. The speed value begins to flash.

Press the up or down arrows to set the new speed in 1 RPM increments. Hold either arrow button to scroll. However, if the up or down arrows are held for about two seconds, the display will scroll in that direction.

Press the speed button again to return to the Operating Screen. Speed can be set over a range of 25 to 550 RPM.

Change Time

The SHKE480HP/SHKE481HP 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 platform to operate for that period of time and automatically stop. 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 SHKE480HP/SHKE481HP 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.

Change from Hold to Countdown

1. Press the button beneath the Time setpoint. Hold will begin to flash.

Actual	00:00	250	37.0
Setpoints	**Hold**	250	37.0

2. Press either arrow to access the countdown time setpoint. The last preset time setpoint will begin to flash.

Change from Hold to Countdown (continued)

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. However, if the up or down arrows are held for about two seconds, the display will 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 platform and begin the countdown sequence. As it counts down, the Actual time shown will decrease. When 00:00 is reached, the shaker will automatically stop and the Cycle Complete alarm will sound.

Actual	00:00	250	37.0
Setpoints	08:30	250	37.0

Shaker Alarms

The SHKE480HP/SHKE481HP Orbital Shaker control system monitors and provides alarms for nine operating parameters.

Table 2-2. Alarm Parameters

Parameter	Alarm Message	Remote Alarm
Overtemp Setpoint Status	Overtemp Shutdown, Undertemp Shutdown	No
Cycle Status	Cycle Complete	Yes
Loss of Input Power	Power Failure	Yes
RPM versus Setpoint	RPM is High, RPM is Low	Yes
Drive Belt Integrity	Check Belt	Yes
Temp Sensor Integrity	Main Temp Sensor, Over Temp Sensor	Yes
Temp Control Status	Temperature is High, Temperature is Low	Yes
Platform Movement Status	Platform Stalled	No
Motor Drive Board Input Power Integrity	Check Fuse	No

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 alarm messages on the display, and an audible tone alerts the operator that an alarm condition has occurred or currently exists.

Shaker Alarms (continued)

For convenience, the audible tone is muted by pressing the Silence button, but rings back in about 15 minutes, for most alarms, if the alarm condition is still present. However, the alarm indicator lights and alarm messages continue until the alarm condition is corrected by the operator. After the root cause of the fault has been corrected, pressing the Silence button will clear the alarm message from the display and stop the alarm indicator lights from flashing. The audible tone will ring back in about 30 minutes for the Check Belt and Check Fuse alarms if the alarm condition is still present. These alarm messages clear from the display when the unit is turned back on after correcting the alarm condition. The audible alarm feature may be turned off to suit operator or laboratory needs.

As discussed in the Configuration section of this manual, the audible alarm feature may be turned off to suit the operator and laboratory needs. Refer also to the Alarm Message/Corrective Action chart in the Service section of this manual.

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 muted by pressing the Silence button, but rings back in about 15 minutes, if the alarm condition is still present. However, the message and indicator lights persist until the fault is corrected. Afterward, the remaining relevant alarm components are 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 muted by pressing the Silence button, but rings back in about 15 minutes, if the alarm condition is still present. However, the message and indicator lights persist until the fault is corrected. Afterward, the remaining relevant alarm components are 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	00	37.0
Setpoints		Cycle Complete	

The Cycle Complete message shown is displayed and the platform stops. Chamber temperature is controlled by the Hold Temperature setpoint. Pressing the Silence button clears the alarm message from the display screen and mutes the audible alarm.

Power Failure

Power Failure alerts the operator that electrical power to the unit has been interrupted, under specific operating conditions.

Actual	00:00	00	37.0
Setpoints		Power Failure	

While the system returns to normal operation when power is restored, the alarm message remains and the audible tone continues to sound to alert the operator. Both the display message and the audible tone are cleared by pressing the Silence button.

If power is interrupted for more than 1½ hours while the unit is turned on but not shaking, a Power Failure 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 unit is turned on after being turned off for more than 1½ hours (such as when the unit is shipped from the factory, or when it is returned to use after a period of storage).

RPM Tracking

RPM Tracking alerts the operator that the platform speed has varied ±5 RPM consistently for more than 2 minutes by the appropriate alarm message as shown.

Actual	08:41	255	37.0
Setpoints		RPM is High	

Actual	08:41	245	37.0
Setpoints		RPM 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 alarm condition is still present. However, the alarm message and indicator lights persist until the fault is corrected. Afterward, the remaining relevant alarm components are cleared by pressing the Silence button.

Check Belt

Check Belt alerts the operator that the drive belt may have broken, is slipping because it needs tightened, or something is slowing or preventing platform movement.

Actual	08:41	00	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, if the alarm condition is still present. However, the message and indicator lights persist until the fault is corrected. The remaining relevant alarm components are cleared when the unit is turned back on after correcting the alarm condition.

Temperature Sensor Fault

Temperature Sensor Fault alerts the operator that either of the shaker's two temperature sensors have failed, by the appropriate alarm message as shown.

Actual	08:41	250	37.0
Setpoints		Main Temp Sensor	

Actual	08:41	250	37.0
Setpoints		Over Temp Sensor	

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 is still present. However, the alarm message and indicator lights persist until the fault is corrected. Afterward, the remaining relevant alarm components are cleared by pressing the Silence button.

Temperature is High or Temperature is Low

Temperature is High or Temperature is Low alerts the operator that the operating temperature of the shaker has risen above or fallen below the programmed temperature tracking limit control point, by the appropriate alarm message as shown.

Actual	Temp High/Low:	On
Setpoints		Next

In the alarm state, the audible alarm is muted by pressing the Silence button, but rings back in about 15 minutes if the alarm condition is still present. However, the alarm message and indicator lights persist until the fault is corrected. Afterward, the remaining relevant alarm components are cleared by pressing the Silence button.

An alarm time delay of 3.5 hours is activated when the unit is first turned on or when the temperature setpoint is changed to allow adequate time for the heating or refrigeration system to recover to the setpoint. The delay is reduced to 20 minutes when the temperature is within the temperature setpoint alarm band. See Section 3 for further information on setting the tracking alarm.

Platform Stalled

Caution Turn off unit power when removing any platform obstruction to prevent possible injury. ▲

Actual	08:41	0	23.7
Setpoints		Platform Stalled	

Platform Stalled alerts the operator something is preventing free platform movement. The motor will automatically shut off and attempt to restart after approximately 15 seconds. In the alarm state, the audible alarm is muted by pressing the Silence button, but rings back in about 15 minutes, if the alarm condition is still present. However, the message and indicator lights persist until the fault is corrected. 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 indicator lights are automatically cleared, but the alarm message will remain until cleared by pressing the Silence button.

In the alarm state, the audible alarm is muted by pressing the Silence button, but will ring back in about 15 minutes. However, the alarm message and indicator lights persist until the fault is corrected.

Check Fuse

Check Fuse alerts the operator that there is no communication with the motor drive circuit board (historically the

Actual	08:41	0	23.7
Setpoints		Check Fuse	

primary drive motor fuse has blown). When the unit is turned on after fuse replacement, all alarm indicators are automatically cleared.

In the alarm state, the audible alarm is muted by pressing the Silence button, but rings back in about 30 minutes, if the alarm condition is still present. However, the message and indicator lights persist until the fault is corrected.

Warning Fuse replacement must be performed by qualified service personnel. See Service section. ▲

Change Configuration

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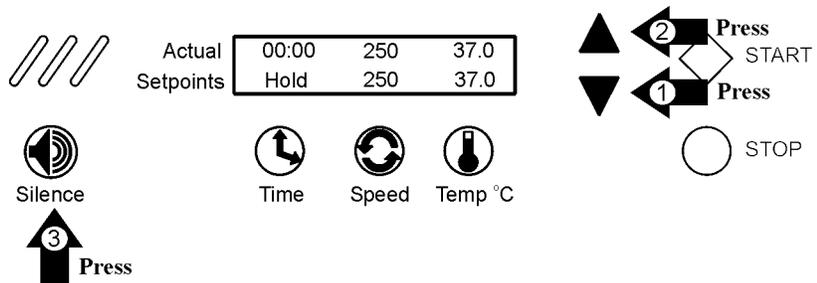
Change Configuration (continued)

This screen will appear on the display.

Actual	▼ for system configuration
Setpoints	▲ to return
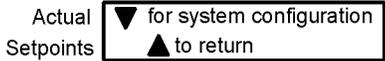
Pressing the down arrow continues with system configuration.

Pressing the up arrow returns to the Operating Screen.

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 unit. ▲

Turn the Audible Alarm On and Off

Open the Configuration menu by pressing the down arrow, the up arrow, and the Silence button, and then the down arrow once again, in the sequence shown at the right. The screen shown below will appear on the display:

Press

Actual	▼ for more
Setpoints	Audible Alarms
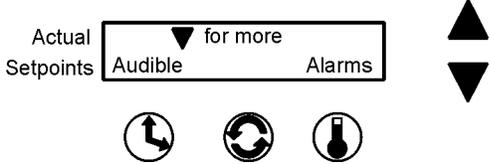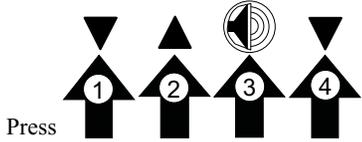
At this screen (above), press the Time button beneath Audible. The screen at right appears.

Actual	Audible Alarm: On
Setpoints	
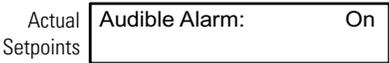
Press the up or down arrow to turn the audible alarm function on or off. Press any of the three buttons (Time, Speed, or Temp) to save the new setpoint value and return the display to the previous screen, or press nothing for about fifteen seconds to save the new setpoint value and return the display 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.

Actual	08:41 250 37.0
Setpoints	Audible is disabled!

Set Alarm Limits

Three temperature alarms are programmed into the Model SHKE480HP/SHKE481HP Orbital Shaker; Overtemperature, Undertemperature, and Tracking Limits.

Set 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, and then the down arrow once again, in the sequence shown at the right.

The screen below appears on the display:
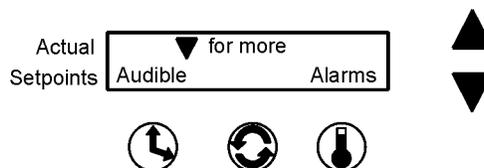
Then press the Temperature button beneath Alarms.
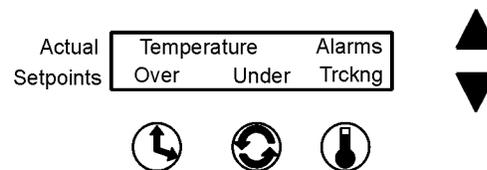
To change the overtemperature alarm setting, press the Time button beneath Over. The following screen appears and the present over-temperature alarm setting flashes.
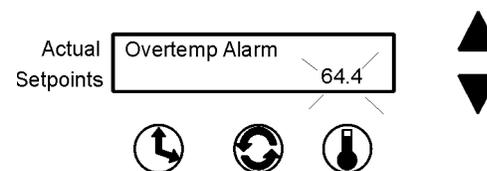
Change the temperature setting by pressing the up or down arrow. When set, press any of the three buttons (Time Speed or Temp) to save the new setpoint value and return to the previous screen, or press nothing for about fifteen seconds to save the new setpoint value and return the display to the Operating Screen.

Note The Overtemp Alarm setpoint values are calculated from the hardware and will not include every numerical value between the upper to lower limits.

Set 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, and then the down arrow once again, in the sequence shown at the right.
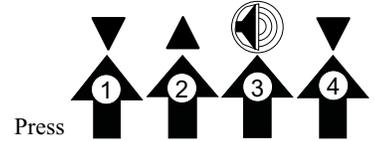
The screen shown below appears on the display.
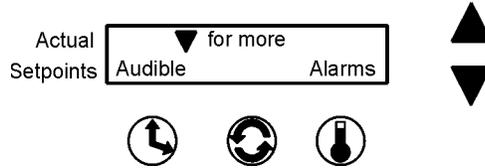
Then press the Temperature button beneath Alarms.
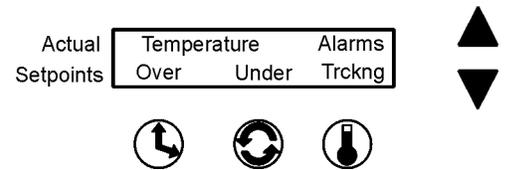
To change the undertemperature alarm setting, press the Speed button beneath Under. The following screen appears and the present undertemperature alarm setting flashes.
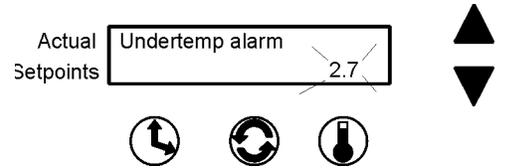
Change the temperature setting by pressing the up or down arrow. When set, press any of the three buttons (Time Speed or Temp) to save the new setpoint value and return to the previous screen, or press nothing for about fifteen seconds to save the new setpoint value and return the display to the Operating Screen.

Note The Undertemp Alarm setpoint values are calculated from the hardware and will not include every numerical value between the upper to lower limits.

Set the Temperature Alarm Tracking Limit

The Temperature Tracking alarm activates whenever the operating temperature goes above or below the setpoint temperature by a user selectable value in the range of 1°C to 20°C. The limit is set at the factory as 10°C above and below the temperature setpoint.

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

To change this value, open the Configuration menu by pressing the down arrow, up arrow, and the Silence button, and then the down arrow once again, in the sequence shown at the right.
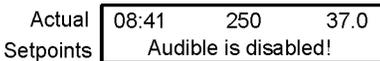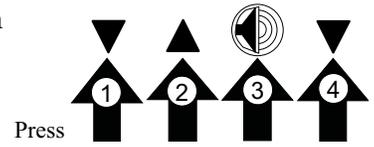
The screen shown below appears on the display.
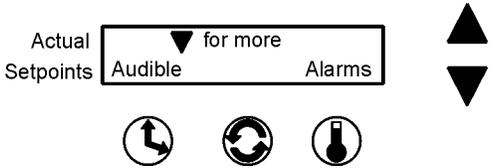
Then press the Temperature button beneath Alarms.

From the screen at right, press the Temperature button beneath Tracking (Trckng).
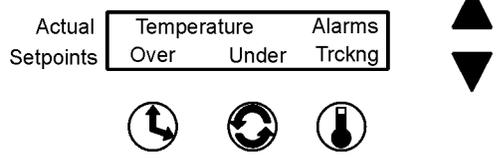
The screen at right appear sand the present Temperature Tracking alarm limit setting flashes.
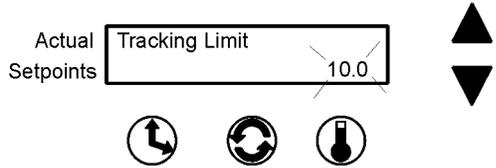
Change the Temperature Tracking limit by pressing the up or down arrow. When set, press any of the three buttons (Time Speed or Temp) to save the new setpoint value and return to the previous screen, or press nothing for about fifteen seconds to save the new setpoint value and return the display to the Operating Screen.

Hold Temperature Control

Another useful feature of the Model SHKE480HP/SHKE481HP 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.

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

The next illustration shows that the time has counted down to zero and the shaker has stopped orbiting (zero RPM). The temperature value of 5.0°C 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.

Actual	00:00	00	37.0
Setpoints	06:30	250	5.0

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

Actual	00:00	00	37.0
Setpoints	Hold	Hold	5.0

Using the up and down arrows, program a new hold temperature. Press the temperature button, or press nothing for about 15 seconds, to save the new setting and return to the Operating Screen.

Remote Alarm System

Most of the alarm states described previously (Table 2-2) 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. Refer also to 'Connect the Remote Alarm' in Section 1. For the convenience of the laboratory, these remote alarms can be individually turned on or off. Any of the remote alarms which are set to On will activate the internal relay.

Note The Overtemp Shutdown, Undertemp Shutdown, Platform Stalled, and Check Fuse remote alarms cannot be deactivated.

To set the remote alarms to On or Off, open the Configuration menu by pressing the down arrow, up arrow, and silence button, and then the down arrow three times, in the sequence shown at right.
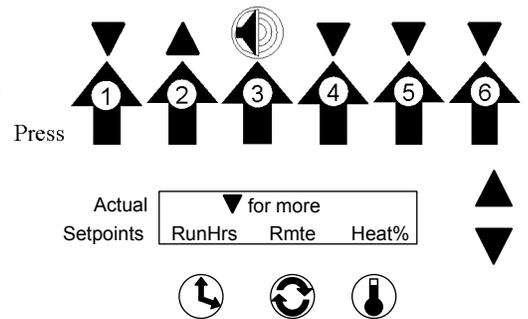
The screen shown at right will appear on the display:

Press the Speed button beneath 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 Temp button beneath Next advances the display to the next alarm, saving the shown Cycle Complete alarm setting to memory.
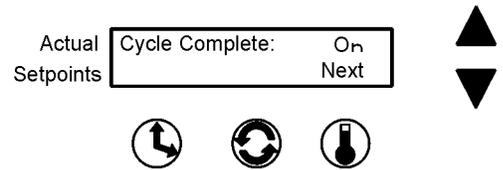
If no buttons are pressed, the display will automatically return to the Operating Screen after about 15 seconds, saving the selection to memory.

Power Failure

Toggle the Power Failure alarm with either the up (On) arrow or the down (Off) arrow. Pressing the Temp button beneath Next advances the display to the next alarm, saving the Power Failure setting to memory.
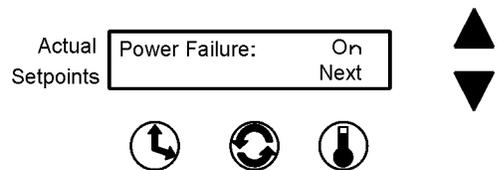
If no buttons are pressed, the display will automatically return to the Operating Screen after about 15 seconds, saving the selection to memory.

RPM Tracking

Toggle the RPM Tracking alarm with either the up arrow (On) or the down arrow (Off). Pressing the Temp button beneath Next advances the display to the next alarm, saving the RPM Tracking setting to memory.
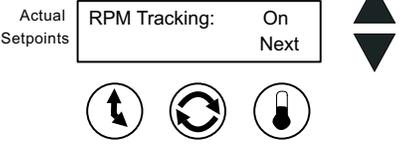
Actual Setpoints | RPM Tracking: On / Next

If no buttons are pressed, the display will automatically return to the Operating Screen after about 15 seconds, saving the selection to memory.

Check Belt

Toggle the Check Belt alarm with either the up (On) arrow or the down (Off) arrow. Pressing the Temp button beneath Next advances the display to the next alarm, saving the Check Belt setting to memory.
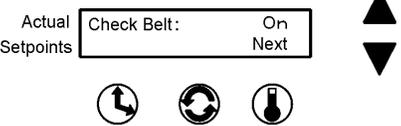
Actual Setpoints | Check Belt: On / Next

If no buttons are pressed, the display will automatically return to the Operating Screen after about 15 seconds, saving the selection to memory.

Sensor Fault

Toggle the Sensor Fault alarm with either the up (ON) arrow or the down (OFF) arrow. Pressing the Temp button beneath Next advances the display to the next alarm, saving the on/off setting to memory.
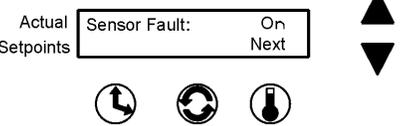
Actual Setpoints | Sensor Fault: On / Next

If no buttons are pressed, the display will automatically return to the Operating Screen after about 15 seconds, saving the selection 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 Temp button beneath Return returns the display to the previous screen.

Actual Setpoints | Temp. High/Low: On / Return

If no buttons are pressed, the display will automatically return to the Operating Screen after about 15 seconds, saving the selection to memory.

Viewing the Total Operating Hours

Whether the unit 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 of platform operating hours.

To view this information, open the Configuration menu by pressing the down arrow, up arrow and the silence button, and then the down arrow three times in the sequence shown at right.
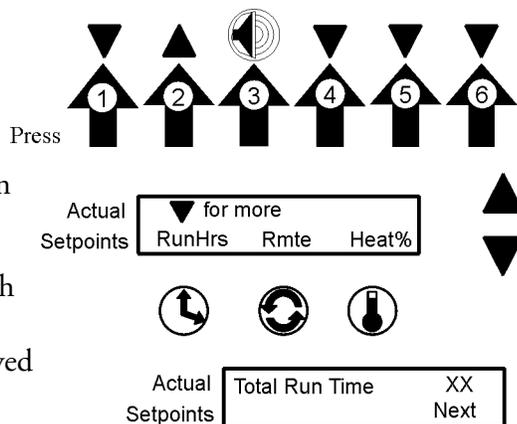
The screen at right will appear on the display.

Pressing the Time button beneath RunHrs shows the total accumulated run hours as displayed in the illustration at right.

When finished, press any of the three buttons (Time Speed or Temp) to save the new setpoint value and return to the previous screen, or press nothing for about fifteen seconds to save the new setpoint value and return the display to the Operating Screen.

Heat %

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

To view this information, open the Configuration menu by pressing the down arrow, the up arrow and the Silence button, and then the down arrow three times, in the sequence shown at right.
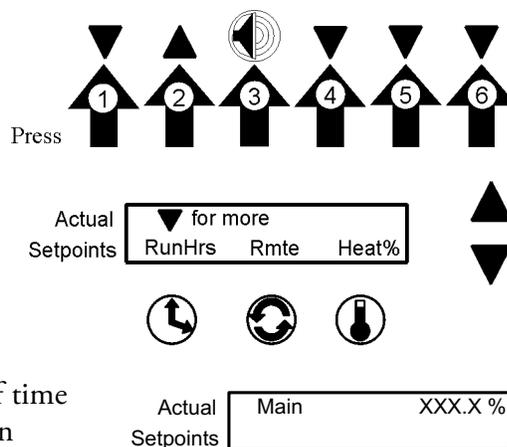
The screen shown at right will appear on the display:

Press Temp button beneath Heat %.

Main Heat % is the percentage of time that the chamber heat is turned on during a five second period. **Example:** If the heater is 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.

Heat % (continued)

When finished, press any of the three buttons (Time Speed or Temp) to save new setpoint value and return to previous screen, or press nothing for about fifteen seconds to save new setpoint value and return display to the Operating Screen.

Software Version

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

To view this information, open the Configuration menu by pressing the down arrow, the up arrow, the Silence button, and then the down arrow four times, in the sequence shown at right.
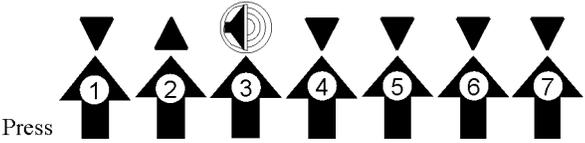
The screen at right will appear on the display:
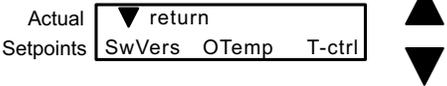
Press the Time button beneath SwVers and the following screen will appear showing the SHKE480HP/SHKE481HP software version in the control system memory, where x is the release level and yy is the revision level.

When finished, press any of the three buttons (Time Speed or Temp) to save new setpoint value and return to previous screen, or press nothing for about 15 seconds to save new setpoint value and return display to the Operating Screen.

Overtemp Sensor Reading

Overtemp Sensor Reading is for factory use only and will be important if troubleshooting is ever necessary.

To view this information, open the Configuration menu by pressing the down arrow, the up arrow, the Silence button, then the down arrow four times, in the sequence shown at right.
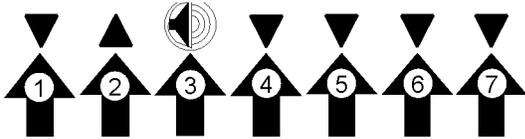
Screen at right appears on the display:
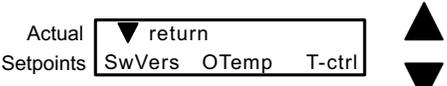
Press the Speed button beneath OTemp and the screen at the right will appear, showing the temperature being read by the Overtemperature sensor.

Overtemp Sensor Reading (continued)

When finished, press any of the three buttons (Time Speed or Temp) to save the new setpoint value and return to the previous screen, or press nothing for about 15 seconds to save the new setpoint value and return the display to the Operating Screen.

Temperature Control

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

To turn the Temperature Control on or off, open the Configuration menu by pressing the down arrow, the up arrow, the Silence button, then the down arrow four times, in the sequence shown at the right.
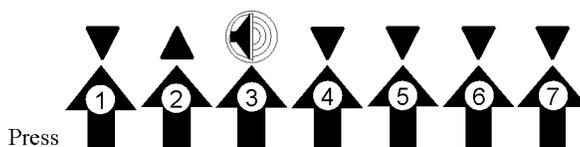
Press

The screen shown at right will appear on the display:
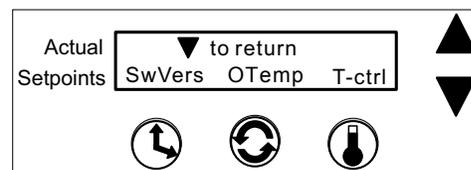
Press the temperature button beneath T-ctrl and the screen shown below will appear.
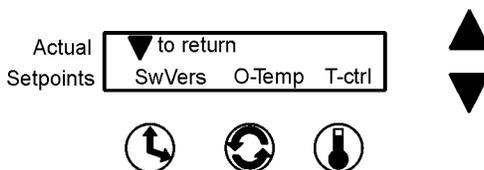
Toggle the Temperature Control with either the up (On) arrow or the down (Off) arrow.

When finished, press any of the three buttons (Time Speed or Temp) to save the new setpoint value and return to the previous screen, or press nothing for about 15 seconds to save the new setpoint value and return the display to the Operating Screen.

Defrost Control

Defrosting of the Model SHKE480HP/SHKE481HP takes place automatically about every eight hours when the setpoint temperature is 10°C or less. When turned on, the defrost control turns off the refrigeration system and increases the cabinet temperature until it reaches the 12°C or 14°C defrost setpoint. At that time, the defrost control turns the refrigeration system back on. The defrost cycle will continue for about 30 seconds. Then the cabinet circulation fan is turned back on and the Defrost message is cleared from the display.

Turn the Defrost Control On and Off

To turn the Defrost Control on and off, open the Configuration menu by pressing the down arrow, the up arrow, the Silence button, then the down arrow button five times, in the sequence shown at right.

The screen at right will appear on the display:

Press the Speed button beneath On/Off and the screen at right will appear:
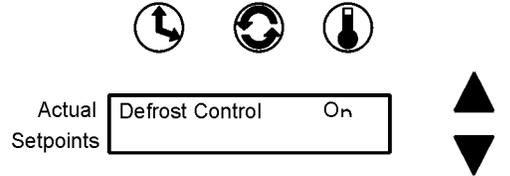
Toggle the Defrost Control with either the up (On) arrow or the down (Off) arrow.

When finished, press any of the three buttons (Time Speed or Temp) to save the new setpoint value and return to the previous screen, or press nothing for about 15 seconds to save the new setpoint value and return the display to the Operating Screen.

Set the Defrost Temperature

To toggle the Defrost temperature between 12°C and 14°C, open the Configuration menu by pressing the down arrow, the up arrow, the Silence button, then the down arrow five times, in the sequence shown at right.

The screen at right will appear on the display:
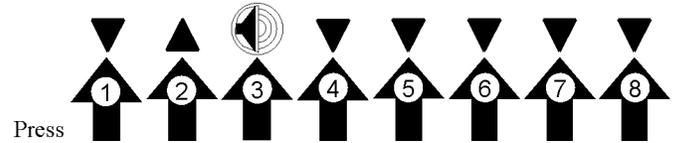
Press the Temperature button beneath Temp and the following screen will appear:
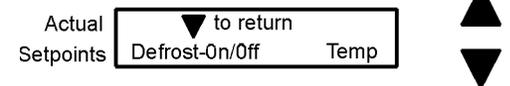
Toggle between the two defrost temperatures using the up and down arrows.
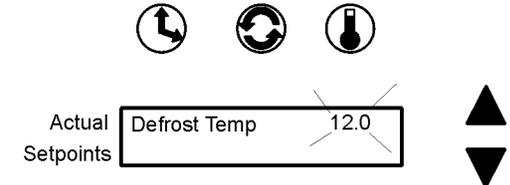
When finished, press any of the three buttons (Time Speed or Temp) to save the new setpoint value and return to the previous screen, or press nothing for about 15 seconds to save the new setpoint value and return the display to the Operating Screen.

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

Orbital Shaker
Menu Map
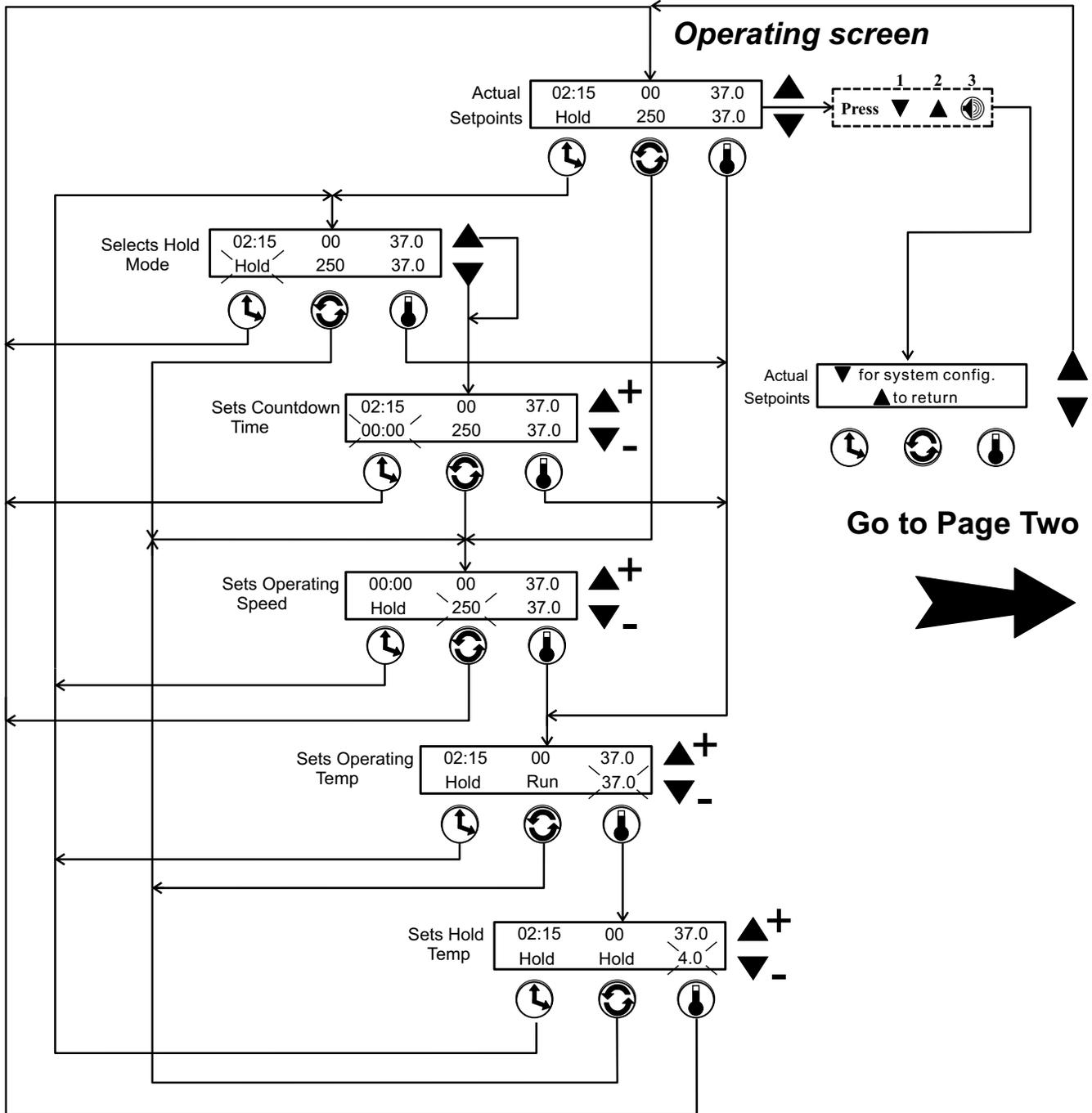
Operating screen

Actual | 02:15 | 00 | 37.0
Setpoints | Hold | 250 | 37.0

▲
▼

Press ▼ ▲ ◉
1 2 3

Selects Hold
Mode

02:15 | 00 | 37.0
Hold | 250 | 37.0

▲
▼

Actual
Setpoints

▼ for system config.
▲ to return

▲
▼

Sets Countdown
Time

02:15 | 00 | 37.0
00:00 | 250 | 37.0

▲+
▼−

Go to Page Two

Sets Operating
Speed

00:00 | 00 | 37.0
Hold | 250 | 37.0

▲+
▼−

Sets Operating
Temp

02:15 | 00 | 37.0
Hold | Run | 37.0

▲+
▼−

Sets Hold
Temp

02:15 | 00 | 37.0
Hold | Hold | 4.0

▲+
▼−

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

Page One

Orbital Shaker
Menu Map
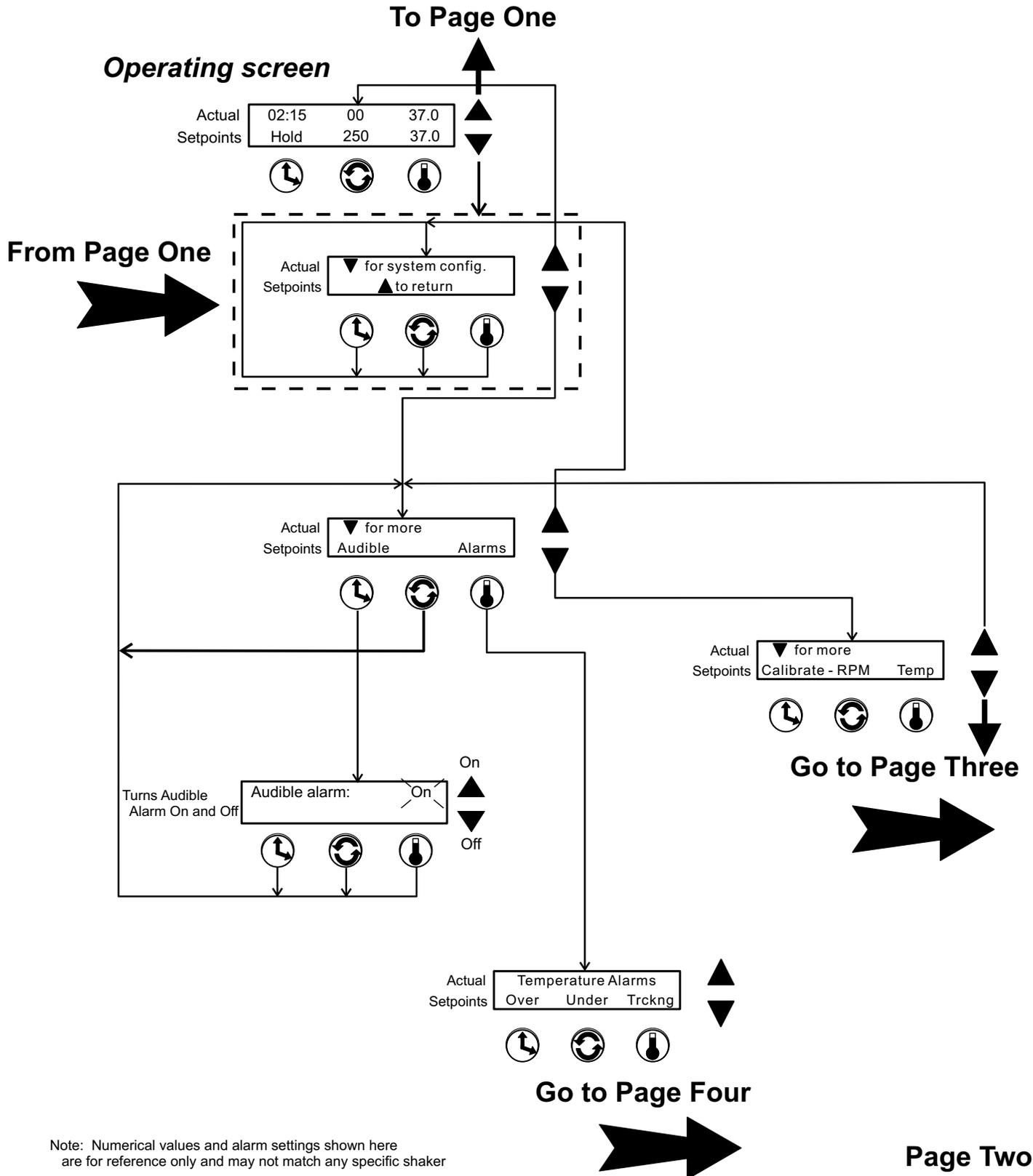
To Page One

Operating screen

Actual	02:15	00	37.0
Setpoints	Hold	250	37.0

From Page One

Actual	▼ for system config.
Setpoints	▲ to return

Actual	▼ for more
Setpoints	Audible Alarms

Actual	▼ for more
Setpoints	Calibrate - RPM Temp

Go to Page Three

On

Turns Audible Alarm On and Off	Audible alarm: On

Off

Actual	Temperature Alarms
Setpoints	Over Under Trckng

Go to Page Four

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

Page Two

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

Orbital Shaker
Menu Map

To Page Two

For more
Audible Alarms

From Page Two

Actual
Setpoints

▼ for more
Calibrate - RPM   Temp

Calibrates
Speed

Calibrate RPM
250

▲ +
▼ −

Calibrates
Operating
Temperature

Calibrate Temp

▲ +
▼ −

Actual
Setpoints

▼ for more
RunHrs   Rmte   Heat%

▲
▼

Shows Total
Run Time

Total Run Time   123
Hours

▲
▼

Shows Percent
Heat On Time

Main   100.0 %
Refrig   100.0 %

▲
▼

Actual
Setpoints

Cycle Complete: On
next

On
▲
▼
Off

Actual
Setpoints

▼ for more
Sw Vers OTemp   T-ctrl

▲
▼

Go to Page Five

Go to Page Six

Page Three

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

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

Orbital Shaker
Menu Map

To Page Two

▼ for system config.
▲ to return

Actual
Setpoints
▼ for more
Audible   Alarms

▼ for more
Calibrate - RPM   Temp

To Page Three

Actual
Setpoints
Temperature Alarms
Over   Under   Trckng

From Page Two

Sets Overtemp
Alarm Value
Overtemp Alarm
64.4
▲ +
▼ −

Sets Undertemp
Alarm Value
Undertemp Alarm
2.7
▲ +
▼ −

Sets Temp
Tracking
Alarm Value
Tracking Limit
10.0
▲ +
▼ −

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

Page Four

Orbital Shaker
Menu Map

To Page Three

Actual
Setpoints | ▼ for more
Calibrate - RPM   Temp

Actual
Setpoints | ▼ for more
RunHrs   Rmte   Heat%

From Page Three

On

Turns the Remote
Alarm On and Off | Cycle Complete: On
next

Off

On

Actual
Setpoints | ▼ for more
Sw Vers O-Temp   T-Ctrl

Go to Page Six

Turns the Remote
Alarm On and Off | Power Failure: On
next

Off

On

Turns the Remote
Alarm On and Off | RPM Tracking: On
next

Off

On

Turns the Remote
Alarm On and Off | Check Belt: On
next

Off

On

Turns the Remote
Alarm On and Off | Sensor Fault: On
next

Off

On

Turns the Remote
Alarm On and Off | Temp.High/Low: On
return

Off

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

Page Five

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°)

Orbital Shaker
Menu Map
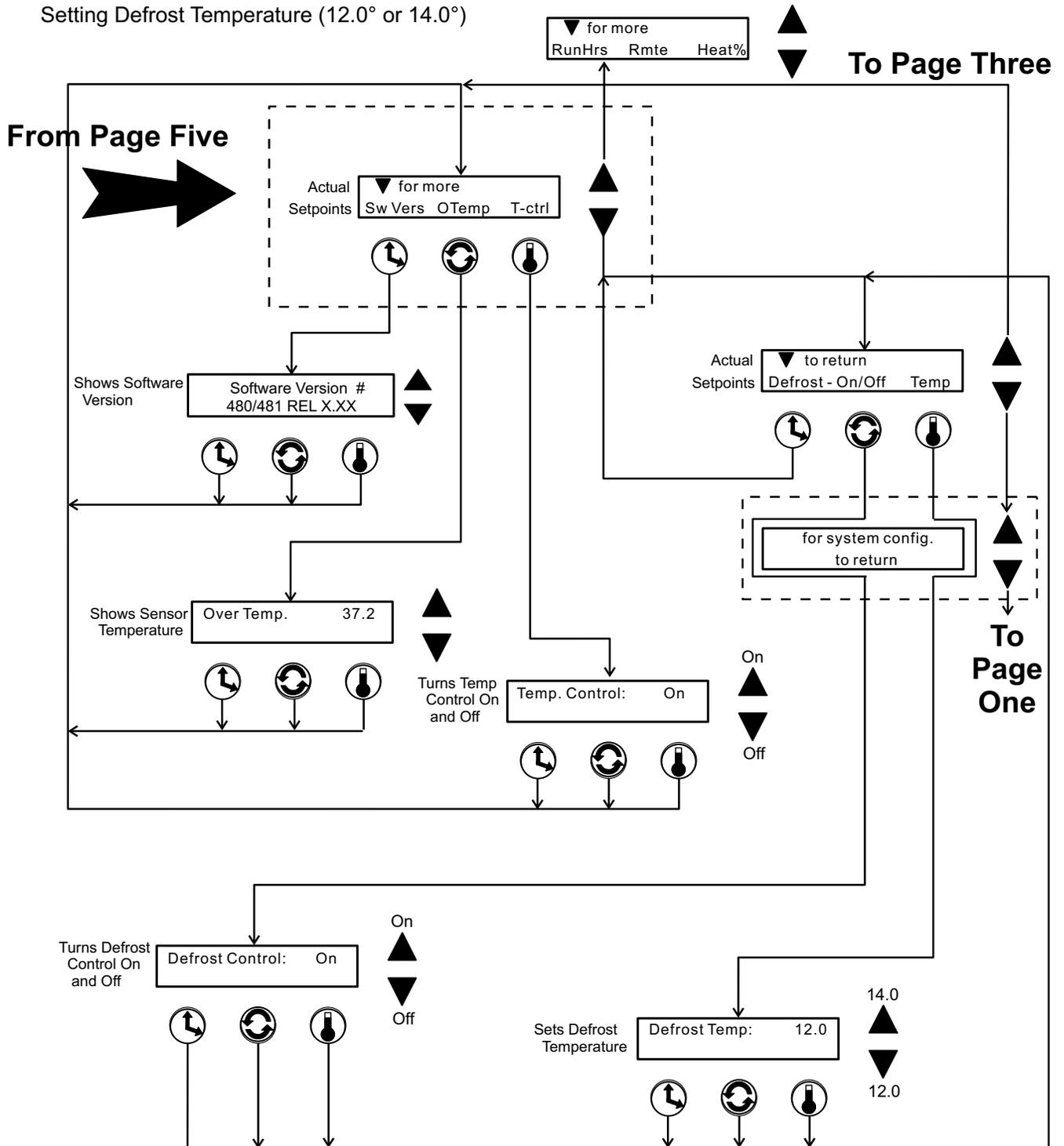
▼ for more
RunHrs   Rmte   Heat%

To Page Three

From Page Five

Actual   ▼ for more
Setpoints   Sw Vers OTemp   T-ctrl

Actual   ▼ to return
Setpoints   Defrost - On/Off   Temp

Shows Software   Software Version #
Version   480/481 REL X.XX

for system config.
to return

**To
Page
One**

Shows Sensor   Over Temp.   37.2
Temperature

On

Off

Turns Temp
Control On   Temp. Control: On
and Off

Turns Defrost
Control On   Defrost Control: On
and Off

On

Off

14.0

Sets Defrost   Defrost Temp: 12.0
Temperature

12.0

Section 3 **Maintenance**

Model SHKE480HP/SHKE481HP Shakers use a brushless DC motor and oversized, permanently lubricated bearings which require no maintenance.

Gas Springs

The gas springs should be checked periodically, and ideally every six months. The opening force, as measured from the front lip from a closed position, should be below 100 N (22.5 lbf) maximum. If the force is above this value, the gas springs should be replaced. If a force measurement is not possible, the gas springs should be replaced every two years.

Platform and Cabinet Cleaning

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 control panel uses sealed push buttons and liquid crystal display. It may be cleaned with a mild detergent and dried with a soft cloth.

Cleaning/Replacing the Cabinet Air Filter

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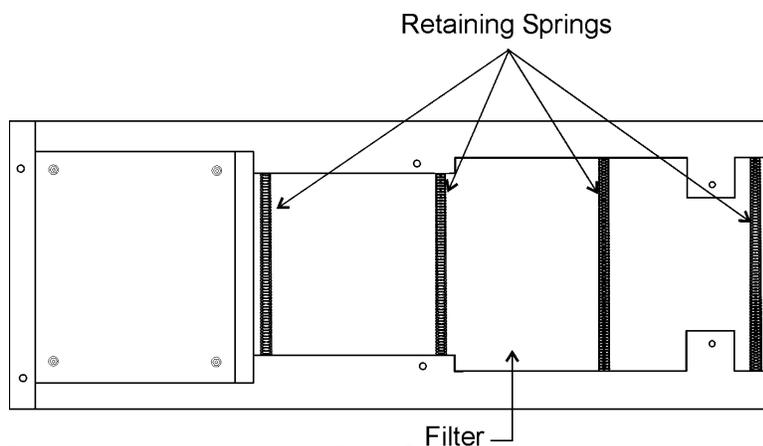
Figure 3-1. Interior View of Front Grille with Filter

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 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 operating 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 Technical Services.

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

Tips for all shakers

• Use only our standard flat-head screws for flask clips.

• Use only our standard round-head screws for test tube racks, holders and utility trays.

•401 Millcreek Road, Box 649 •Marietta, Ohio 45750 USA •740-373-4763
•USA and Canada 800-438-4851 •Telefax: 740-373-4189 •http://www.service.led.marietta@thermofisher.com

Preventive Maintenance for 480 Series Shakers

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

* Qualified service technicians only

Section 4 Service

Warning The procedures outlined in this section must be performed by persons experienced in servicing and maintaining laboratory equipment. Lockout and tagout electrical power connections whenever removing cabinet panels or working on electrical or motor control components. To avoid damage to solid state electrical components, proper grounding techniques must be observed whenever working on this shaker. ▲

With the exception of the chamber HEPA filter, Model SHKE480HP/SHKE481HP Orbital Shakers contain no user-serviceable components.

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 the alarm matrix at the end of this section.

Table 4-1. Alarms

Alarm Message	Fault Condition
Overtemp Shutdown	System shutdown due to overtemp condition
Undertemp Shutdown	System shutdown due to undertemp 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 is High	RPM tracking has sensed shaker speed higher than setting
RPM is Low	RPM tracking has sensed shaker speed lower than setting
Power Failure	Power has failed during shaker operation or shaker power is off for more than 1½ hours
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	Power loss to motor drive circuit board, most likely the rimary drive motor fuse has blown

Change the HEPA Filter

The HEPA filter 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 Figure 4-1 below.

Instrumentation Port

Press-in Fasteners

HEPA Filter (access cover)

Press-In Fasteners

Access Cover
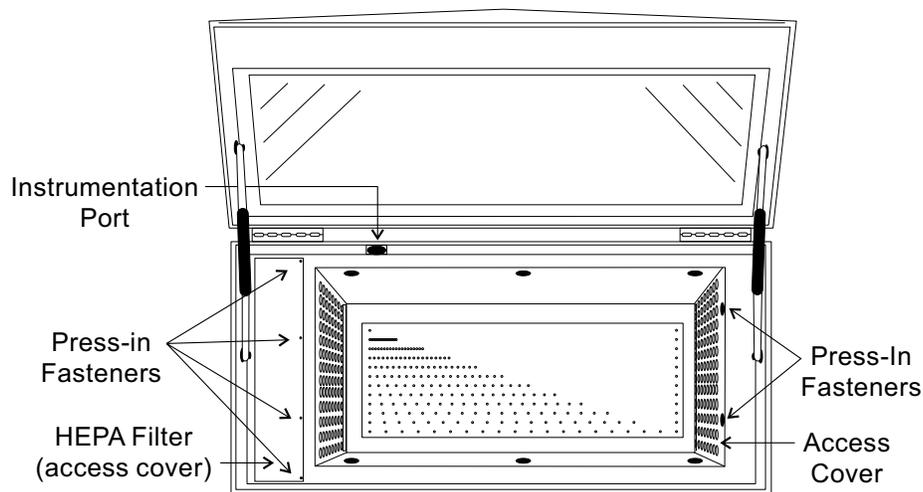
Figure 4-1. HEPA Filter and Temperature Sensor Locations

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 continuous operation (Hold).

Spare Fuses

Three spare fuses are provided with this shaker and are taped to the underside of the control panel plastic frame. The plastic frame is attached to the cabinet by Velcro strips. Grasp the frame by the corners and pull to remove. There are also small indents located along the edges of the panel to accommodate a flat screwdriver blade. Figure 4-2 illustrates the underside of the frame.
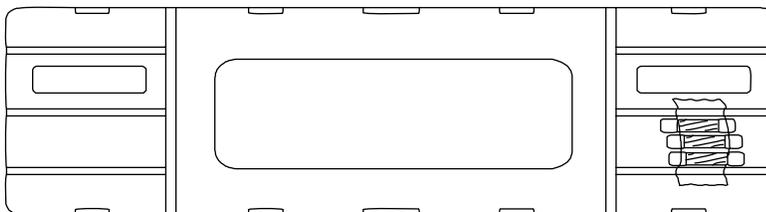
Figure 4-2. Spare Fuse Location

Spare Fuses (continued)

Three fuse holders are located on the left side of the relay tray located in the lower part of the console cabinet. Figure 4-3 shows the fuse locations.
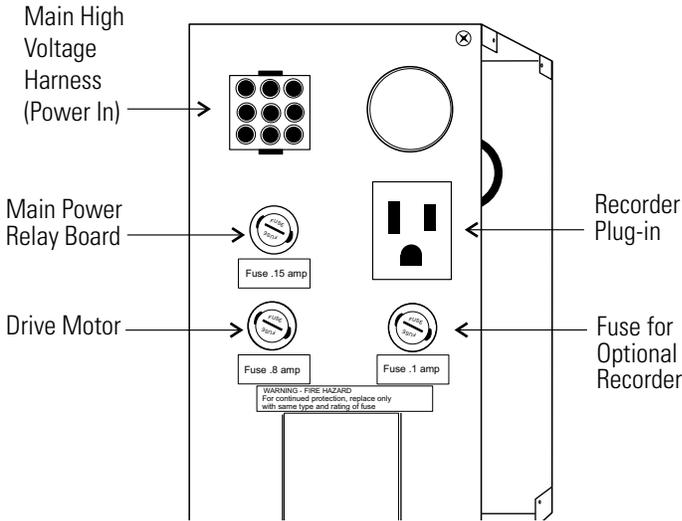
Figure 4-3. Fuse Holder and Connector Locations (SHKE481HP shown)

Refer to Table 4-2 for a list of their electrical ratings, part numbers, and applications. **Caution** Do not substitute! Replace these fuses with fuses of identical electrical ratings only. ▲

Table 4-2. Fuses

Fuses, SHKE480HP		
Rating	**Application**	**Part Number**
0.25 amp	Main Power Relay Board	230144
1.6 amp	Drive Motor	230145
0.1 amp	Optional Recorder	230107

Fuses, SHKE481HP		
Rating	**Application**	**Part Number**
0.15 amp	Main Power Relay Board	230142
0.8 amp	Drive Motor	230141
0.1 amp	Optional Recorder	230107

Spare Fuses (continued)

Access to the relay tray is made by removing the grille from 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 it off.

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 slide outward.

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

Circuit Boards

Four circuit boards control the Orbital Shaker. Three boards are located in the relay tray compartment, the fourth is behind the liquid crystal display. Figure 4-4 identifies the circuit boards and other major components in the relay tray.
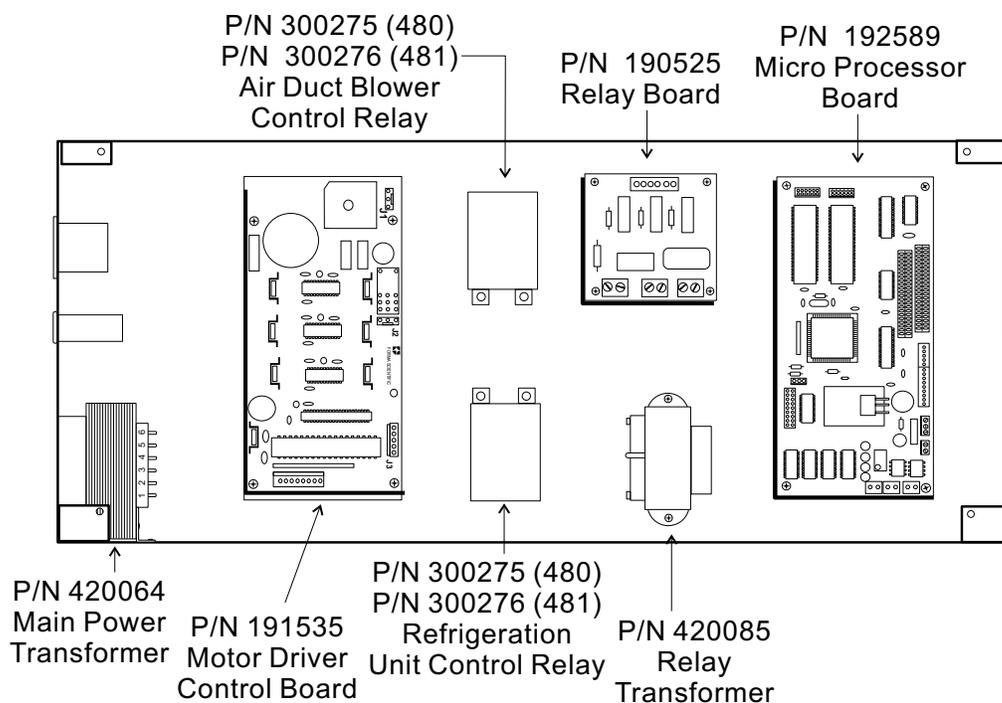
Figure 4-4. Electrical Component Locations, Relay Tray Compartment

Refer also to the relay tray wiring diagrams in Section 8.

Temperature Sensors

Two temperature sensors are located behind a perforated cover plate on the right side of the chamber (refer to Figures 4-1 and 4-5). 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.
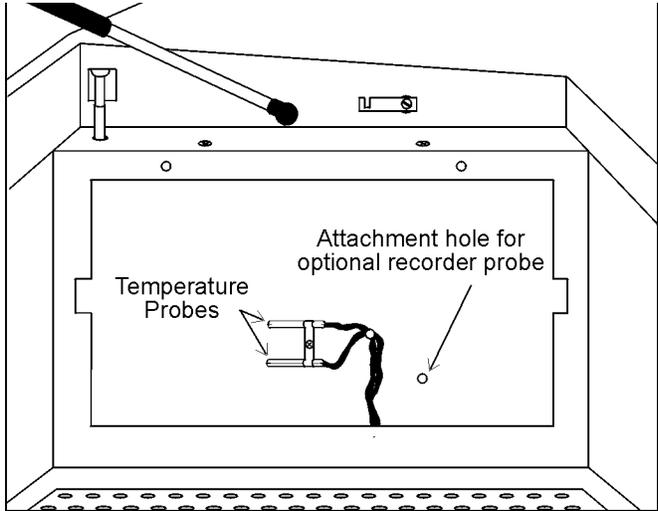
Figure 4-5. Right Side Chamber - Temperature Sensor Cover Plate Removed

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 4-6.)
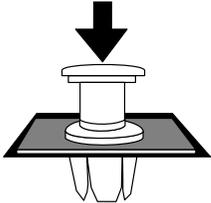
Figure 4-6. Press-in Sheet Metal Fastener

Blower Fan Motors and Heating Elements

Locations of the blower motor and ambient fan motor are shown in Figure 4-7 (refrigeration unit removed).

Removal of the relay tray is necessary to service the blower motor or the heating elements.
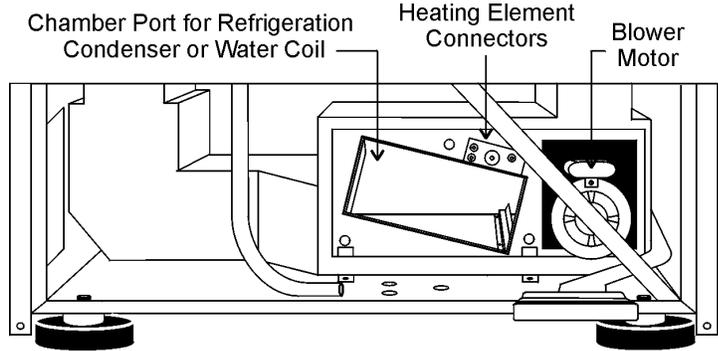
Figure 4-7. Air Plenum with Heating and Air Moving Components

Heater Element Circuit Breaker

Warning Only qualified service personnel should perform this procedure. 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. ▲

A manual reset circuit breaker is located between the heating element electrical connectors on the side of the air plenum. (Figures 4-7 and 4-8) 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.
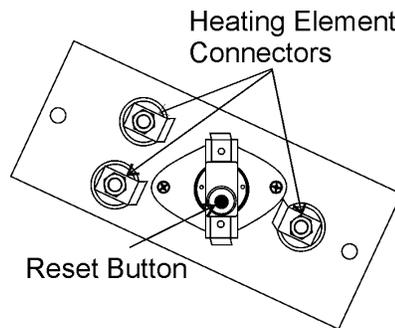
Figure 4-8. Heating Element Connectors and Manual Reset Circuit Breaker

Tuning the Cabinet

After the console cabinet is in place, leveled and the platform installed, turn the unit on and set the speed to 300RPM. Kneeling in front of the console, lightly touch the lower left and right corners of the cabinet. If one side seems to vibrate more then 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 reduced as far as possible.

Servicing the Drive Belt

The motor drive pulley, the large mechanism pulley, belt and motor mounting bolts will be visible after removing the grille and Belt/Pulley Cover Tray (Figures 4-9 and 4-10).
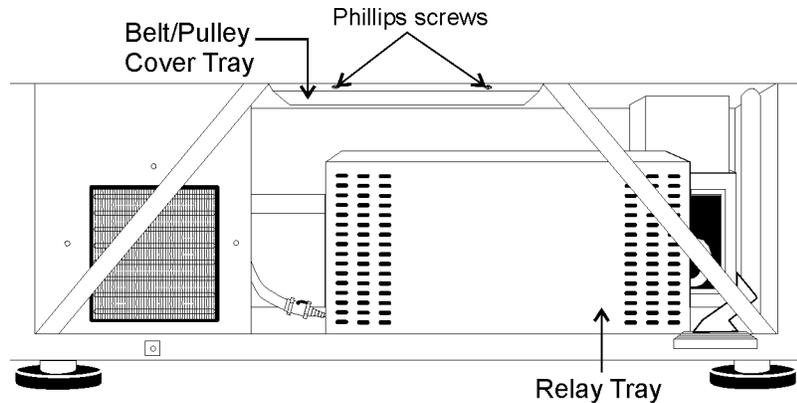
Figure 4-9. Front View of Cabinet with Grille Removed
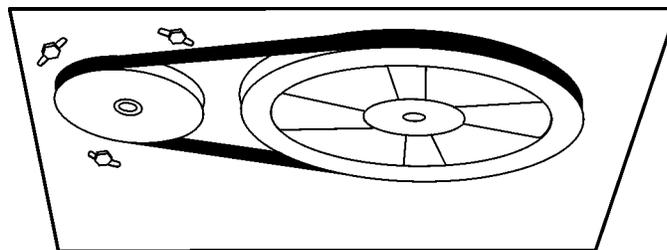
Figure 4-10. Motor/Belt Drive System

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.

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

Calibrate Platform Speed (RPM)

An external calibrated speed measuring device can be used to adjust the actual platform speed so that the unit setpoint speed matches the external device measurement. Calibration of the platform speed is performed at the factory at 250 RPM. To change the actual platform speed, open the Configuration menu by pressing the down arrow, up arrow, and the Silence button, and then the down arrow once again, in the sequence shown below.
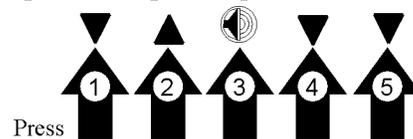
Then press the Speed button beneath RPM.
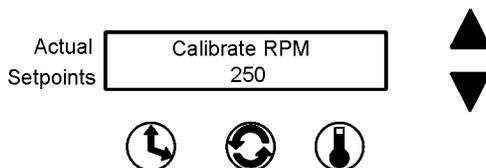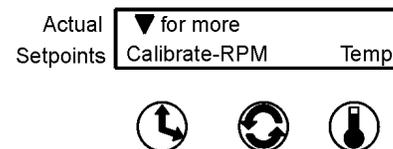
The value shown on this screen is the present Speed setpoint. Using the up and down arrows, increase or decrease the platform speed until the reading on an independent, accurate speed measuring device matches the shaker speed setpoint.

When finished, press any of the three buttons (Time, Speed, or Temp) to save the new setpoint value and return to the previous screen, or press nothing for about 15 seconds to save the new setpoint value and return to the Operating Screen.

Calibrate the Temperature

1. Place a 250ml Erlenmeyer flask (filled with approximately 100ml of liquid) in approximately the geometric center of the platform.

2. Suspend an independent temperature measuring device of known accuracy into the flask. The sensor should be submerged in the liquid but not in contact with the bottom or sides of the flask.

3. Adjust the shaker temp setpoint at desired calibration temperature.

4. Set the shaking speed setpoint to 75 RPM.

5. Start the unit and allow a minimum of 2 hours stabilization of cabinet and flask liquid.

6. Enter Calibration mode by pressing the down arrow, the up arrow, the Silence button. Then press the down arrow twice.
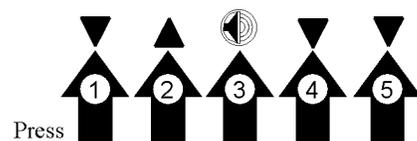
Calibrate the Temperature (cont.)

7. The screen at right will appear on the display:

Actual	▼ for more
Setpoints	Audible Alarms

8. Press the Temperature button beneath Temp.

9. Using the up and down arrows, increase or decrease the temperature value to match the independent, accurate temperature measuring device.

10. When complete, 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 return to the Operating Screen and the setting will be automatically saved to memory.)

11. Allow the cabinet to re-stabilize for 1 hour. Recheck temperature. If necessary, return to Step 6 until no additional adjustments are needed.

12. Temperature calibration is now complete. Remove calibration equipment and resume use.

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 button to mute audible alarm Air intake blockage Over temperature probe malfunction Sensor connector unplugged Heater circuit not cycling Main circuit board failure Call Technical Services 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 button to mute audible alarm Over temperature probe malfunction Sensor connector unplugged Heater circuit not cycling Refrigeration system stuck on Main circuit board failure Call Technical Services 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 button to mute audible alarm Check board connector Check sensor circuit Replace sensor Call Technical Services 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 button to mute audible alarm Check board connector Check sensor circuit Replace sensor Call Technical Services 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 button to mute audible alarm Check temperature tracking limit Check sensor circuit Replace main temperature sensor Call Technical Services 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 below 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 button to mute audible alarm Check if lid is completely closed Check temperature tracking limit Check sensor circuit Replace main temperature sensor Call Technical Services Department
Power Failure	Unit power has been off for more than 1½ hours or electrical power has been disrupted during operation for more than 15 seconds.	30 seconds	None	Alarm light on Audible alarm on Fans, motor, heaters, refrigeration; same as before power interruption	Warning notice only Press SILENCE to silence the audible alarm and extinguish visible alarm
Cycle Complete	Count-down time has reached zero	None	None	Alarm light on Audible alarm on Blower fans on Shaker motor off Heaters and refrigeration per Hold temperature setpoint	Advisory notice only Press SILENCE button to mute audible alarm and extinguish visible alarm
RPM is High	Speed is above control set point by 5RPM tracking limit	2 min.	15 min.	Alarm light on Audible alarm on Blower fans on Shaker motor on Heaters on	Press SILENCE button to mute audible alarm Check platform loading Shut the unit off and call Technical Services Department
RPM is Low	Speed is below control set point by 5RPM tracking limit	2 min.	15 min.	Alarm light on Audible alarm on Blower fans on Shaker motor on Heaters on	Press SILENCE button to mute audible alarm Check for overloaded platform Check for obstruction to edges of platform Check for low input AC mains voltage Shut the unit off and call Technical 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 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	30 min.	Alarm light on Audible alarm on Blower fans on Shaker motor on Heaters off	Press SILENCE button to mute audible alarm Shut the unit off and check the belt If the alarm persists, call Technical Services 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
Platform Stalled	Motor tries to start but platform is obstructed	15 sec.	15 min.	Alarm light on Audible alarm on Blower fans on Shaker motor on/off/on Heaters off	Press SILENCE button to mute audible alarm Check for overloaded platform Check for platform edge obstructions Turn unit off and call Technical Services Department
Check Fuse	Power is disconnected from the motor drive circuit board	30 sec.	30 min.	Alarm light on Audible alarm on Blower fans on Shaker motor off Heaters off	Press SILENCE button to mute audible alarm Check/replace drive motor fuse If alarm persists, call Technical Services Department

* 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

Range . . . Programmable from 5 minutes to 200 hours, or continuous operation

Indicator . . . . .LCD in 5 minute increments

Run Time. . . LCD counts down for a timed run or counts up when in "hold" function in 1 minute decrements or increments

Alarms

Temperature . . Adjustable tracking high/low temps

Speed . . . . Fixed tracking high/low RPM

Time . . . . .Cycle complete

Power Failure . . . . .Loss of input power

Safety

Temperature . . . . Software independent overtemperature and undertemperature shutdown circuit

Platform Speed . . . . . . Software independent speed control circuit

Platform Stall . . . . . Software independent motor overcurrent protection circuit

LCD (Liquid Crystal Display)

Top line displays actual elapsed run time, speed, and temperature; Bottom line displays user time, speed, and temperature setpoints alternating with any active alarm messages

Mechanical Drive System

Triple counterbalanced. Compensates for unbalanced platform loads

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

Interior . . . . Stainless steel with coved corners

Exterior . . . . Cold rolled steel

Finish. . .Powder coated for a durable, easily maintained surface

Platform . . . . Anodized brushed aluminum

Dimensions

Exterior . . . . .45.0" 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)

Interior . . . . 34.3" W x 18.8" H x 21.1" F-B

. . . .(87.1cm x 47.8cm x 53.6cm)

Electrical

SHKE480HP

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

SHKE481HP

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

Data Output . . . . .RS-232 standard

Remote Alarm Contacts . . .Cycle Completion, Speed, Temperature, and Power Failure Alarms as selected by the user

Certifications

Declaration of Conformity available on request.

Capacity

Flasks . . . . From (91) 25ml up to (4) 6L

Weights

Net . . . . 568 lbs. (257.9kg)

Shipping . . . . 645 lbs. (292kg)

Optional Platforms

Size . . . . 29.5" 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

HEPA . . . . .Rated efficient at 0.3 microns

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

Ambient Operating Conditions

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

Intended Use

Orbital shakers are designed to provide increased aeration in a stable temperature environment.

Unintended Use

1) Not intended for use in Class I or II applications as defined in 21 CFR

2) Not intended for mixtures of flammable materials

Safety Specifications

Indoor use only

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 . . . . ±10%

Installation Category II [1]

Pollution Degree 2 [2]

Class of Equipment I

Climatic Condition - ST (EN 60335, Subtropical)

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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.

Fluorinated Greenhouse Gases

Compliant with REGULATION (EU) No 517/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on fluorinated greenhouse gases. This product contains fluorinated greenhouse gases in a hermetically sealed system. This product contains foam blown with fluorinated greenhouse gas, R-245fa. If a leak in the sealed system is detected, the operator shall repair without undue delay.

The following model is designed for use with the following amounts of fluorinated greenhouse gases:

Model	Refrigerant	Amount (kg)	GWP
SHKE481HP	R-134a	0.289	1430

Section 6 Parts List

SHKE480HP

Part No. . . . . **Description**

129024 . . . . (2) Pneumatic Spring, 80 lbs.

138009 . . . . Heater, Wirewound 450W 115/230V

156089 . . . . Motor, Brushless - DC 24V

191535 . . . . Motor Drive Board

190525 . . . . Triple Outlet Relay Board

191734 . . . . Display/Keypad Replacement Kit

192589 . . . . Control Board Replacement Kit

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 . . . . Relay, DPDT, 20A, 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

290160 . . . . Probe, 2252 ohm/25C, 1/8 x 2 (2)

800040 . . . . V-Belt, 1/2" x 45"

760167 . . . . Air Filter 10.5" x 23.625"

760164 . . . . HEPA Filter

443021 . . . . 3/4" Open End Wrench

435051 . . . . Screwdriver, 8¾" Phillips

443020 . . . . Wrench, 5/32" Hex with T-handle

194046 . . . . Spare Parts Bag, (for 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

SHKE481HP

Part No. . . . . Description

129024 . . . . (2) Pneumatic Spring, 80 lbs.

138009 . . . . Heater, Wirewound 450W 115/230V

156089 . . . . .Motor, Brushless DC 24V

191535 . . . . Motor Drive Board

190525 . . . . Triple Outlet Relay Board

191734 . . . . .Display/Keypad Replacement Kit

192589 . . . . Control Board Replacement Kit

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 . . . . Relay, DPDT, 20A, 240V

230141 . . . . 800 mA Fuse T.D. 5mm x 20mm

230142 . . . . 150 mA Fuse T.D. 5mm x 20mm

290160 . . . . Probe, 2252 ohm/25C, 1/8 x 2 (2)

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

443021 . . . . 3/4" open end wrench

435051 . . . . Screwdriver, 8¾" Phillips

443020 . . . . .Wrench, 5/32" Hex with T-handle

194046 . . . . Spare Parts Bag, (for 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 P/N 194582

DRAWING NUMBER: 194582-90-0-B

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
0	DS-151	03-20-98	RTT	PDK	LDN	RELEASED FOR PRODUCTION
1	DS-155	04-20-98	MB	MB	DHS	ADDED MODEL 481
2	DS-279	02-11-04	BDB	pdk	DHS	4581 & 4586 PRODUCT ELIMINATION
3	DS-422	09-01-11	JWE	SAG	CCS	REFRIGERANT FROM 11.0 TO 10.2

STANDARD REFRIGERATION

REFRIGERANT R-134a: 10.2 ozs.

990702
CAPILLARY TUBE
132" OF .044"

250115

991003

Y2
220309

CAPILLARY TUBE
102" OF .064"

CAP TUBE MODULATOR:
990705
133009
270091

205121

212036

Y1
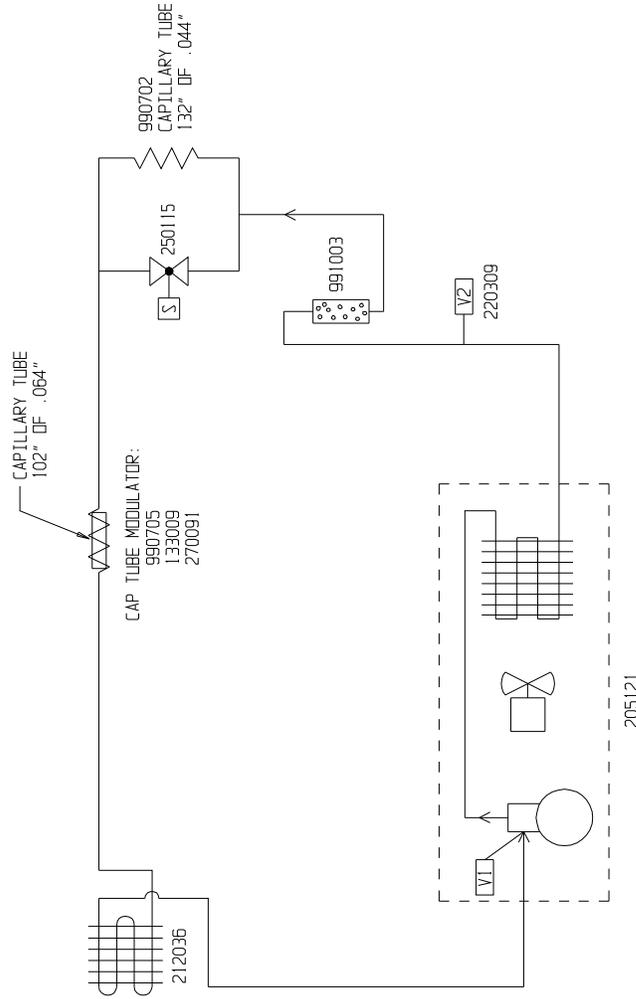
EVACUATION SPECIFICATION:

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

ThermoFisher
SCIENTIFIC

BOX 649, MARIETTA, OHIO 45750

MODEL/PART NAME:	481 CONSOLE INCUBATOR / REFRIGERATED SHAKER				
DWG TITLE:	REFRIGERATION SCHEMATIC				
DWN: MB	CAD: pdk	APPD: LDN	DATE: 02-17-97	SCALE: NONE

MATERIAL: N/A

PAINT COLOR: N/A

TOLERANCE UNLESS OTHERWISE SPECIFIED		DRAWING NUMBER	SIZE
DECIMAL: .XX=± .XXX=±		194582-90-0	B
ANGLES:			

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

1 — POWER INLET 460169
2
3 — RFI FILTER — RFI FILTER 270127
4 — 86 — B7
5 — 16A POWER SWITCH CIRCUIT BREAKER 230181
6 — 4 — 5 — BLOWER 900092
7 — J1-1 — 1-CR 59 J1-4 59A — 1 MTR — 3A
8 — 2 MTR — 3B J2-3 — COMPRESSOR 1/3 HP 205142
9 — 2-CR 6 J2-1 6A — 5B J2-2 — J1-2
10 — 4A — 3 MTR — 5A — CONDENSOR FAN (PART OF CONDENSING UNIT)
11 — J2-4 4B — 5C J2-5
12 — 4 MTR — AMBIENT FAN 900105
13 — 5 MTR — AMBIENT FAN 900105
14 — FUSE 0.1A 230107 — 10 — RECORDER OUTLET 460024
15 — 3C — J1-3
16
17 — FUSE 0.25A 230144 — FUSE 1.6A 230145
18
19 — I1 — I3
20 — 1 5 2 6 — 1 5 2 6 — 25VA CONTROL TRANSFORMER 420085 — 130VA MOTOR DRIVE TRANSFORMER 420064
21 — 12 8 7 — 12 11 7
22 — 15 16 — 17 18 19
23 — MODULATOR T-STAT 270091
24 — 20 J2-6 20A — 21 — H — 5D J2-7 — MODULATOR HEATER 180W 600600
25 — 23 J1-6 23A — 115V H — MANUAL RESET T-STAT 400113
26 — 230V H — 22 — CHAMBER HEATER 450W 138009
27
28 — J13 — H1 L1
29 — 24 25 — COM NO NC — REMOTE ALARM CONTACTS
30 — S1 1=OFF 2=OFF 3=ON — J15 — 26
31
32 — FAN 28 27 — RELAY BRD 190525 — TB1 — 31 1-CR — BLOWER CONTROL 300275 7
33 — MPU BOARD 192058 — J12 R1 29 — TB2 — 32 2-CR — REFRIGERATION CONTROL 300275 9
34 — SOL — 9 8 30 — J1 — TB3 — J2-8 1-SOL J2-9 — BYPASS SOLENOID 250111
   — 82A 82 — 5E
35
36 — CTRL SENSOR — 33 — TEMPERATURE SENSOR 290137
37 — O/U SENSOR — J11 — 3E 3F — 34
38 — 15 16 — 35 — 17 19 — OVER/UNDER TEMPERATURE SENSOR 290137
   — 36

Electrical Schematic
Model:
480
Incubated/
Refrigerated Shaker

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DISPLAY BOARD
190818

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17 19

INTERCONNECT 194022

J4

MPU BOARD
192058
(CONTINUED)

37
38
39
40
41

J6
1

42
43
44
45

J5
1

J9

J1

58

57

DRIVER BOARD
191535

J4

J1
1

3I

3G   3H

J2
1

J3

54   56
55

C A B
2 PHASE
3
4 MOTOR
5
6

3J

+5V
GND
HS4

3K

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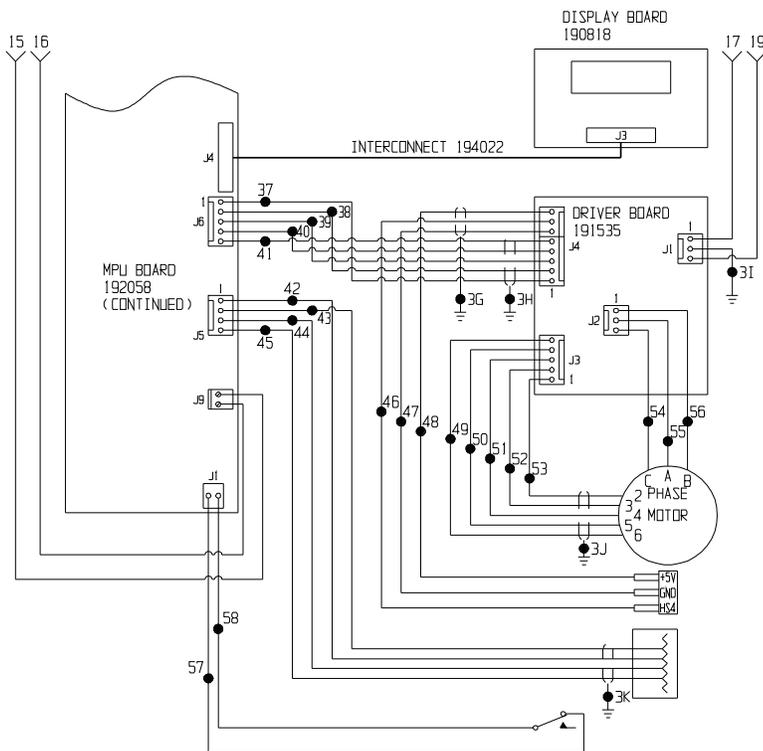
MOTOR
156089

BELT SENSOR
290144

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

LID SWITCH
(SHOWN LID OPEN)
285306

Electrical Schematic
Model:
480
Incubated/
Refrigerated 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-3C	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
16	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

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
3	OS-751	04-03-14	GLS	GLS	CCS	CHG MICRO BD FROM 191538
2	OS-340	02/06/09	JAS	JAS	LON	TRIM STRAY LINE AT WIRE #20
1	SI-9436	08/30/05	RS	GLS	LON	CHG CONDENSING UNIT FROM 205064
0	OS-279	02-11-04	BOB	pdk	LON	RELEASED FOR PRODUCTION

Electrical Schematic
Model:
480
Incubated/
Refrigerated Shaker

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

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
ANGLES: DECIMAL: .XX=± .XXX=±
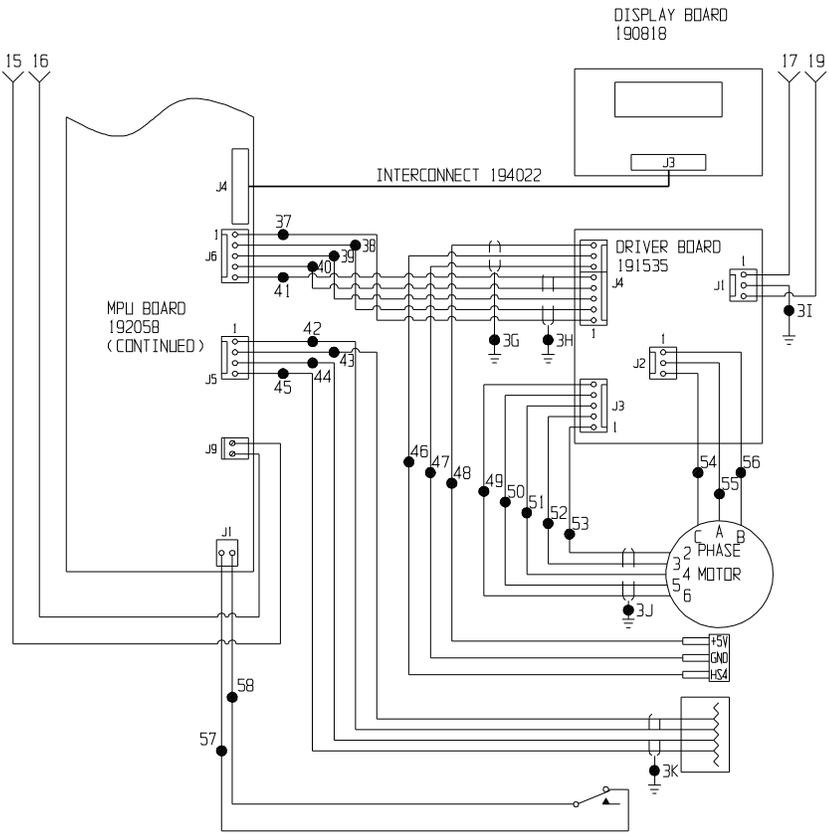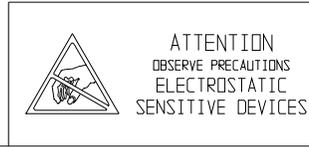DRAWING NUMBER: 480-70-0
SIZE: D

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

ThermoFisher
SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

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

1

2

3   RFI FILTER

4   86   87

5   10A POWER SWITCH

6   4   5

7   1-CR   59   J1-4   59A   1 MTR   3A   BLOWER
900093

8   2   3B   J2-3   COMPRESSOR 1/3 HP
205121
MTR

9   2-CR   6   J2-1   6A   5B   J2-2   J1-2

10   4A   3 MTR   5A   CONDENSOR FAN
(PART OF CONDENSING UNIT)

11   J2-4   4B   5C   J2-5

12   4 MTR   AMBIENT FAN
900107

13   5 MTR   AMBIENT FAN
900107

14   10   RECORDER OUTLET
FUSE 0.1A   460024
230107

15   3C   J1-3

16

17   FUSE 0.15A   FUSE 0.8A
230142   230141

18   11   12   13   14

19   1   5   2   6   1   5   2   6

20   25VA CONTROL   130VA MOTOR DRIVE
TRANSFORMER   TRANSFORMER
420085   420064
12   8   11   7   12   8   11   7

21   18

22   15   16   17   19

23   20   J2-6   20A   21   50   J2-7   MODULATOR T-STAT
270091

24   MODULATOR HEATER 200W
133009
MANUAL RESET T-STAT
400113

25   115V   H   22

26   23   J1-6   23A   230V   H   CHAMBER HEATER 450W
138009

27

28   J13
HI   LI

29   S1   24   25   COM
1 = OFF   J15   N/O
2 = OFF   N/C   26   COM   REMOTE ALARM CONTACTS
3 = ON   N/O
N/C

30

31   FAN   28   27   RELAY BRD   TB1   31   1-CR   BLOWER CONTROL
190525   300276   7

32   J12   R1   29   TB2   32   2-CR   REFRIGERATION CONTROL
SOL   300276   9
J1

33   MPU BOARD   TB3   J2-8   1-SOL   J2-9   BYPASS SOLENOID
192058   9   8   30   82A   82   5E   250115

34

35   CTRL SENSOR   33   TEMPERATURE SENSOR
290137

36   O/U SENSOR   34
J11   3E   3F

37   35   OVER/UNDER
TEMPERATURE SENSOR
290137

38   15   16   36   17   19

POWER INLET
460169

RFI FILTER
270126

10A POWER SWITCH
CIRCUIT BREAKER
230179

Electrical Schematic
Model:
481 Console Incubator
/Refrigerated Shaker

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Electrical Schematic
Model:
481 Console Incubator
/Refrigerated 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-3C	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	82	18	PURPLE
24	24	GREEN	82A	18	PURPLE
25	24	RED	86	14	BROWN
26	24	BLACK	87	14	BLUE

1	DS-751	04-03-14	GLS	GLS	CCS	CHG MICRO BD FROM 191538
0	DS-279	02-11-04	BOB	pdk	LON	RELEASED FOR PRODUCTION
REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION

Electrical Schematic
Model:
481 Console Incubator
/Refrigerated Shaker

MODEL/PART NAME: 481 CONSOLE INCUBATOR / REFRIGERATED SHAKER
DWG TITLE: ELECTRICAL SCHEMATIC
DWN: pdk   CAD: pdk   APPD: DATE: 02-11-04   SCALE: NONE
MATERIAL: N/A
PAINT COLOR: N/A

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TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=±
.XXX=±
DRAWING NUMBER
481-70-0
SIZE
D

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

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

THERMO FISHER SCIENTIFIC DIGITAL 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 24 months, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, labor included. For an additional 3 years, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, labor excluded. In addition, the Orbital Shaker mechanism is warranted for 10 years, parts only, F.O.B. factory. The mechanism is defined as the bearing assemblies. The warranty will be void if the equipment is altered without written authorization from Thermo. 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. Extended warranties are dependent on the units being maintained regularly as stated in the operation and service manuals.

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.

ISO 9001 REGISTERED

Rev. 2 6/2015

THERMO FISHER SCIENTIFIC INTERNATIONAL DIGITAL 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 24 months, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, including labor. For an additional 3 years, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, excluding labor. In addition, the Orbital Shaker drive mechanism is warranted for 10 years, parts only, F.O.B. factory. The mechanism is defined as the bearing assemblies. The warranty will be void if the equipment is altered without the written authorization from Thermo. Installation and calibration is not covered by this warranty agreement. The local Thermo Fisher Scientific office 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. Extended warranties are dependent on the units being maintained regularly as stated in the operation and service manuals.

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 local Thermo Fisher Scientific office 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 local Thermo Fisher Scientific office. We're ready to answer your questions on equipment warranty, operation, maintenance, service and special applications.

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