1 OVERVIEW

The Innova 4430 Large Stackable Refrigerated Incubator Shakers are large capacity orbital shakers that utilize an eccentric counter-balanced drive mechanism. They provide horizontal plane rotary motion in either a 1" (2.54 cm) or a 2" (5 cm) diameter circular orbit, depending on the model. A Proportional / Integral (PI) microprocessor controller with instantaneous digital feedback controls the speed over a range of 25-400 rpm for the 1" (2.54 cm) orbit and 25-300 rpm for the 2" (5 cm) orbit.

The Innova 4430 provides temperature control from 15°C below ambient (subject to a minimum setpoint of 4°C) to 80°C. The Shakers may be operated either continuously or in a timed mode via a programmable timer for shaking periods of 0.1 to 99.9 hours.

For safe operation, the Innova 4430s are designed with a safety switch that automatically stops the Shaker mechanism when the door is opened. Additionally, the door can easily be operated with one hand.

The Innova 4430 is equipped with visual and audible alarms that alert the user to the following conditions:

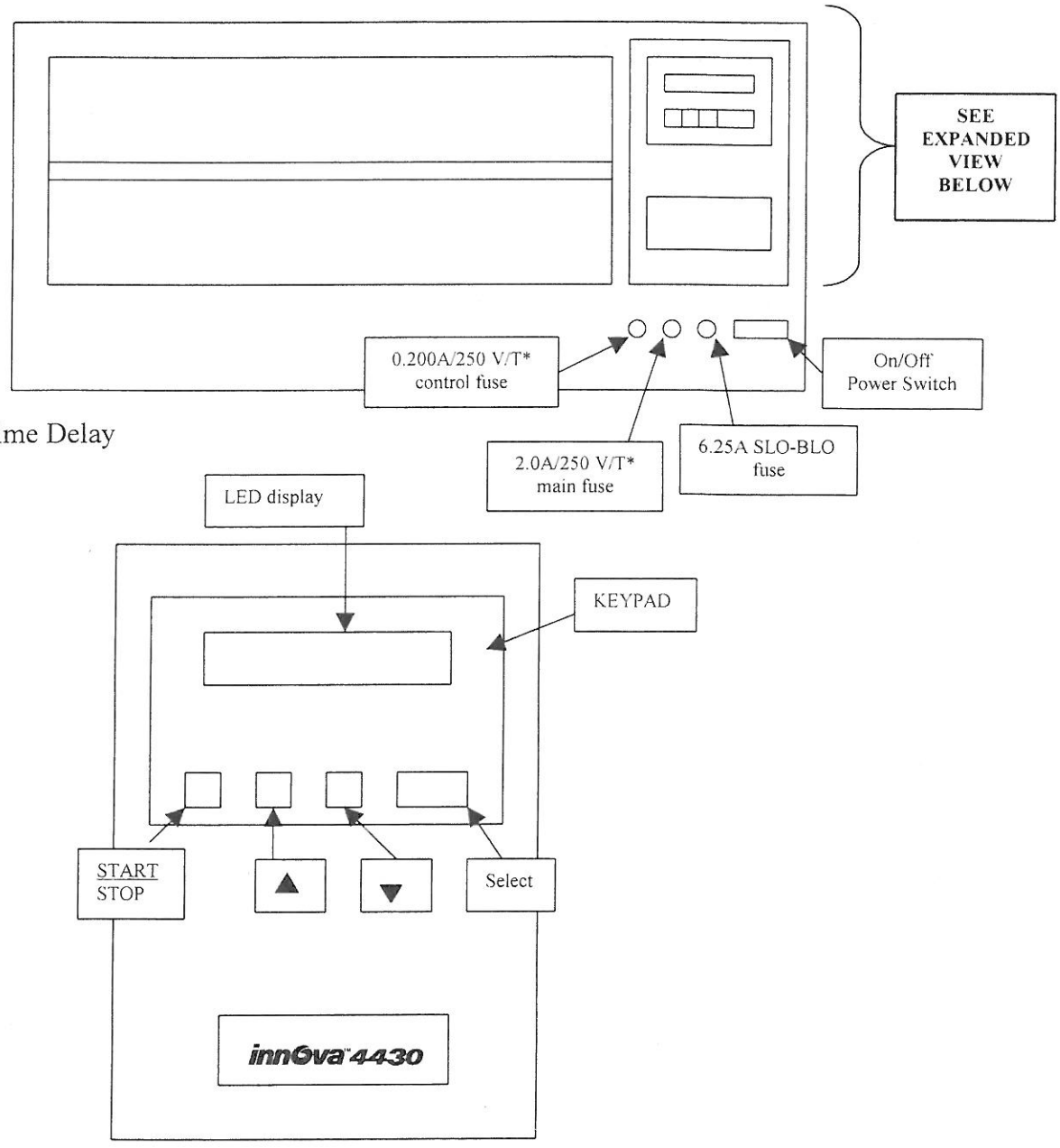
- The end of a timed run
- Deviations from speed setpoint
- Deviations from temperature setpoint
- Power failure
- Door open

A wide variety of platforms can be used with the Innova 4430. There are two categories of platforms: *bolt-on* and *easy lift-out*. The *easy lift-out* platforms (which require Quick Release Platform Base P/N M1249-0200) allow complete removal without using tools. In each category, dedicated platforms and universal platforms are available for a variety of flask sizes. Test tube racks, microtiter plate holders, and test tube rack holders are also available (a universal platform is needed for all test tube racks and holders). For further information on these accessories, see Section 10.

1.1 *INNOVA 4430, Front View*

This drawing is for reference only. It is not to scale.

Figure 1: Front View



* T = Time Delay

NOTE:

On the right side panel of the Innova 4430, there are two ports that are plugged. These are Service Access Ports, reserved for use only by NBS Service Technicians.

1.2 Specifications

These specifications assume a maximum load of 34 pounds (15.5 kg), including platforms, clamps, glassware and contents.

Innova 4430 Incubator Shaker			
SHAKING			
Speed	25-400 rpm with 1-inch (2.5 cm) stroke or 25-300 rpm with 2-inch (5.1 cm) stroke or 25-250 rpm with 2-inch (5.1 cm) stroke for 3 units stacked		
Control Accuracy	± 1 rpm		
Indication	3 Digit LED, in 1 rpm increments		
Stroke/Orbit	1-inch (2.5 cm) or 2-inch (5.1 cm)		
TEMPERATURE			
Range	15°C (minimum setpoint 4° C) below ambient temperature to 80°C		
Control Accuracy	± 0.1°C from 30-40 °C, ± 0.5°C over the remaining range.		
Indication	3 Digit LED, in 0.1°C increments		
Heaters	Long-life, low-watt density resistance-type heaters with high temperature thermostats		
Refrigeration	CFC-free		
ALARMS	Visible and audible warning indication when speed deviates more than 5 rpm or temperature more than 1°C from setpoints, and when timer has expired. Audible alarm can be muted.		
LED DISPLAY	Indicates speed, temperature, running time alarm conditions, and displays readout of internal clock (actual accumulated operating time). Character height: 3/8 inch (9.5 mm)		
RECORDER OUTPUT	0-5 VDC output for tracking temperature (and speed) with an external recorder or computer.		
SETPOINT RETENTION	All setpoints and operating status are retained in non-volatile memory		
Automatic Restart	Automatic restart after power is restored, indicated by flashing display		
Stacking	Up to three units may be stacked; the 2nd & 3rd units require a stacking kit.		
Drive	Triple-eccentric counterbalanced drive with nine permanently lubricated ball bearings		
Drive Motor	Solid-state brushless DC motor. Maximum torque 40 oz-in (2880 cm-g)		
Safety	Unique sensor automatically limits speed of Shaker when overloaded or unbalanced condition is detected. Drive Interrupt shuts off power to Shaker when door opens. Acceleration/deceleration circuit prevents sudden starts and stops, minimizing both splashing and mechanical damage.		
Electrical Requirements	100/120/230/240 VAC 50/60 Hz. 1,000 VA per Shaker.		
Overall Dimensions	Single Unit	Two Units	Three Units
Width	51.5" (131 cm)	51.5" (131 cm)	51.5" (131 cm)
Depth (Front to Back)	33" (84 cm)	33" (84 cm)	33" (84 cm)
Height	27" (69 cm)	52.25" (133 cm)	77.5" (197 cm)
Chamber Dimensions	34" (86.4 cm) W X 23" (58.4 cm) D X 15.5" (39.4 cm) H clearance above platform		
Chamber Door	32" X 14.5" (81.3 X 36.8 cm) see through door allows for viewing of cultures. Door swings out and up. Open door position adds 6" (15.2 cm) to depth (D) dimension and adds 18" to height (H) when open.		
Platform	Aluminum. Choice of 16.5" X 33.5" (42 X 85 cm) lift-out style, or 18" X 30" (46 X 76 cm) bolt-on style. Both platform styles are 5/16" (0.79 cm) thick.		
Weight	Net: 490 lbs (222 kg)		Gross: 575 lbs (261 kg)

NOTE: Add 18 in. (45.6 cm) to height and 6 in. (15.2 cm) to depth for door clearance.

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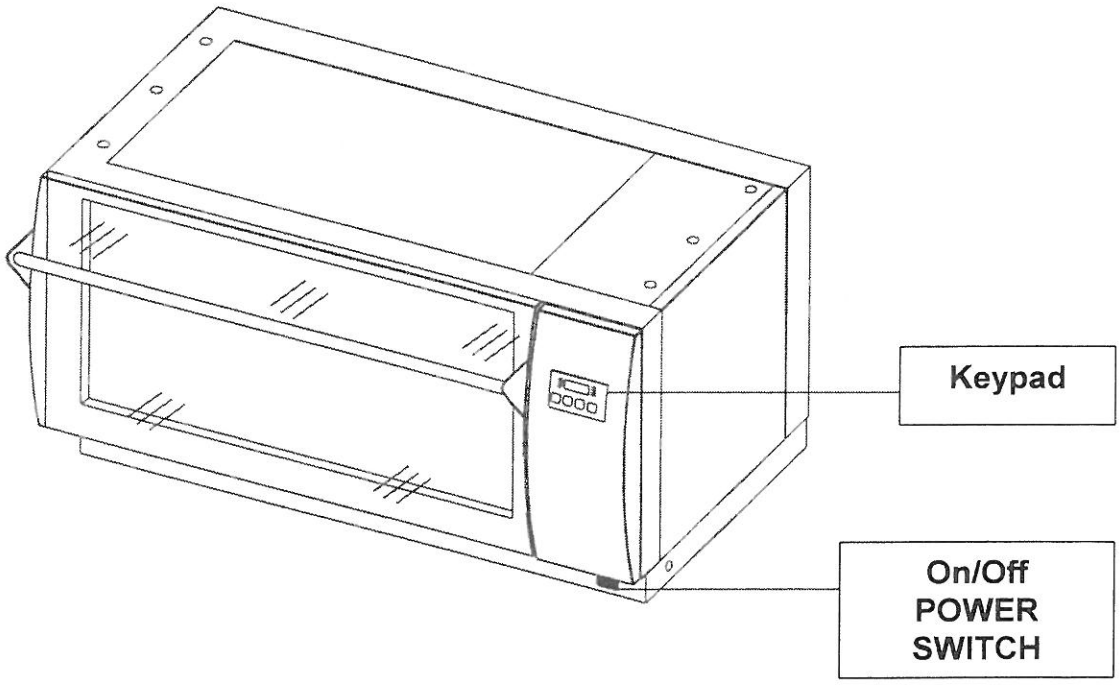
7 OPERATION

7.1 Starting the Shaker

To initially start the Shaker, close the door and turn the **ON/OFF SWITCH** on the front panel of Shaker to the **ON** position. When the Shaker begins to operate, the **LED DISPLAY** will track the speed as it accelerates to the last entered setpoint. The shaking action may be started or stopped by pressing the **START/STOP KEY** on the **KEY PAD**.

Figure 14: Front Panel



NOTE:

The Shaker will not operate if the door is open. This is indicated by the word LID appearing in the LED DISPLAY.

7.2 Continuous (Unlimited) Run

1. Press SELECT until the RPM INDICATOR is illuminated.
2. If the display indicates that the Shaker is OFF, press the START/STOP KEY.
3. Press either ▲ (UP) or ▼ (DOWN) KEY to enter SET MODE (the SET INDICATOR will illuminate).
4. Set the speed by using the ▲ or ▼ KEY until the desired setpoint is displayed. Continued pressure on the ▲ or ▼ KEY will cause the setting to change more rapidly.

NOTE:

The setpoint may be changed during a run without stopping the Shaker by following steps 2-4 above. During speed changes, a visual alarm (flashing RPM INDICATOR) will flash and an audible alarm will sound until the speed returns to within 5 rpm of the setpoint.

7.3 Checking Any Setpoint

1. Press SELECT until the desired indicator is illuminated.
2. Briefly press either the ▲ or ▼ KEY to enter the SET MODE and display the current setpoint.

CAUTION!
Holding the ▲ or ▼ for more than 0.5 seconds causes the speed setpoint to change.
Should this occur, resetting will be necessary.

7.4 Timed Functions

The Shaker may be programmed to automatically stop after a preset time period of 0.1 to 99.9 hours. There must be power to the Shaker in order to set the timer, although a timed run can be initiated while the unit is either stopped or operating.

To set the timer:

1. Press the SELECT KEY until the HRS INDICATOR is illuminated.
2. Press either ▲ or ▼ KEY to enter the SET MODE and set the desired run time, between 0.1 and 99.9 hours.
3. While the SET INDICATOR is illuminated, press the START/STOP KEY to program the time (and start the run). The TIME INDICATOR will light and remain on for the duration of the run. At the end of the timed run the display will read OFF, the TIME INDICATOR will flash and the audible alarm will beep.

To disable the visual alarm (flashing **TIME INDICATOR**), press the **SELECT KEY** and change to any other function.

To cancel the timer without stopping the Shaker:

Repeat steps 1 and 2 above, then immediately press the **START/STOP KEY**. The **TIME INDICATOR** will cease to flash and the display will read **OFF**.

7.5 Alarm Functions

The Innova 4430 Shakers have an audible alarm which is activated at predetermined times. It may be deactivated in the following way:

1. Press SELECT until the HRS INDICATOR is illuminated, **AND**
2. **Simultaneously** press the ▲ and ▼ KEYS. The SET and MAINT INDICATORS will flash.
3. While the SET and MAINT INDICATORS are flashing, press the START/STOP KEY. The MUTE INDICATOR will illuminate.

To reactivate the alarm, repeat steps 1-3.

7.6 Temperature Setpoint

Press the **SELECT KEY** until the function **°C INDICATOR** illuminates. The temperature can be set from 15°C below the current ambient temperature (with a minimum setpoint of 4° C) up to 80°C. Increasing or decreasing the setpoint is accomplished with the ▲ or ▼ **KEYS**.

During operation, if the temperature of the chamber is more than 1.0°C higher or lower than the temperature setpoint, an alarm is triggered. This alarm consists of a flashing **°C INDICATOR** and audible beep. The alarm will automatically deactivate as the unit achieves the set temperature.

If desired, the temperature control system may be shut off during set-up for special investigations. **To deactivate the temperature control system**:

1. Press and hold the ▼ KEY until the setpoint is at 4.0°C.
2. Holding the ▼ KEY, press the START / STOP KEY.
3. The temperature setpoint display shows OFF and both the heater and the refrigeration system are deactivated.

To reactivate the temperature controller, press the ▲ KEY until the desired temperature setpoint is displayed.

7.7 *Temperature Offset Calibration*

The temperature probe and the temperature controller are calibrated together at the factory. The temperature probe measures the temperature of the air at the probe's location, near the heat exchanger return vent. The controller uses the probe input to adjust air temperature, up or down, to match the temperature setpoint.

Depending on various conditions within the chamber, such as flask placement and size, the heat produced by growing organisms, heat losses due to liquid evaporation from flasks, etc., the display temperature may differ from temperatures within the flasks themselves.

If you wish to have the temperature display ("Indicated Temperature") match the temperature at a given point, or match the average of a series of points within the chamber ("Actual Temperature"), proceed as follows:

1. Let the unit equilibrate at or near the desired temperature. Record the Indicated Temperature.
2. Record the Actual Temperature.
3. Calculate the temperature correction value: Actual Temperature – Indicated Temperature = Temperature Correction Value.
4. Press the **SELECT KEY** until the function **°C INDICATOR** illuminates.
5. Simultaneously press the ▲ and ▼ KEYS. The **SET** and **MAINT INDICATORS** will light.
6. While the **SET** and **MAINT INDICATORS** are illuminated, use the ▲ or ▼ KEY to set the display to the calculated Temperature Correction Value.

NOTE:

The °C light will pulse rapidly for a short duration to indicate it is not operating in the factory default mode. It will pulse for a longer duration and less rapidly (with a frequency of approximately one second) to indicate temperature is more than one degree above or below setpoint.

To return to the factory calibration:

1. Press the **SELECT KEY** until the function **°C INDICATOR** illuminates.
2. Simultaneously press the ▲ and ▼ KEYS. The **SET** and **MAINT INDICATORS** will light.
3. While the **SET** and **MAINT INDICATORS** are illuminated, press the START / STOP KEY.

7.8 Total Running Time

The control modules of the Innova 4430 Shaker totalize the time the Shaker has been "**ON**" to track hours of usage. To display the accumulated running time:

1. Press SELECT until the HRS INDICATOR is illuminated.
2. Simultaneously press the ▲ and ▼ KEYS.

The **SET** and **MAINT INDICATORS** will flash and the accumulated running time will be displayed in hundreds of hours (i.e., "02" equals 200 hours; "102" equals 10,200 hours). This display will continue for 10 seconds and then default to the previous mode readout.

7.9 Maint [Maintenance] Indicator

After 10,000 hours of operation, the **MAINT INDICATOR** will illuminate. **Preventive maintenance is recommended at this point.**

To deactivate the **MAINT INDICATOR**:

1. Press SELECT until the HRS INDICATOR is illuminated.
2. Simultaneously press the ▲ and ▼ KEYS.
3. Press the ▼ KEY.

7.10 Power Failure

In the event of a power failure, the Innova 4430 Shakers are equipped with an **automatic restart** function.

If the Shaker was in operation prior to the power interruption, the Shaker will begin to operate at its last entered setpoint. The **LED DISPLAY** will flash, indicating that a power failure has occurred. Press any key to stop the flashing of the **LED** display.

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