

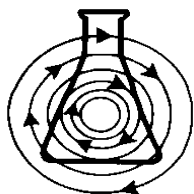


Guide to Operations

***innova*[™] 4335**

**Digital Refrigerated
Incubator Shaker**
with TEMPERATURE & SPEED TIMER

MANUAL No. M1193-1057
Revision D
August 5, 2002



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**CAUTION!**

This equipment *must* be operated as described in this manual. If operational guidelines are not followed, equipment damage and personal injury *can* occur. Please read the entire User's Guide before attempting to use this unit.

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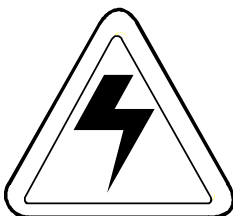


Notes contain essential information that deserves special attention.



CAUTION!

Caution messages appear before procedures which, if caution is not observed, could result in damage to the equipment.



WARNING!

Warning messages alert you to specific procedures or practices which, if not followed correctly, could result in serious personal injury.

Bold

Text in bold face type emphasizes key words or phrases.

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WARRANTY

Innova Shakers are warranted by New Brunswick Scientific Co., Inc. for two years or 10,000 hours of actual shaker use, whichever comes later. This warranty covers parts and labor for the entire machine, with the exception of glassware and its contents. This warranty covers faulty components and assembly, and our obligation under this warranty is limited to repairing or replacing the shaker or part thereof which shall, within two years after date of shipment or 10,000 hours of operating time, prove to be defective after examination. This warranty does not cover any loss of time, materials, biological or biochemical by-products caused by any work interruption resulting from shaker failure, nor does it extend to any Innova Shaker which has been subjected to misuse, neglect, accident or improper installation or application. In addition, the warranty does not apply to any Innova Shaker that has been repaired or altered outside the NBS factory without prior authorization from New Brunswick Scientific. For a period of two years (or more) after the shipment date, the Innova warranty will be in effect as long as the shaker has not been in operation for a total of 10,000 hours. After the 10,000 hours of operating time have elapsed, the Innova warranty may still be in effect, as long as the two-year minimum warranty period has not been reached. Operating time is based on actual usage of the shaker, as determined by the shaker's internal electronic clock. Any tampering or alteration of the clock will void the 10,000-hour warranty.

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TABLE OF CONTENTS

1	OVERVIEW	13
1.1	GENERAL DESCRIPTION.....	13
2	INSPECTION & VERIFICATION	15
2.1	INSPECTION	15
2.2	UNPACKING & VERIFICATION	15
3	PREPARING THE LOCATION.....	17
3.1	SPACE REQUIREMENTS	17
3.2	ENVIRONMENT	18
4	FEATURES	19
4.1	KEYPAD	20
4.2	ELECTRONIC TIMER.....	22
4.3	UNIVERSAL POWER CAPABILITY	25
4.4	PLATFORM ASSEMBLIES.....	25
4.5	QUICK CHANGE PLATFORM KIT	25
4.6	CONSTRUCTION.....	25
4.7	REFRIGERATION SYSTEM.....	26
4.8	VENT.....	27
4.9	RECORDER OUTPUT.....	28
5	GETTING STARTED	29
5.1	LEVELING THE UNIT	29
5.2	VOLTAGE SELECTION	29
5.3	FREQUENCY SELECTOR	31
5.4	ELECTRICAL CONNECTIONS	31
5.5	INSTALLATION OF PLATFORMS	32
5.6	QUICK CHANGE PLATFORM OPTION.....	32
5.7	INITIAL STARTUP.....	34
6	THE ELECTRONIC TIMER.....	35
6.1	SETTING THE ELECTRONIC TIMER	35
6.2	ORDINARY TIMER OPERATION	36
6.3	SAMPLE PROGRAM	39
6.4	MULTIDAY OPERATION	43
6.5	CYCLIC OPERATION	45
6.6	VIEWING PROGRAMS.....	47
6.7	DAY OVERRIDE.....	50
6.8	CLEARING/CANCELING PROGRAMS.....	53
7	OPERATION	55
7.1	STARTING THE SHAKER	55
7.2	CONTINUOUS MODE.....	55
7.3	CHECKING ANY SETPOINT.....	56
7.4	INNOVA TIMER MODE	56
7.5	ALARM FUNCTIONS	57
7.6	PRIMARY TEMPERATURE SETPOINT.....	58

7.7	PROGRAMMED TEMP MODE	58
7.8	PROGRAMMED SHAKE MODE	59
7.9	TEMPERATURE OFFSET CALIBRATION	59
7.10	TOTAL RUNNING TIME	60
7.11	MAINT INDICATOR	61
7.12	POWER FAILURE.....	61
8	PREVENTIVE MAINTENANCE.....	63
8.1	CLEANING	63
8.2	CONDENSER COIL.....	63
8.3	CHANGING FUSES.....	64
8.4	BELT REPLACEMENT	64
8.5	MOTOR ASSEMBLY REPLACEMENT	65
8.6	ESD PRECAUTIONS	66
8.7	REPLACEMENT OF MAIN CONTROL BOARD	66
8.8	TEMPERATURE CONTROL BOARD REPLACEMENT	68
9	SPECIFICATIONS.....	71
10	REPLACEMENT PARTS & ACCESSORIES	73
10.1	REPLACEMENT PARTS DESCRIPTIONS AND PART NUMBERS	73
10.2	ACCESSORY DESCRIPTIONS & PART NUMBERS	74
11	DRAWINGS.....	77
11.1	CONTROL SCHEMATIC	77
11.2	LIST OF DRAWINGS	84
12	INDEX.....	85

1 OVERVIEW

1.1 *General Description*

The Innova 4335 shaker incorporates a triple eccentric counterbalanced drive to provide horizontal plane rotary motion in a 1inch (25.4 mm) circular orbit. A Proportional/Integral (PI) Microprocessor controller, with instantaneous digital feedback, controls the speed over a range of 25-500 rpm. It also provides temperature control over a range of 4.0°C to 60°C (at 20°C ambient). The internal chamber is 34¾ inches (88.3 cm) wide, 22¼ inch (56.6 cm) deep, 19¼ inch (48.9 cm) above the platform and will accept flasks up to 6 liters. It is equipped with a foot-pedal lid lift assist.

The Innova 4335 is equipped with an integral refrigeration system which allows precise temperature control at or below ambient temperature.

The shaker may be operated either continuously or in a timed mode via a programmable timer for shaking periods of 0.1 hour to 99.9 hours.

The Innova 4335 is equipped with audible and visible alarms that are activated when an alarm condition exists, as follows:

- The end of a timed run
- Deviations of shaking speed or temperature outside of tolerance limits

A wide variety of platforms can be used with the Innova 4335. Dedicated platforms are available for a variety of flask sizes. A Universal platform and test tube racks are available. (*See Section 10.1 for Accessories*)

Additionally, the Innova 4335 has analog outputs for a chart recorder that will record speed and/or temperature. (*See Section 4.9 for recorder output information.*)

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2 INSPECTION & VERIFICATION

2.1 *Inspection*

After you have received your order from NBS, inspect the boxes carefully for any damage that may have occurred during shipping. Report any damage to the carrier and to your local New Brunswick Scientific Co., Inc. Sales Order Department or local NBS distributor. Do not discard any of the packing material.

2.2 *Unpacking & Verification*

Verify against your NBS packing list that you have received the correct materials. Report any errors or missing material to your local New Brunswick Scientific Co., Inc. Sales Order Department or local NBS distributor.

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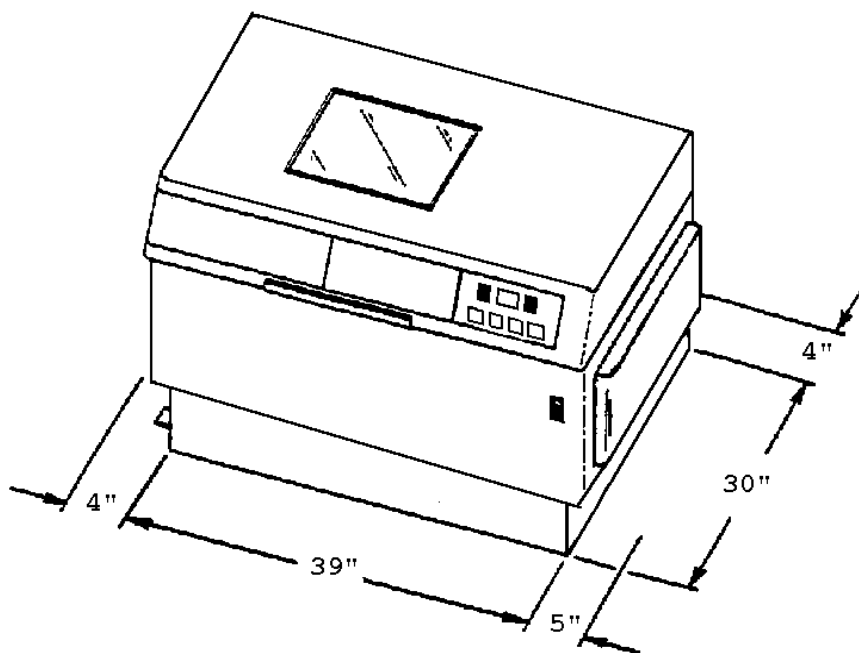
3 PREPARING THE LOCATION

3.1 Space Requirements

The surface where you place the Innova 4335 should be smooth, level and sturdy.

It is essential that the instrument be situated in an area where there is sufficient space for the shaker and service lines (see *Figure 1* below).

Figure 1: Space Requirements



The outside dimensions of the Innova 4335 are:

OUTSIDE DIMENSIONS		
Width	45 inches	114 cm
Depth	28 inches	71 cm
Height	37 inches	94 cm

The effective surface area required for operation is:

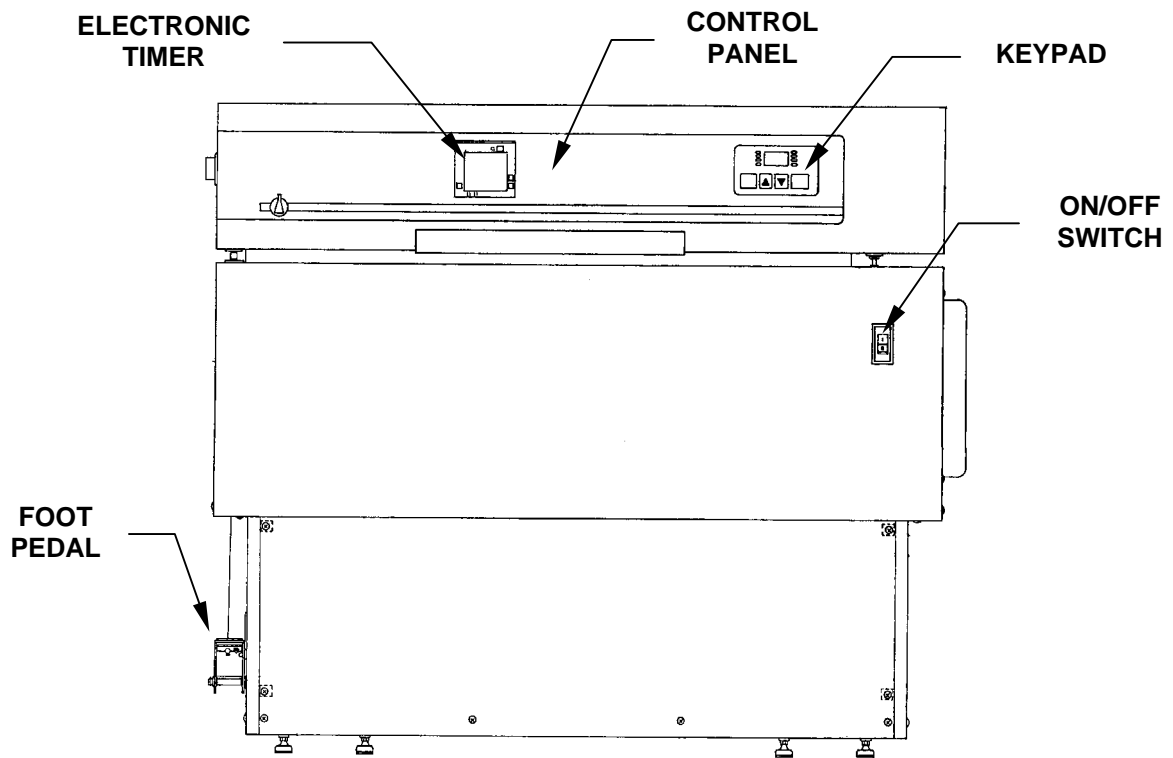
REQUIRED SURFACE AREA		
Width	48 inches	122 cm
Depth	30 inches	76 cm

3.2 ***Environment***

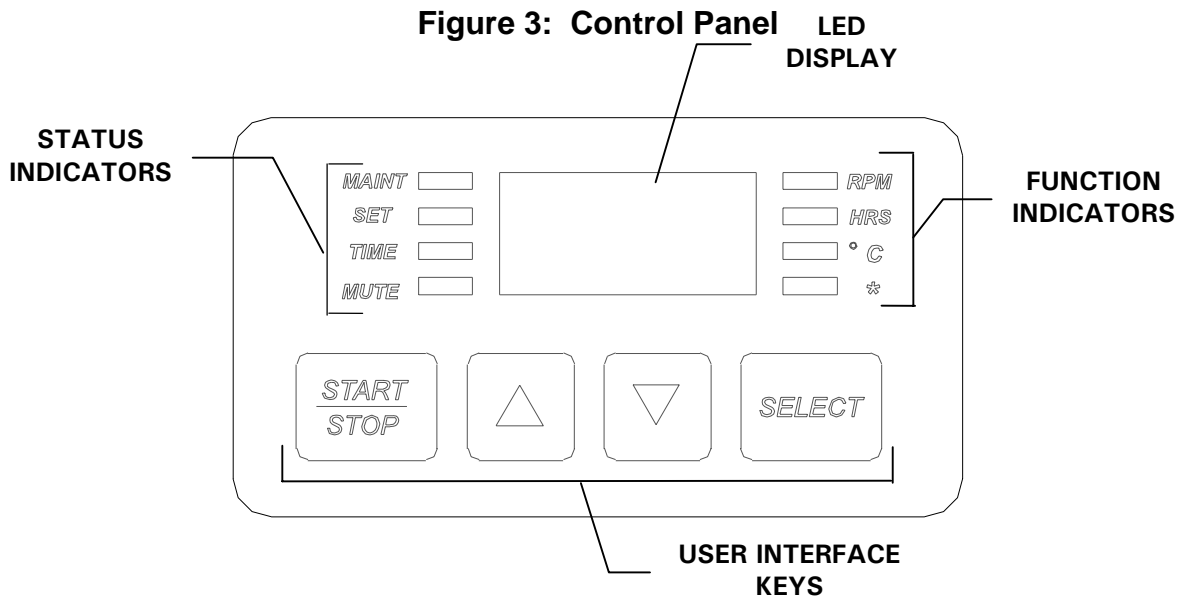
The Innova 4335 operates properly under the following conditions: 0°C - 35°C, 90% humidity, non-condensing.

4 FEATURES

Figure 2: Innova 4335 Front Panel



4.1 Keypad



4.1.1 LED Display

The digital display on the control panel is a three digit **LED DISPLAY**. During normal shaker operation the display will indicate:

- Shaker status (on/off)
- Shaking speed
- Chamber temperature
- Setpoints
- Hours remaining (timed run)
- Lid open (cover open/shaker operation stops)

4.1.2 User Interface Keys

- **START/STOP** This key is used to start or stop the shaker. It will also activate or stop the timer when a timed run is desired.
- **SELECT** This key is used to change the displayed parameter.
- **▲(UP), ▼(DOWN)** These keys are used to adjust the setpoint of a displayed parameter up or down. They also allow the user to enter the **SET MODE** for setpoint changes.

4.1.3 Status Indicators

Four status indicator lights are located to the left of the **LED DISPLAY**. They are:

- **MAINT** Remains lit after 10,000 hours of use. Accumulated running time is internally monitored and may be displayed as a guideline.
- **SET** Indicates that the shaker is in the **SET MODE** and setpoints are being displayed and can be altered.
- **TIME** Indicates that the timer is in operation. The shaker can be programmed to run for a preset time from 0.1 hour to 99.9 hours. The timer can be disengaged without stopping an ongoing run.
- **MUTE** Indicates the status of the audible alarm. When illuminated, the audible alarm is disabled.

4.1.4 Function Indicators

The four function indicator lights are located to the right of the LED display. They indicate the current parameter being displayed.

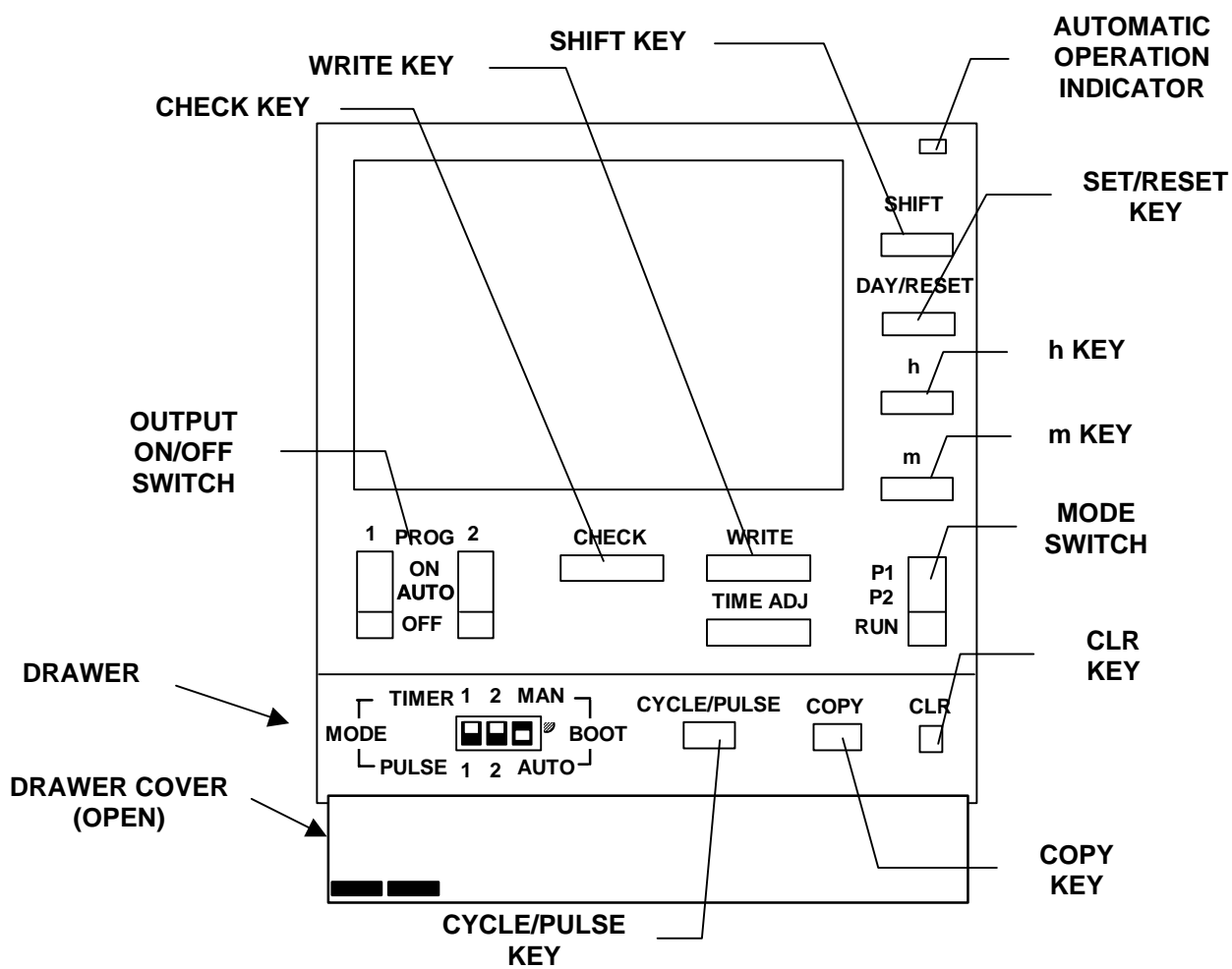
- **RPM**
Revolutions per minute.
- **HOURS**
Time remaining when used in **INNOVA TIMER MODE**.
- **°C**
Used to display current incubator temperature and set primary temperature setpoint.
- *****
Used to display current incubator temperature and set alternate or secondary temperature setpoint, which is used with the electronic timer.

4.2 Electronic Timer

The electronic timer is used to set programmed times to control the operation of the shaker. **PROG1** enables the unit to alternate between primary ($^{\circ}\text{C}$ setting on the keypad) and secondary (*) temperature setpoints at preset intervals (cycles) or at specific times. **PROG2** controls the operation of the shaker. The timer controls speed by stopping and starting the shaker at preset intervals (cycles) or at specific times.

Chapter 6 provides instructions for programming and using the electronic timer feature. This feature allows the operator to leave a culture unattended over a weekend, for example, and yet maintain a no-growth environment. By selecting the low temperature setpoint from end of day Friday until a pre-determined time Sunday night or Monday morning, the operator can ensure stasis while the culture is unsupervised. At the operator-selected time, the temperature will rise to the maximum setpoint, encouraging growth. (See Section 6.3 for details.)

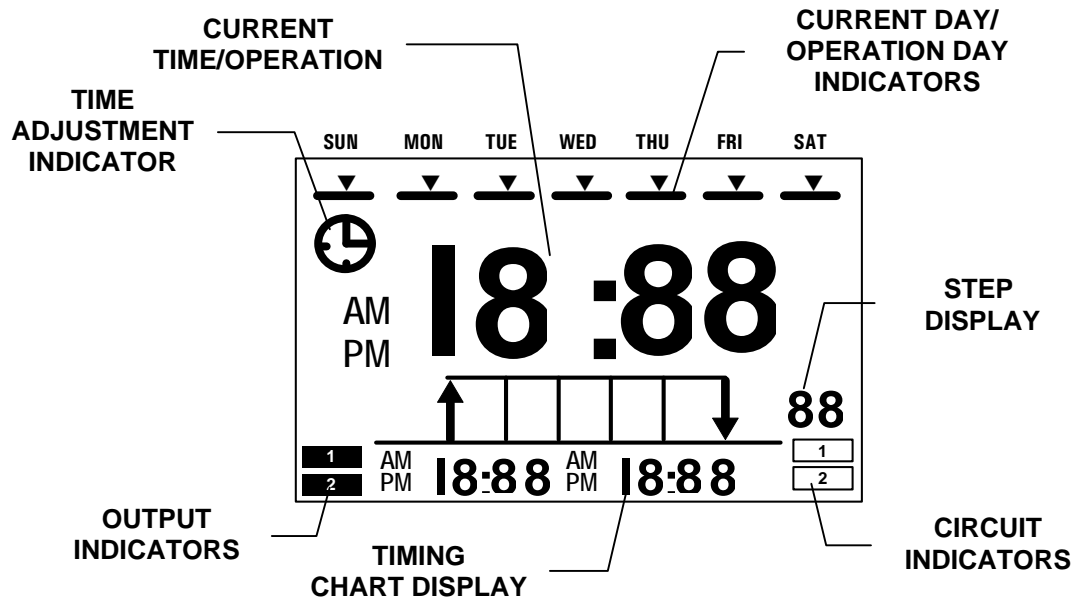
Figure 4: Electronic Timer Detail



The following is a brief description of the electronic timer's features and functions:

Component	Function
AUTOMATIC OPERATION INDICATOR	Illuminates during automatic operation
CHECK KEY	Allows the user to view the programmed timing operations in sequence.
CLR KEY	Clears the parameters set for each program and overrides day operation.
COPY KEY	Specifies an override day.
CYCLE/PULSE KEY	Specifies a cyclic operation.
h KEY	Sets hours.
m KEY	Sets minutes.
MODE SWITCH	<p>Sets the operating mode of the timer</p> <p>P1: PROG1 SET MODE, allows the user to set timing operations in PROG1.</p> <p>P2: PROG2 SET MODE, allows the user to set timing operations in PROG2.</p> <p>RUN: RUN MODE, normal operating mode of the timer.</p>
OUTPUT ON/OFF SWITCH	<p>Allows the user to operate PROG1 and PROG2 separately:</p> <p>ON: The switch contact on the specified program is closed. This position in PROG2 will cause the shaker to run at setpoint speed and cause the unit to operate at the alternate (*) temperature setpoint for PROG1.</p> <p>OFF: The switch contact on the specified program is open. This position in PROG2 will cause the shaker to stop and, in PROG1, cause the unit operate at the primary (°C) temperature.</p> <p>AUTO: Each program will operate at its specified timed settings. The AUTOMATIC OPERATION INDICATOR will illuminate when either switch is in this position.</p>
SET/RESET KEY	Selects or cancels the day selected by the SHIFT KEY .
SHIFT KEY	Moves the cursor (▼) to specify a day.
TIME ADJ	Allows the user to adjust the time.
WRITE KEY	Sets in the specific time in RUN MODE or PROGRAMMING MODE .

Figure 5: Electronic Timer Display Detail



Component	Function
Current Time/Operation	Displays current set time when the MODE SWITCH is in the RUN position. Displays programmed time, and/or time width when the MODE SWITCH is in the P1 or P2 position.
Time Adjustment Indicator	Indicates that the timer is in TIME ADJUST MODE when the TIME ADJUST KEY is pressed.
Output Indicators	When present on display, it indicates that the output is being produced by PROG1 or PROG2 .
Current Day/Operation Day Indicators	When the MODE SWITCH is in the RUN position, this indicates the current day and displays program operation when output is being produced When the MODE SWITCH is in the P1 or P2 position, it displays the days of operation for each program.
Step Display	Displays the remaining number of available programmable steps in the timer. The total number of programmable steps available is 24.
Timing Chart Display	When the MODE SWITCH is in the RUN position, this displays the time at which the next operation will be performed. When the MODE SWITCH is in the P1 or P2 position, it displays the set time and time width.
Circuit Indicators	When the MODE SWITCH is in the RUN position, this indicates that there are programmed operations for PROG1 or PROG2 . Indicates the position of the MODE SWITCH when it is in the P1 or P2 position.

4.3 Universal Power Capability

A voltage selector incorporated in the power entry module and a frequency selector switch are used to select the appropriate voltage and frequency. This universal system adapts to worldwide power requirements. Voltage and frequency have been set prior to shipment. Innova shakers are available in 100V, 120V, 220V and 240V, and accommodate both 50 and 60 Hz frequencies.

4.4 Platform Assemblies

The Innova 4335 can be used with a wide variety of NBS 18" x 30" (46 cm x 76 cm) platforms which will accept a variety of clamps for flasks and test tubes.

4.5 Quick Change Platform Kit

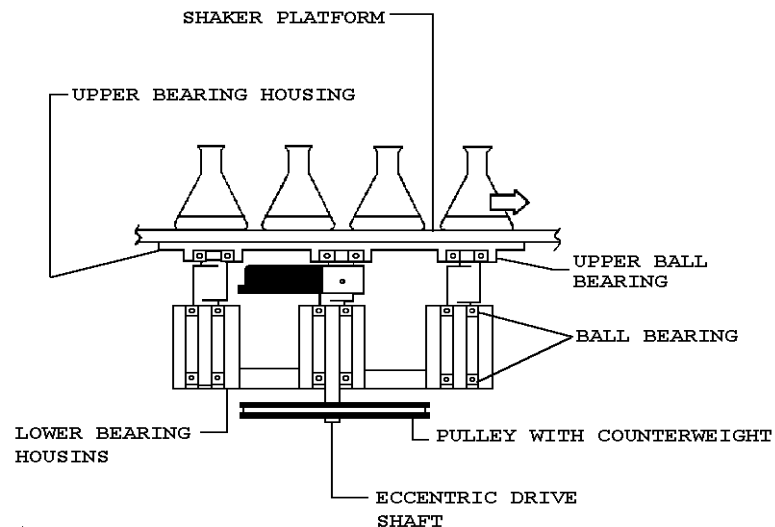
This easy-load accessory (M1193-9931) enables the user to snap-in platforms without tools or hardware. With this accessory, Maximum Speed should be limited to 400 rpm.

4.6 Construction

4.6.1 Triple Eccentric Drive

The Triple Eccentric Drive used in the Innova Shakers employs the same proven technology which has driven New Brunswick Scientific's shakers for over 30 years. This drive mechanism utilizes a counterweight system to stabilize the rotary motion produced during operation. When the workload moves in one direction, opposing forces are generated to stabilize the shaker. This action will help eliminate the problem of "walking" which may occur with less precisely balanced instruments. Vibration is minimized and the life of the unit is extended.

Figure 6: Counterbalanced Drive Mechanism



4.6.2 Bearings

Innova shakers employ shielded lubricated ball bearings of the highest quality. Shielded bearings minimize the generation of airborne particulate which may be disadvantageous in clean rooms or controlled environment areas. These bearings require no maintenance.

4.6.3 Motor

The Innova 4335 uses a 3-phase brushless ball bearing DC motor. This low profile motor provides high torque along with quiet, efficient operation and low maintenance. This motor has a rating of 1/8 horsepower.

4.7 Refrigeration System

The Innova 4335 shaker is equipped with a 1/5 HP refrigeration system. The condensing unit is hermetically sealed and the evaporating temperature is closely regulated to prevent coil icing. The refrigeration system is automatically started and stopped by the digital control system based on the temperature setpoint and ambient temperature conditions.

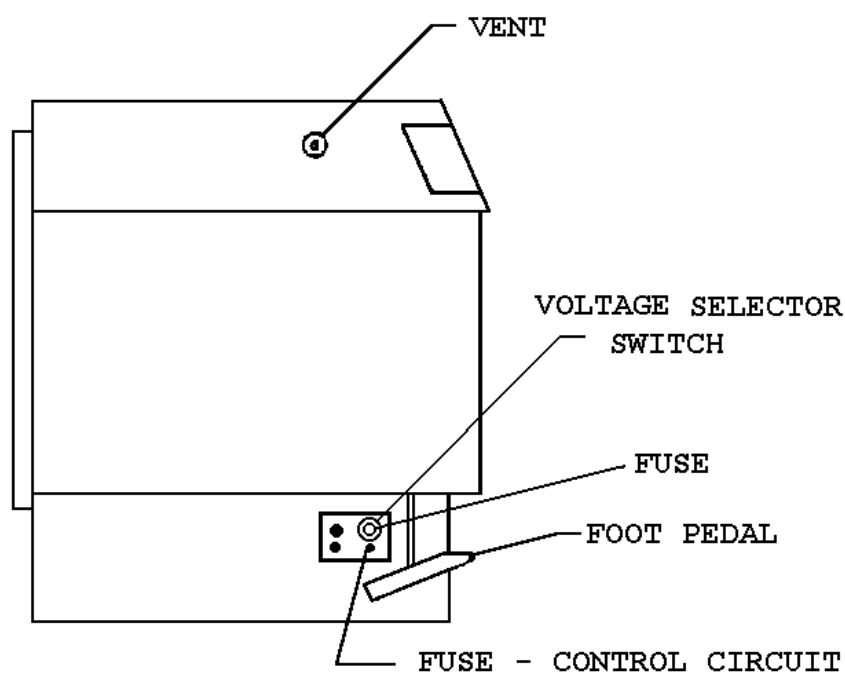
The Temperature Control module for the Innova shaker has the following functions:

- Control of analog power supplies;
- Rectification and regulation for analog power supplies;
- Provides signal conditioning circuitry and A/D conversion for the RTD based temperature measurement;
- Provides remote monitoring capabilities by supplying analog output for speed and temperature which are compatible with chart recorders and analog data acquisition system;
- Controls the heater;
- Control of the refrigeration system.

4.8 Vent

The Innova 4335 is provided with a vent to exhaust gas or allow small amounts of ambient air into the chamber. The vent is located in the left side of the cabinet. When the knob is tight in a clockwise position then the vent holes are sealed. Rotating the knob counter-clockwise opens the vent.

Figure 7: Innova 4335 Side Panel



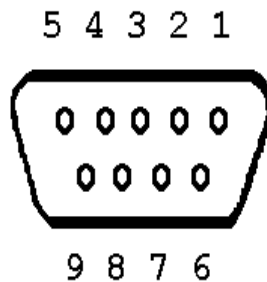
4.9 Recorder Output

To record speed and temperature, a recorder (not supplied) can be used that has the following capabilities:

For speed and temperature, two channels are required. Each channel should have signal conditioning which accepts a 0-5 volt DC input.

The pin-out diagram and scale below identify the application.

A mating connector is required on the recorder cable (not supplied). This is a 9-pin male D subminiature connector, which is AMP Amplimite HDP-20 series or equivalent.



NOTE:

As seen from the back of the unit.

<i>Pin No.</i>	<i>Signal Name</i>	<i>Scale</i>
6	Speed	1V = 100 rpm
2	Ground	
7	Temperature	1V = 20°C
3	Ground	

5 GETTING STARTED

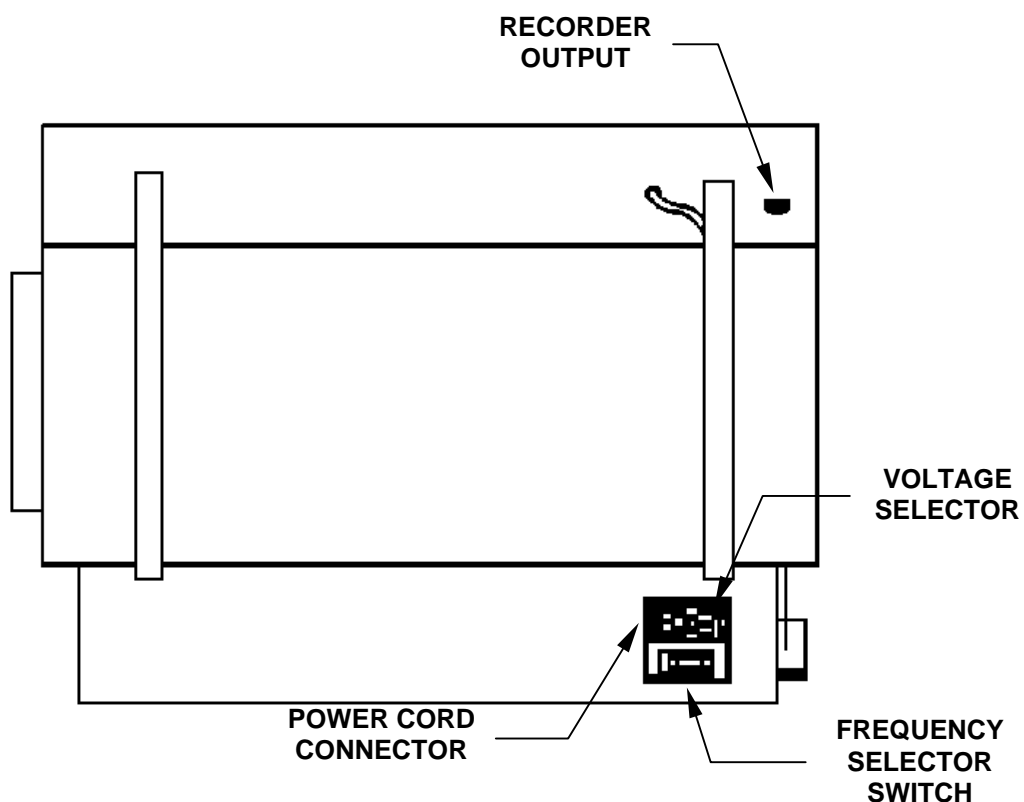
5.1 *Leveling the Unit*

The Innova 4335 should be installed on a smooth, sturdy surface, and must be leveled before operation. The eight feet can be adjusted for leveling by loosening the locking nuts on the threaded studs attached to the feet and retighten when the level condition is attained.

5.2 *Voltage Selection*

The Innova 4335 is set to the appropriate line voltage prior to shipment. The **VOLTAGE SELECTOR** is on the back panel of the unit and is a universal power-entry device that can adapt to worldwide power requirements. If you need to reset the voltage for the Innova 4335, perform the following steps.

Figure 8: Innova 4335 Rear Panel

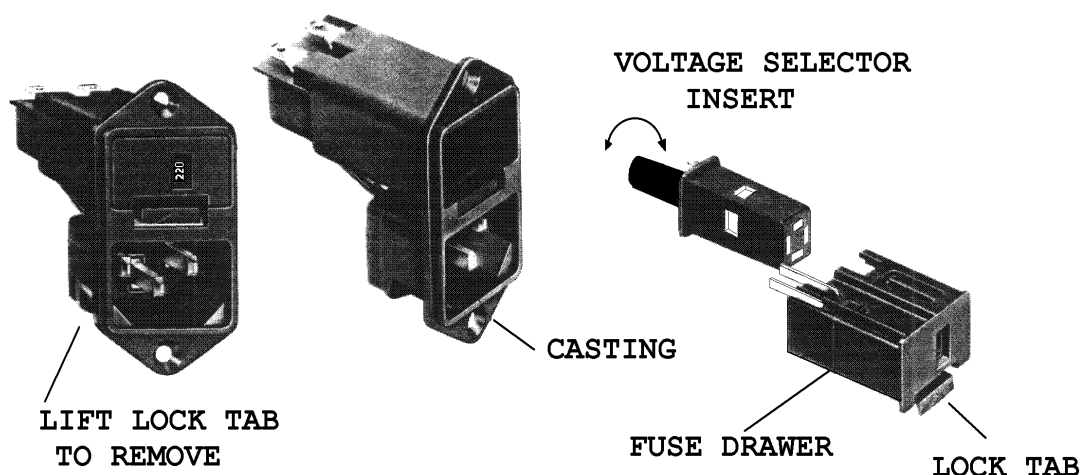


**CAUTION!**

If the Innova 4335 is being operated in Europe, CE Labeling requires that the following procedure be performed only by a qualified Electrical or Service Engineer.

1. Verify that the unit is disconnected from the power source.
2. Use a flat-bladed screwdriver to push the **FUSE DRAWER LOCK TAB** down and pull out the **FUSE DRAWER**.

Figure 9: Voltage Selector



3. Remove the **VOLTAGE SELECTOR INSERT** and rotate the selector until the desired voltage is found. Use the following table to set the correct voltage for your unit:

<i>NBS Part Number</i>	<i>Voltage</i>	<i>Electrical Service Package</i>
M1193-1015	100V 50 Hz	M1193-0072
M1193-1014	120V 60 Hz	M1193-0072
M1193-1016	220V 50 Hz	M1193-0073
M1193-1017	240V 50 Hz	M1193-0073

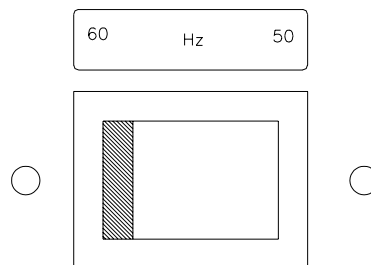
4. Place the **VOLTAGE SELECTOR INSERT** back into the **FUSE DRAWER**. Verify that the correct voltage is displayed through the **VOLTAGE WINDOW**.
5. Slide the **FUSE DRAWER** back into the **FUSE HOUSING** and verify that it locks into place.

5.3 Frequency Selector

The Innova 4335 is set to the appropriate frequency prior to shipment. The **FREQUENCY SELECTOR** is on the back panel of the Shaker. If you need to reset to the frequency prior to operation, perform the following steps:

1. Verify that the unit is disconnected from the power source.
2. Facing the rear panel of the unit, slide the switch all the way to the right for 50 Hz, or all the way to the left for 60 Hz.

Figure 10: Frequency Selector detail



5.4 Electrical Connections



WARNING!

Verify that the voltage and frequency settings of the unit match the supply voltage and frequency before connecting the unit to a power source.

1. Check the voltage and frequency selector switches on the rear of the unit to ensure that they are set to the appropriate voltage and frequency.
2. Remove the caution label from the rear of the unit.
3. Set the circuit breaker on the front side of the unit to the **OFF** position.
4. **ONLY AFTER STEP 3:** Connect the line cord to the power cord connection and to a grounded electrical outlet.

5.5 Installation of Platforms

A platform must be installed on the unit prior to use.

1. Set the **POWER SWITCH** in the **OFF** position. Open the cover.
2. The unit is shipped with the four **PLATFORM SCREWS** installed in the **SUBPLATFORM** of the bearing housing. These screws must be removed before a platform can be installed. Using the 7/32" hex wrench provided, loosen and remove the platform screws from the bearing housing.
3. Place the platform on the subplatform of the bearing housing.
4. Reinstall and secure the four Allen head platform screws, with the 7/32" hex wrench provided, to secure the platform.

If the Quick Change Option is installed:

5. Slip the platform between the side guides and push the platform to the rear retainer.
6. Press down on the front edge of the platform. The platform should snap down into the place and be retained by the springs. Check that the rear edge of the platform is engaged under the bend of the rear clip.



NOTE:

When the Quick Change Platform is installed, recommended maximum speed is 400 rpm.

5.6 Quick Change Platform Option

The Easy Loading Platform Kit (M1193-9931) enables user to change or mount the series of 18" x 30" (46 cm x 76 cm) platforms without the use of tools or hardware.

The following parts are required to make this upgrade or change. They included in the kit:

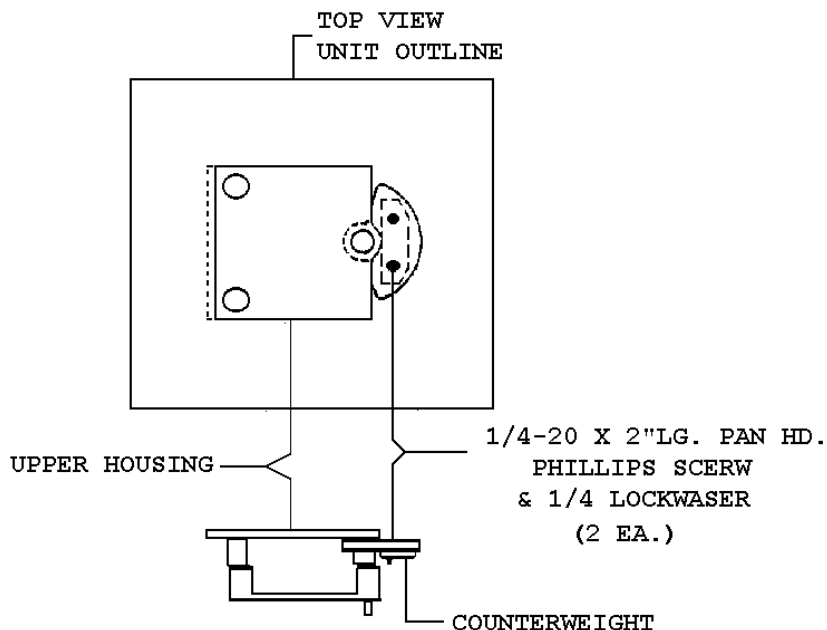
<i>Description</i>	<i>Quantity</i>
Plastic subplatform with springs, retainers and friction pads attached	1
Counterweight with tapped holes	1
Counterweight with clearance holes	1
1/4-20 x 2" long pan head Phillips screws and lock washers	2
3/8-16 x 1" long Allen socket flat head screws	4
7/32" Allen key wrench	1

5.6.1 Installation

1. Turn the power **OFF** using the power switch and disconnect the line cord.
2. Check the parts in the M1193-9931 kit.
3. Remove the existing platform if one is on the machine.

4. Rotate the counterweight so that the heavy section is in the extreme right position.
5. Slip the set of counterweights under the unit counterweight keeping the part with the clearance holes on top and the one with the tapped holes below. Mount with the two 1/4" x 2" long screws and lock washers supplied. Be sure to tighten the screws securely.

Figure 11: Quick Change Platform Installation



6. Mount the subplatform with the four flat head Allen screws, keeping the side with the two springs to the front of the machine. Tighten the screws securely.
7. Slip an 18" x 30" (46 cm x 76 cm) platform between the side guides, push the platform to the rear retainer and press down on the front edge of the platform. It should snap down into place and be retained by the springs. Check that the rear edge of the platform is engaged under the bend of the rear retainer.
8. Reconnect the power cord to the unit and to a grounded electrical outlet.



NOTE:

When the Quick Change Platform is installed, recommended maximum speed is 400 rpm.

5.6.2 Removal

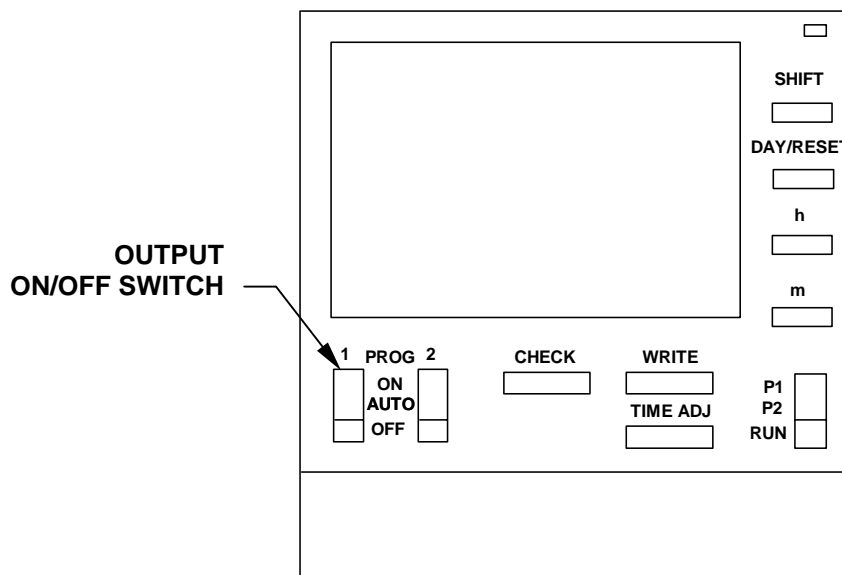
1. Stop the machine by pressing the **START/STOP KEY**.
2. Face the machine squarely.
3. Put your index fingers under each front corner of the platform. Note that there is a relief in these corners on the subplatform. With your thumbs, press the two corner springs toward your body and, with an upward pressure of your index fingers, lift the platform from its retained position.

5.7 Initial Startup

Before initially turning on the unit, verify the following:

- The lid is in the closed position.
- Set the **OUTPUT ON/OFF SWITCH** for **PROG1** to the **OFF** position and **PROG2** to the **ON** position.

Figure 12: Electronic Timer Program On/Off Switches



1. Turn on the unit by pushing the **ON/OFF SWITCH** on the front of the shaker to the **ON** position.
2. Using the **KEYPAD**, verify that the shaker is **OFF** by pressing the **SELECT KEY** until the **RPM** is lit.
3. If the word **OFF** appears in the display, the shaker is **OFF**.
4. If a numeric value appears in the display, press the **START/STOP KEY** to stop the shaker.

6 THE ELECTRONIC TIMER

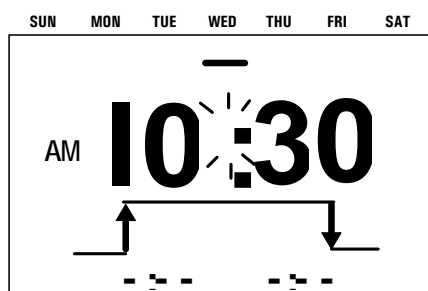
6.1 Setting the Electronic Timer

Before operation, verify that the **ELECTRONIC TIMER** is displaying the current day of the week and time. If it is not, the timer must be set to the current day/time in the order of “**DAY OF THE WEEK**”, “**HOURL**”, and “**MINUTE**”. If the day/time settings are correct, proceed to the next section to view the program settings.

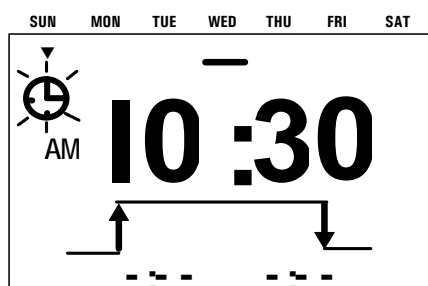
Once the timer is set, it does not have to be continually reset, only periodically checked to verify that the timer is functioning properly. The **ELECTRONIC TIMER** is equipped with a built-in battery that stores the day/time settings in memory when the Innova 4335 is turned **OFF**.

To change the day/time settings of the **ELECTRONIC TIMER**, perform the following:

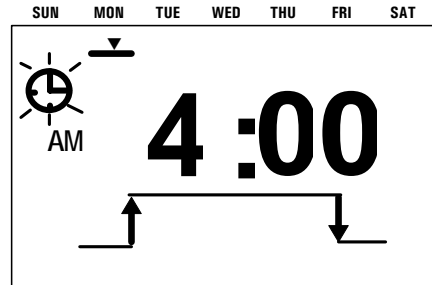
1. Verify that the Innova 4335 is in the “initial startup” condition as described in the previous section.



2. Hold down the **TIME ADJ KEY** for one second or more. An arrow and a flashing clock will appear under the word **SUN** in the display to signify that the timer is in **TIME ADJUST MODE**. The timer will stay in this mode for approximately one minute if no adjustments are made.



3. Select the current day of the week by pressing the **SHIFT** and **SET** keys. The **SHIFT KEY** allows you to move the cursor (▼) through the days of the week (from **SUN** to **SAT**). Holding down this key rapidly advances the cursor. The **SET** key turns the day of the week on by placing a bar in the display.
4. **SET** the hour of the day (**0-11 AM** and **0-11 PM**) by pressing the **h KEY**. Holding down this key rapidly advances the hour.
5. Select the minute of the hour (**00** through **59**) by pressing the **m KEY**. Holding down this key rapidly advances the minute.



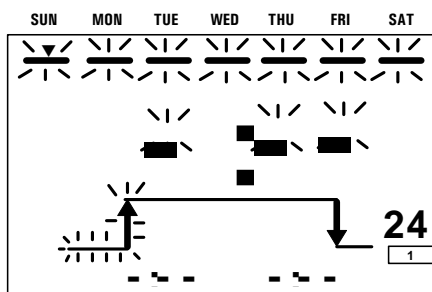
6. Verify that the settings entered are correct, and press the **WRITE KEY** to set the day and time. When the **WRITE KEY** is pressed, the arrow and flashing clock disappear from the display, and the timer is set to the displayed time at 0 seconds.



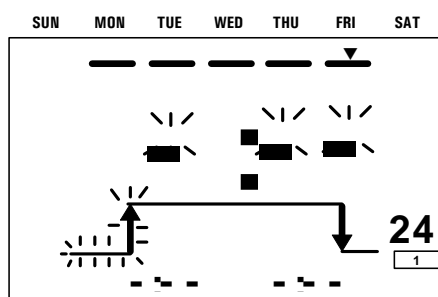
6.2 Ordinary Timer Operation

Remember that **PROG1** controls temperature and **PROG2** controls shaker operation. In the following example, **PROG1** will operate at 8:30 am and stop at 5:15 pm from Monday through Friday. To accomplish this, perform the following:

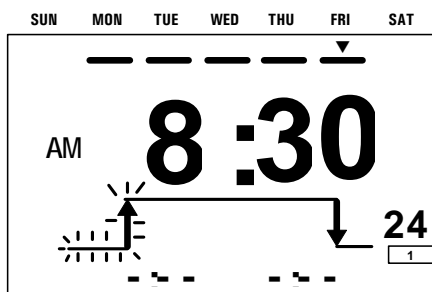
1. Enter the set **PROG1 SET MODE** by setting the **MODE SWITCH** in the **P1** position. The initial **PROG1** display will appear:



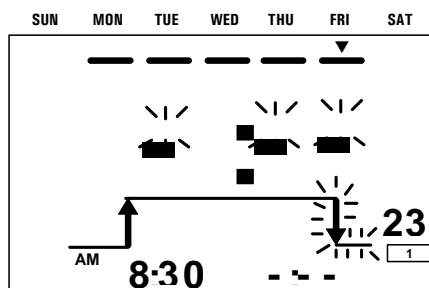
2. Using the **SHIFT** and **SET** keys, select Monday through Friday. All bars at the positions of Monday through Friday indicate that they are turned on.



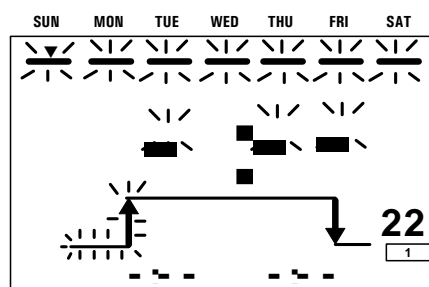
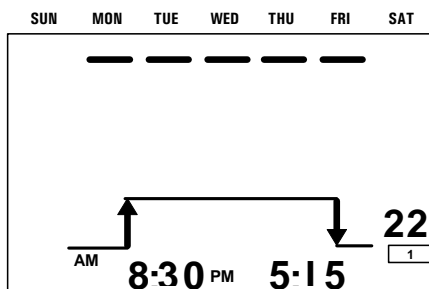
3. Using the **h** and **m** **KEYS**, set the time the program will begin to operate to 8:30 am.



4. Press the **WRITE KEY** to enter this setting into memory. If the day, hour, or minute have not been set, the specified time and day will not be entered into memory when the **WRITE KEY** is pressed. Once the **WRITE KEY** is pressed, the timer will display the next available setting in **PROG1**. In this case, the timer will display the time the operation will stop.



5. In **PROG1** or **PROG2 SET MODE**, when either the **h** or **m** **KEY** is pressed after setting a time, the previously set time will be displayed first. Using the **h** and **m** **KEYS**, set the time (5:15 pm) you want the program to stop. Press the **WRITE KEY** to enter this time into memory. Once the **WRITE KEY** is pressed, the complete operation will be displayed for one second, after which the display will return to the initial **PROG1 SET MODE DISPLAY**. The number of programmable operation steps remaining displayed in the lower right hand corner.



 **NOTE:**

The procedure for **PROG2** is identical. To perform this procedure for **PROG2**, set the **MODE SWITCH** in the **P2** position.

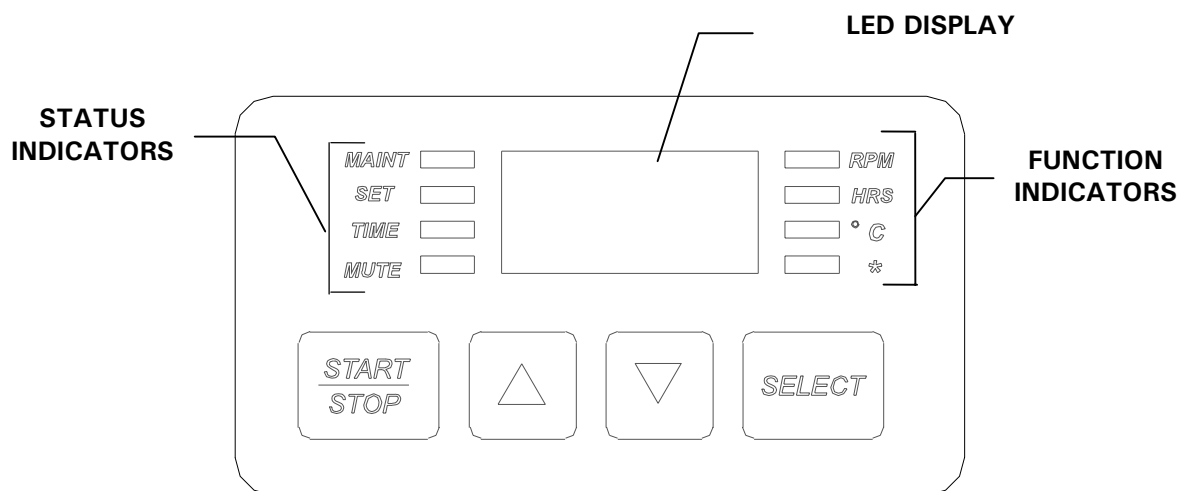
 **NOTE:**

Return the **OUTPUT SWITCH** to the **AUTO** position for **PROG1** and **PROG2**, and set the **MODE SWITCH** to the **RUN** position. When the **MODE SWITCH** is set to the **P1** or **P2** position, the timer does not operate automatically and the output of the timer turns off.

6.3 Sample Program

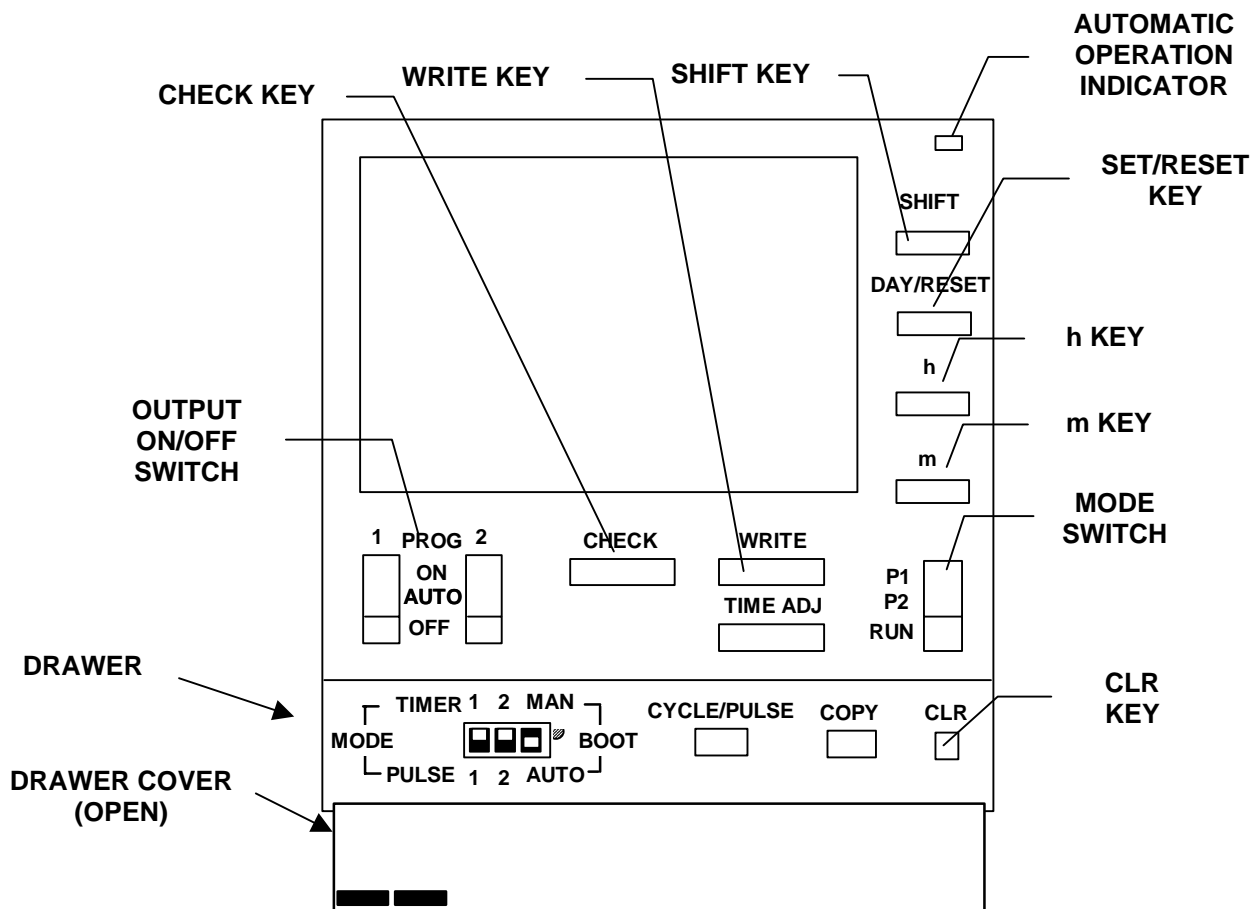
One of the most frequently used electronically timed programs permits an operator to leave a culture unattended over a weekend or for some other period of time. It is desirable to maintain a viable culture while minimizing metabolic activity during that period. A simple application of Multiday Programming (*see also Section 6.4*) will meet those needs.

In the following example, at 4:45 pm Friday, **PROG1** will automatically decrease the incubator temperature to the lower setpoint (4°C) which you have pre-programmed. Then, at 7:45 Monday morning, **PROG1** will raise the temperature to your default setpoint (37°C). We will allow time for the temperature to change setpoint, so **PROG2** will stop the shaker at 5:00 pm Friday and start it again at 8:00 Monday morning. In this way, a healthy no-growth environment will be created and maintained during the absence of the operator.



1. Check or Reset Alternate Temperature (*)
2. Press the **SELECT** KEY on the **CONTROL PANEL KEYPAD** until the * **FUNCTION INDICATOR** illuminates.
3. Press the Δ or the ∇ KEY once.
4. If it does not display 4, press the Δ or the ∇ KEY until it says 4.
5. Check or Reset Default Temperature (°C)

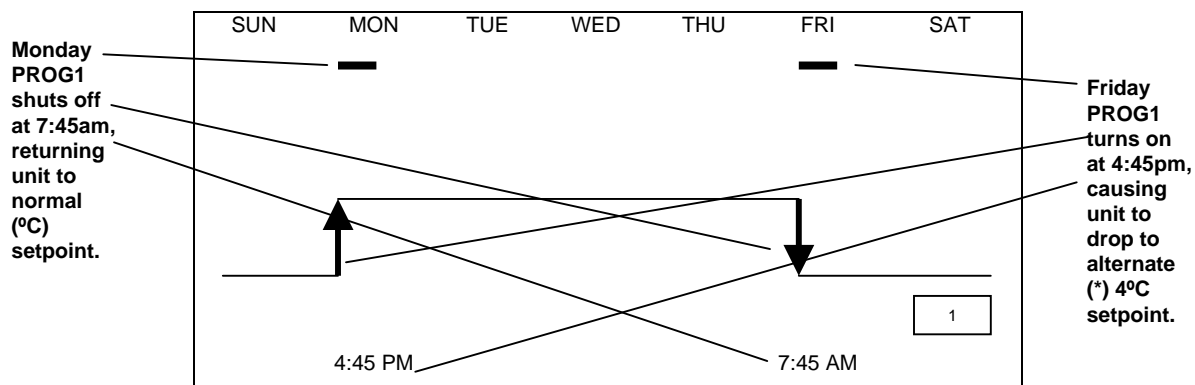
6. Press the **SELECT KEY** on the **CONTROL PANEL KEYPAD** until the **°C FUNCTION INDICATOR** illuminates.
7. Press the **Δ** or the **∇** **KEY** once.
8. If it does not display 37, press the **Δ** or the **∇** **KEY** until it says 37.
9. Make sure that the **HOUR TIMER** is off.
10. Press the **SELECT KEY** on the **CONTROL PANEL KEYPAD** until the **HRS FUNCTION INDICATOR** illuminates.
11. Press either the **Δ** **KEY** or the **∇** **KEY** until the **SET STATUS INDICATOR** is lit.
12. Press the **START/STOP KEY**. The **TIME STATUS INDICATOR** will go out and the **LED DISPLAY** will read OFF.



6.3.1 Set Program 1

1. Set the electronic timer's **MODE SWITCH** in the **P1** position to enter the **PROG1 SET MODE**.
2. Press the **SHIFT KEY** until the cursor (**▼**) arrives at Friday.
3. Press the **SET KEY**. A bar will appear in the Friday position.
4. Press **h** until **pm 4:--** appears in the timer display.
5. Press **m** until **45** appears.
6. Press the **WRITE KEY** to enter your choices into memory.

7. Press the **SET KEY** once, then press the **SHIFT KEY** until the cursor (▼) arrives at Monday.
8. Press the **SET KEY**. A bar will appear in the Monday position.
9. Press **h** until **am 7:--** appears in the timer display.
10. Press **m** until **45** appears.



11. Press the **WRITE KEY** to enter your choices into memory. **PROG1** programming is now complete.
12. Set the **PROG1 OUTPUT** to the **AUTO** position.



NOTE:

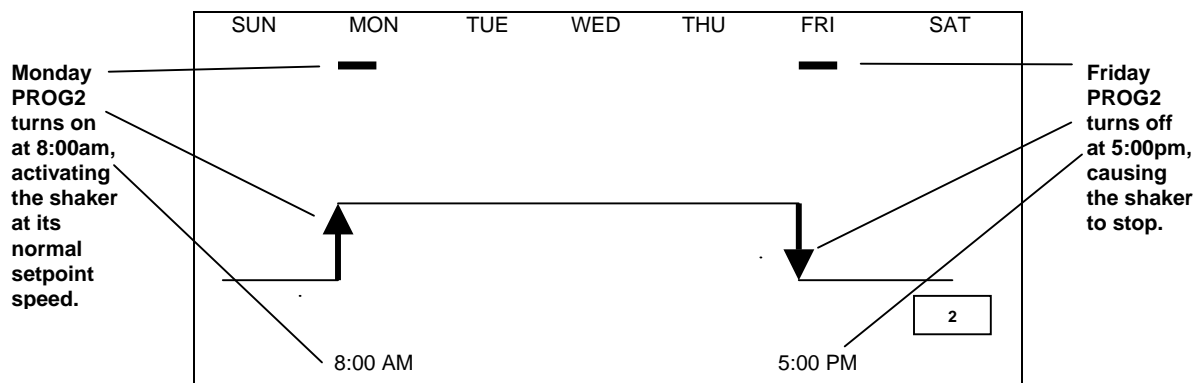
When the electronic timer is programmed and turned on, it shows the current time in large numbers, in the center of the display is current. The blinking day bar above and the blinking time in the timing chart display below indicate the next operation *according to the sequence the operations were entered into the program*. This may not be the next operation to occur in time. To check the settings, see Sections 6.3 and 6.6.

6.3.2 Set Program 2.

When **PROG2** is on, the shaker is on. We are now going to program the shaker to be on during the week and off over the weekend.

1. Set the **MODE SWITCH** in the **P2** position to enter the **PROG2 SET MODE**.
2. Press the **SHIFT KEY** until the cursor (▼) arrives at Monday.
3. Press the **SET KEY**. A bar will appear in the Monday position.
4. Press **h** until **am 8:--** appears in the timer display.
5. Press **m** until **00** appears.
6. Press the **WRITE KEY** to enter your choices into memory.
7. Press the **SET KEY** once, then press the **SHIFT KEY** until the cursor (▼) arrives at Friday.
8. Press the **SET KEY**. A bar will appear in the Friday position.

9. Press **h** until **pm 8:--** appears in the timer display.
10. Press **m** until **00** appears.
11. Press the **WRITE KEY** to enter your choices into memory. **PROG1** programming is now complete.



12. Set the **PROG2 OUTPUT SWITCH** to the **AUTO** position.

6.3.3 Activate Programmed Control

Set the **MODE SWITCH** to **RUN**.

The 4335 conditions should revert to normal settings if your current time is not between Friday 4:45pm and Monday 7:45am. If the shaker should be on but is not, use the **KEYPAD** to check the **RPM FUNCTION INDICATOR**. If it reads **OFF**, press the **START/STOP KEY** to restart the shaker. If it reads **lid**, either the lid is ajar or the electronic timer setting is incorrect. Make appropriate corrections.

If the alarm is activated, it will sound at 4:45 pm on Friday until the alternate temperature setpoint is reached. To mute the alarm, follow the simple steps in Section 7.5.

When **PROG2** turns off and the shaker stops, the console **LED** display for RPM will read **lid**. This is normal. On Monday morning, when the program turns itself back on, the shaker will return to its setpoint speed, and the **lid** message will disappear.

If you wish to view your program settings in time sequence, press the **CHECK** key. This is for viewing only. Each time the key is pressed, the pre-set operations are displayed in sequence, beginning with **PROG1**. After scrolling through all the operations in **PROG1**, the display will scroll through **PROG2** operations. Finally, it will return to the real time (current) display.

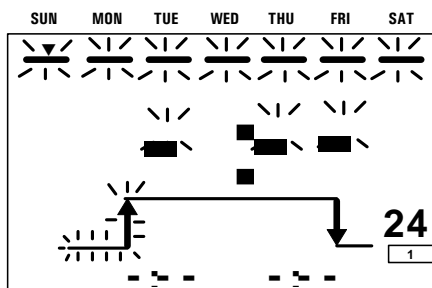
If you wish to view your program settings in sequence with the possibility of making corrections or changes, see Section 6.6.

At any time you can clear programs by setting the **MODE SWITCH** to the desired program (**P1** or **P2**), opening the timer drawer, and pressing the **CLEAR** button until the display reads **Clr.** (See also Section 6.8)

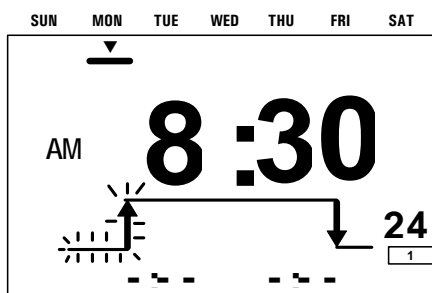
6.4 Multiday Operation

In this example, **PROG1** will operate at 8:30 am on Monday and stop at 0:00 pm on Saturday. To accomplish this, perform the following:

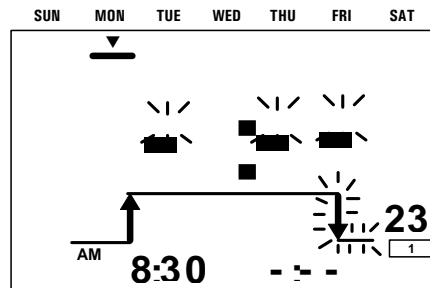
1. Enter the set **PROG1 SET MODE** by setting the **MODE SWITCH** in the **P1** position. The initial **PROG1** display will appear:



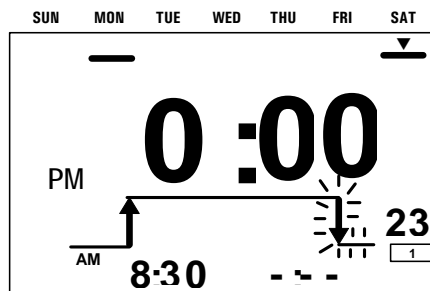
2. Using the **SHIFT** and **SET KEYS**, select Monday as the day of the week that this operation will start. A bar displayed in the Monday position signifies that the day of the week is turned on. Using the **h** and **m KEYS**, set the time the program will begin to operate to 8:30 am.



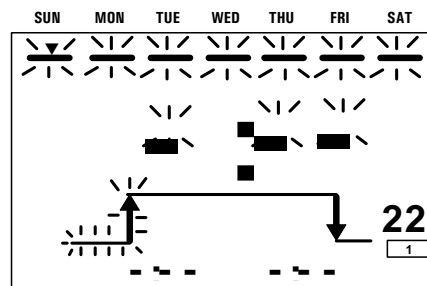
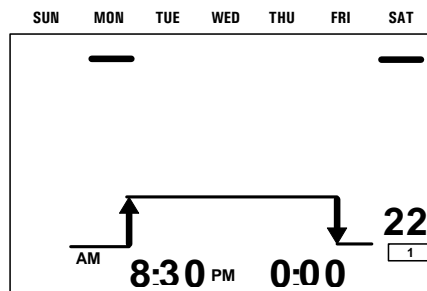
3. Press the **WRITE KEY** to enter this operation in memory. The timer will display the next operation to be programmed.



4. Press the **SET KEY** to cancel Monday. Use the **SHIFT** and **SET KEYS** to select Saturday.



5. Using the **h** and **m KEYS**, set the time to 0:00 pm. Press the **WRITE KEY** to enter this setting into memory. The timer will display the complete operation for approximately one second, then the display will return to the initial **PROG1 SET MODE DISPLAY**, with the number of programmable operation steps remaining displayed in the lower right hand corner.



**NOTE:**

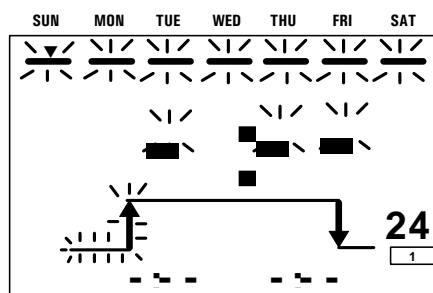
The procedure is identical for **PROG2**. To perform this procedure for **PROG2**, set the **MODE SWITCH** in the **P2** position.

- After setting **PROG1** and **PROG2**, set the **OUTPUT SWITCH** to **AUTO** for **PROG1** and **PROG2**, and set the **MODE SWITCH** to the **RUN** position to run the unit with programmed control.

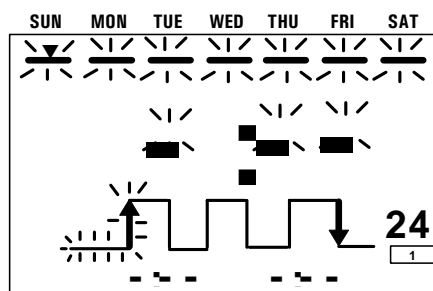
6.5 Cyclic Operation

The **ELECTRONIC TIMER** can be programmed for cyclic operations. In other words, the timer can be programmed to turn on and off at predetermined intervals repeatedly over a given time period. In this example, **PROG1** will be set to turn **ON** for 2 minutes and **OFF** for one minute repeatedly from 8:30 am to 5:30 pm on Monday. To program the electronic timer for this operation, perform the following:

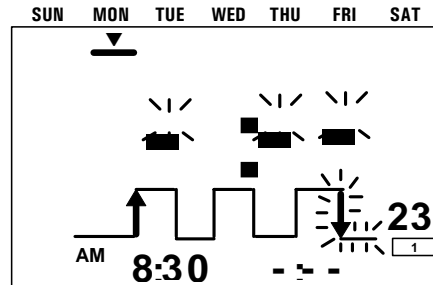
- Enter the set **PROG1 SET MODE** by setting the **MODE SWITCH** in the **P1** position. The initial **PROG1** display will appear:



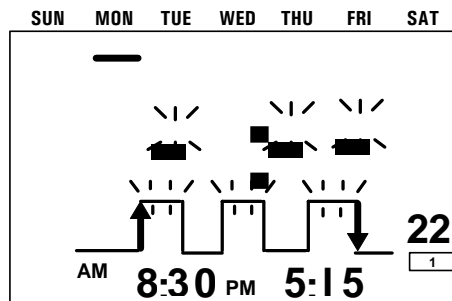
- Open the lower drawer of the timer by pulling the cover down, and press the **CYCLE KEY**. The timer will enter the **CYCLE PROGRAM MODE**.



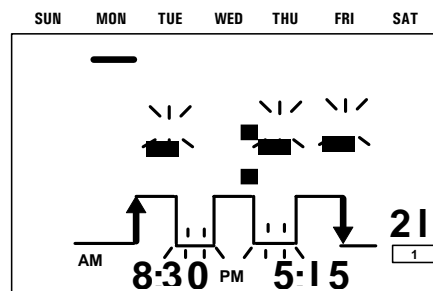
3. Using the **SHIFT** and **SET KEYS**, select the day of the week that the cycle operation is to start. In this example, the cycle is to be performed on Monday. Using the **h** and **m KEYS**, set the time the cycle operation will begin on Monday to 8:30 am. Press the **WRITE KEY** to enter this setting into memory.



4. Using the **SHIFT**, **SET**, **h** and **m KEYS**, set the day and time the timer will stop the cycle operation. In this example, the timer will cease to cycle on Monday at 5:15 pm. Press the **WRITE KEY** to enter these settings into memory. The timer will then prompt you to enter in the on-cycle time.

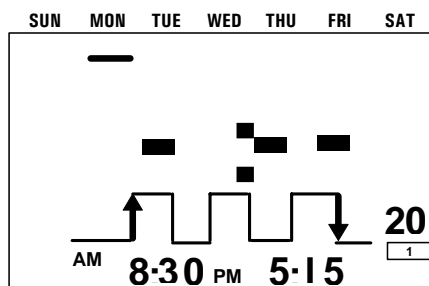


5. Using the **h** and **m KEYS**, set the span of time that the switch will be on to 0:02 (2 minutes). Please note that the cycle-on or cycle-off time cannot be set to 0:00. Press the **WRITE KEY** to enter this value into memory. The timer will then prompt for the off-cycle time.



6. Using the **h** and **m KEYS**, set the span of time that the switch will be off 0:01 (1 minute). Press the **WRITE KEY** to enter this value into memory. Please note that the cycle-on or cycle-off time cannot be set to 0:00. The timer will display the complete operation for approximately one second, then the display will return to the initial

PROG1 SET MODE DISPLAY, with the number of programmable operation steps remaining displayed in the lower right hand corner.



7. Set the **MODE SWITCH** to the **RUN** position to exit the **PROG1** set mode.



NOTE:

The procedure is identical for **PROG2**. To perform this procedure for **PROG2**, set the **MODE SWITCH** in the **P2** position.

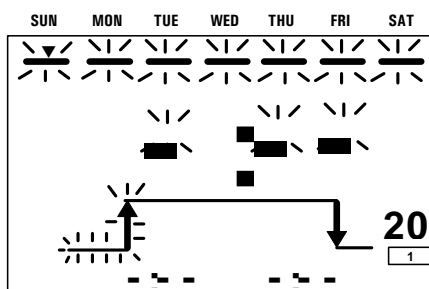
8. Set the **OUTPUT SWITCH** to the **AUTO** position to run the unit with programmed control.

6.6 Viewing Programs

The timed operations for **PROG1** or **PROG2** can be viewed in either the **PROG1** and **PROG2 SET MODE**, or in **RUN MODE**. To view previously set programs in the **ELECTRONIC TIMER**, perform the following:

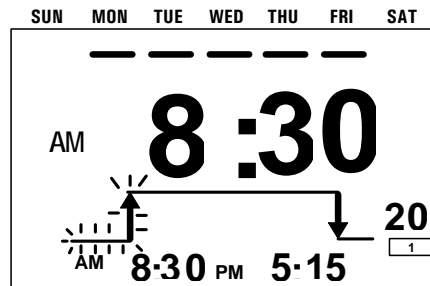
6.6.1 PROG1 or PROG2 Set Mode

1. Enter the set **PROG1 SET MODE** by setting the **MODE SWITCH** in the **P1** position. The initial **PROG1** display will appear:

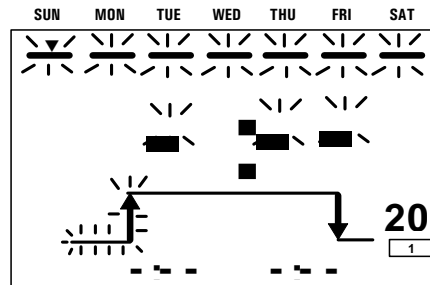


2. Press the **WRITE KEY**. If it is necessary to change the setting, do so with the necessary keys and press the **WRITE KEY** to enter these values into memory.

Each time the **WRITE KEY** is pressed, the programmed times are displayed in the order that they were set.



3. Continue to press the **WRITE KEY** to view the programmed (set) times. After all the operations have been displayed, the initial **PROG1** display will appear in the display.

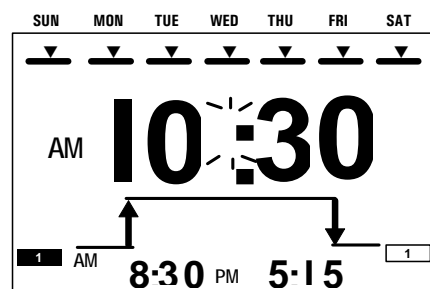


NOTE:

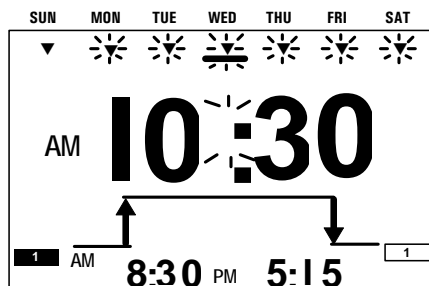
This procedure is identical for **PROG2**. To perform this procedure for **PROG2**, set the **MODE SWITCH** in the **P2** position.

6.6.2 RUN Mode

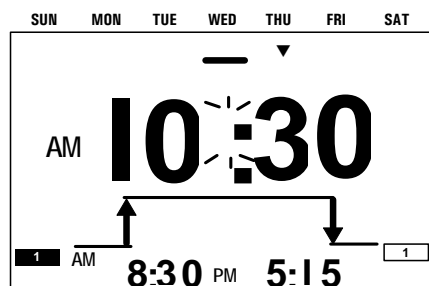
In **RUN MODE**, the operations for both **PROG1** and **PROG2** can be viewed by the day. In the following example, the current day of the week is Wednesday, and the timer operations to be performed on Thursday will be checked.



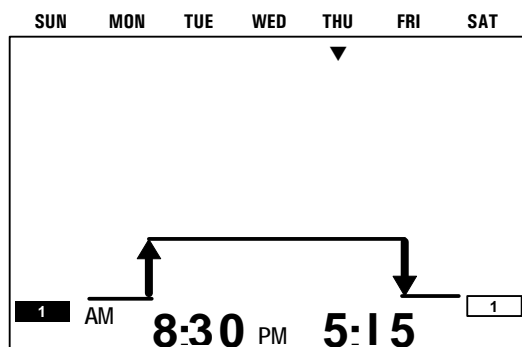
1. Press the **SHIFT KEY**. The cursor (denoted by a solid ▼) will initially appear in the Sunday position. In all other days of the week the ▼ will be blinking.



2. Press the **SHIFT KEY** to stop the blinking of the cursor (▼) at the Thursday position, and press the **SET KEY**.



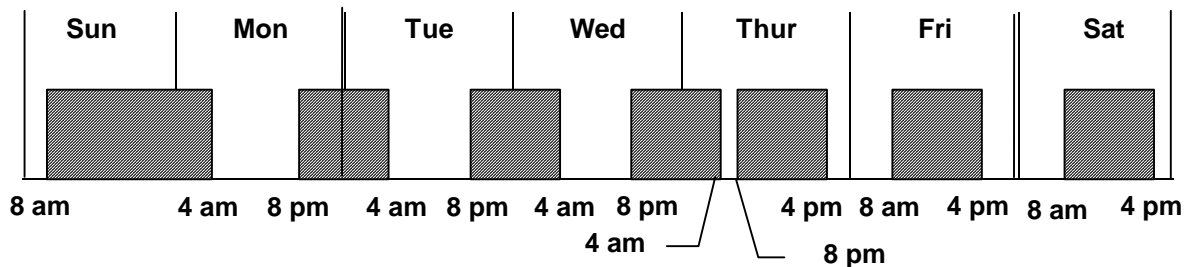
3. Open the lower drawer of the timer and press the **CHECK KEY**. Each time this key is pressed, the operation schedule is displayed in the sequence the operations are to be executed. The **ON** and **OFF** times for **PROG1** are displayed, starting with the earliest **ON** time. Then the times set for **PROG2** are displayed. After all the set times of both programs have been displayed, the timer returns to the **RUN** display.



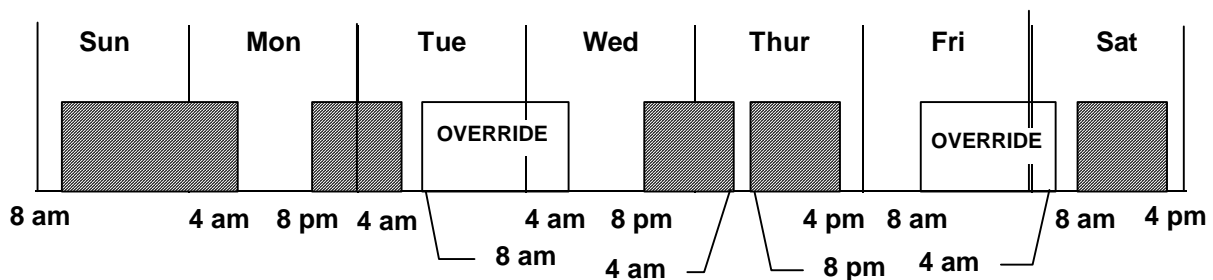
6.7 Day Override

Circumstances may require that the timer operations for a given day be executed on another. The override function affects both **PROG1** and **PROG2**. If an override is executed for a particular day, the settings of both programs are transferred to that day.

When you use the day override function, the operation that is transposed to another takes precedence. For example, consider the following control scheme:



It is desired to perform Sunday-Monday's programming on both Tuesday and Friday. Using the day override function, the control scheme becomes:



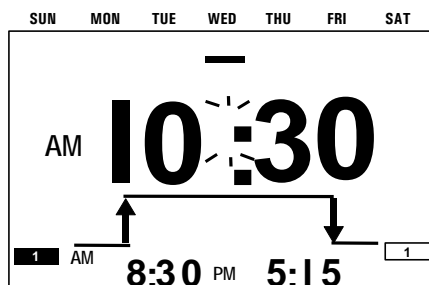
In this case, the programmed operation of Sunday-Monday is transposed upon Tuesday and Friday. On Tuesday, the switch output of the timer is turned on at 8:00 am (Sunday's time) instead of the original programmed time of 8:00 pm. The switch output of the timer is then turned off the following day, Wednesday, at 4:00 am. The same occurs for Friday.

When the day override function is used, the timer executes the newly set program for only one week from the day next to when the program is set. In other words, if the override function is set on Monday, it will execute and stay in memory until Tuesday. Afterward, the timer operates to the previous programming scheme.

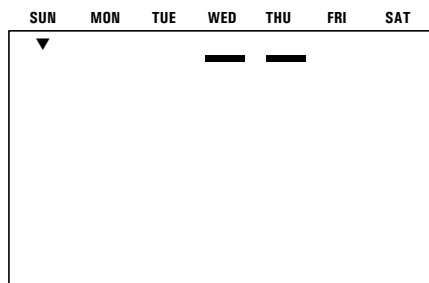
6.7.1 Setting an Override

In the following example, the timer operations for Wednesday and Thursday will be overridden with Sunday's. To transpose Sunday's operations onto Wednesday and Thursday, do the following:

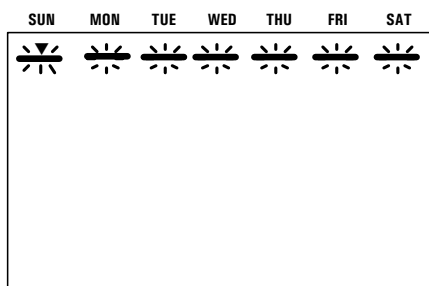
1. Verify that the timer is in **RUN MODE**. If it is not, place the **MODE SWITCH** in the **RUN** position.



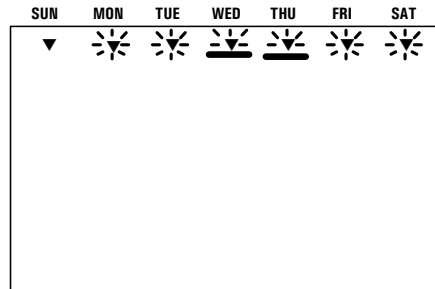
2. Open the lower drawer of the timer and hold down the **COPY KEY** for one second or more.
3. If an override has been previously set, the following display will appear. To change the setting of that day, cancel it once and specify the new setting using the **SHIFT** and **SET KEYS**.



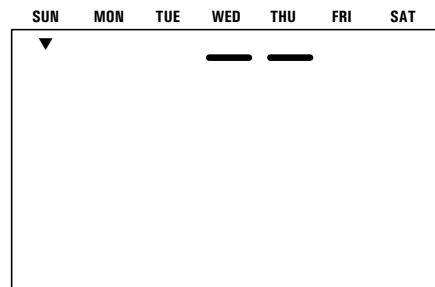
4. If no override has been previously set, the following display will appear:



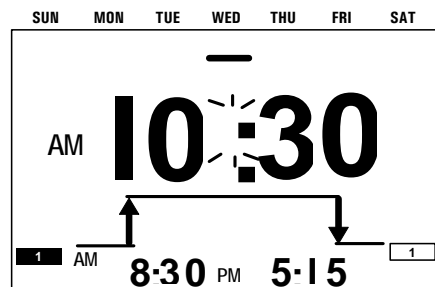
5. Using the **SHIFT** and **SET KEYS**, select both Wednesday and Thursday as the days to be overridden.



- Using the **SHIFT** and **SET KEYS**, select Sunday as the program that will be used on Wednesday and Thursday.



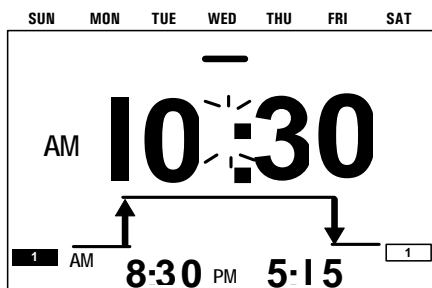
- Press the **WRITE KEY** to enter this override into memory. The override will stay in the timer's memory for one week and a day (until the following Monday). Afterward, the timer will operate at its previously set programming scheme.



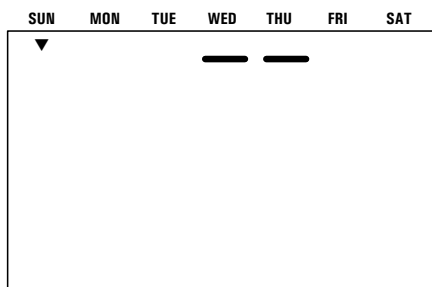
6.7.2 Cancelling an Override

To cancel a day override, do the following:

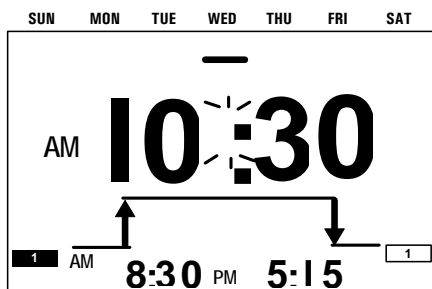
- Verify that the timer is in **RUN MODE**. If it is not, place the **MODE SWITCH** in the **RUN** position.



2. Open the lower drawer of the timer, and hold down the **COPY KEY** for one second or more.



3. Press the **CLR KEY**. The display will return to **RUN MODE**.

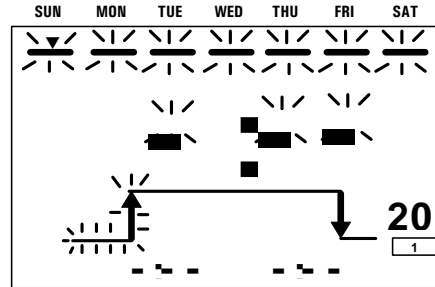


6.8 *Clearing/Canceling Programs*

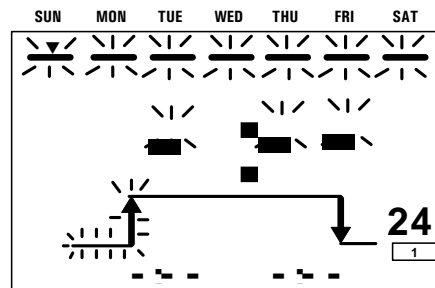
To clear previously set programs in the **ELECTRONIC TIMER** memory, do the following:

6.8.1 **PROG1 or PROG2 Setting**

1. Enter the **PROG1 SET MODE** by setting the **MODE SWITCH** in the **P1** position.



2. Open the lower drawer of the timer, and press the **CLR KEY**. The display will revert to the initial **PROG1 SET MODE DISPLAY**, and the number of steps remaining will be increased by the number of steps cleared in Program 1.



NOTE:

This procedure is identical for **PROG2**. To perform this procedure for **PROG2**, set the **MODE SWITCH** in the **P2** position.

7 OPERATION

The Innova 4335 can be operated in four different modes depending upon the application. The modes incorporate the various features that are unique to the Innova 4335, and are dependent upon timed operation. They are as follows:

Control Mode	Output On/Off Switch		Keypad HRS
	Prog1	Prog2	
Continuous	Off	On	Off
Innova Timer*	Off	On	0.1 - 99.9
Programmed Temp	Auto	Off	Off
Programmed Shake	Off	Auto	Off

* Not a recommended mode of operation

7.1 Starting the Shaker

To initially start the shaker, close the lid and turn the **ON/OFF SWITCH** on the front panel of shaker to the **ON** position. If 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 stopped or started by pressing the **START/STOP KEY**.



NOTE:

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

7.2 Continuous Mode

CONTINUOUS or **UNLIMITED MODE** is when the unit is operated as a shaker for an unspecified time. To run the unit in continuous mode, do the following:

1. Close the lid.
2. Verify that the **OUTPUT ON/OFF SWITCH** on the **ELECTRONIC TIMER** for **PROG1** is in the **OFF** position and in the **ON** position for **PROG2**.
3. Turn on the Innova 4335 by setting the **ON/OFF SWITCH** of the shaker to the **ON** position.
4. Using the **KEYPAD**, verify that the shaker is **OFF** by pressing the **SELECT KEY** until the **RPM** indicator is illuminated. If the word **OFF** appears in the display, the shaker is **OFF**. If a numeric value appears in the display, press the **START/STOP KEY** to stop the shaker.
5. Press the **SELECT KEY** until **HRS** indicator is illuminated. Verify that the word **OFF** appears on the **LED DISPLAY**. If not, press the **START/STOP KEY** to disable the **HRS** function.

6. Press **SELECT KEY** until the **RPM INDICATOR** is illuminated.
7. Press either **▲** or **▼ KEYS** to enter the **SET MODE** (the **SET INDICATOR** will illuminate).
8. Set the speed by using the **▲** or **▼ KEYS** until the desired setpoint is displayed.
9. Press the **START/STOP KEY** to start the shaker. A numeric value will appear in the display indicating that the shaker is operating.

**NOTE:**

The setpoint may be changed during a run without stopping the shaker by following steps 2-4. 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. Press either **▲** or **▼ KEYS** 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 Innova Timer Mode

The **INNOVA TIMER MODE** utilizes the keypad **HRS** function to automatically stop after a preset time period of 0.1 hour - 99.9 hours. In order to set the **HRS** function, the **OUTPUT ON/OFF SWITCH** of the **ELECTRONIC TIMER** for **PROG2** must be set to the **ON** position. The following instructions illustrate how to set the **HRS** function with the shaker stopped. However, a timed run can be initiated while the unit is either shaking or stopped. To set the **HRS** function with the shaker stopped, do the following:

**NOTE:**

To avoid confusion between the **ELECTRONIC TIMER** and the timer function on the **KEYPAD**, it is recommended that the **INNOVA TIMER MODE** should not be used for timed experiments.

1. Verify that the **OUTPUT ON/OFF SWITCH** on the **ELECTRONIC TIMER** for **PROG1** is in the **OFF** position and in the **ON** position for **PROG2**.

2. Using the **KEYPAD**, verify that the shaker is **OFF** by pressing the **SELECT KEY** until the **RPM** indicator is illuminated. If the word **OFF** appears in the display, the shaker is **OFF**. If a numeric value appears in the display, press the **START/STOP KEY** to stop the shaker.
3. Press either **▲** or **▼ KEYS** to enter the **SET MODE** (the **SET INDICATOR** will illuminate).
4. Set the speed by using the **▲** or **▼ KEYS** until the desired setpoint is displayed.
5. Press the **SELECT KEY** until the **HRS INDICATOR** is illuminated.
6. Press either **▲** or **▼ KEYS** to enter the **SET MODE** and set **HRS** to any value between 0.1 - 99.9 hours.
7. 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”.
8. To disable the visual alarm (flashing **TIME INDICATOR**), press the **SELECT KEY** and change to any other function on the keypad.

To cancel the timer without stopping the shaker:

1. Press the **SELECT KEY** until the **HRS INDICATOR** is illuminated.
2. Press either **▲** or **▼ KEYS** to enter the **SET MODE**, 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 4335 is equipped with an audible and visual alarm that is activated at predetermined times. It may be deactivated in the following way:

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

The alarm may be reactivated by repeating the previous steps. The **MUTE INDICATOR** will turn off when the alarm has been reactivated.

To disable the visual alarm:

- Press the **SELECT KEY** and change to any other function.

7.6 Primary Temperature Setpoint

Press the **SELECT KEY** until the function **°C INDICATOR** illuminates. The temperature can be set from 17°C below the current ambient temperature up to 60.0°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 of the may be shut off during set-up for special investigations. To deactivate the temperature control system, do the following:

1. To deactivate the temperature control system press and hold the **▼ KEY** until the setpoint is at 4.0°C.
2. Holding the **▼ KEY**, press the **START/STOP KEY**. The temperature setpoint display shows **OFF** and both the heater and the refrigeration system are deactivated.
3. To reactivate the temperature controller, press the **▲ KEY** until the desired temperature setpoint is displayed.

7.7 Programmed Temp Mode

This Innova 4335 allows a secondary or alternate temperature setpoint to be entered. **PROG1** of the programmable **ELECTRONIC TIMER** determines whether the Innova 4335 operates at a primary or alternate/secondary temperature setpoint. When the status indicator of **PROG1** is **ON** the unit is operating at the alternate temperature setpoint. In this mode, the primary temperature setpoint (°C) must be the lower temperature and the alternate/secondary temperature (*) must be the higher temperature setpoint.

This is accomplished by setting the **OUTPUT ON/OFF SWITCH** for **PROG1** of the **ELECTRONIC TIMER** to the **ON** or **AUTO** position. If the switch is in the **ON** position, the unit will operate entirely at the alternate temperature setting. If the switch is in the **AUTO** position, the unit will operate at the primary temperature setpoint until programmed to run at the alternate. To operate the unit in **PROGRAMMED TEMP MODE**, do the following:

1. Turn the unit on.
2. Verify that the shaker is **OFF**.
3. Verify that the **HRS** function on the keypad is **OFF**.
4. Create a timed or cycle program for the alternate temperature setpoint on **PROG1** of the **ELECTRONIC TIMER**.
5. Set the **OUTPUT ON/OFF SWITCH** for **PROG1** of the **ELECTRONIC TIMER** to either the **ON** or **AUTO** position, depending upon the application.

6. Press the **SELECT KEY** on the keypad until the * function indicator lights. The keypad display will show the current incubator temperature.
7. Press the **▲** or **▼ KEY** to display the alternate temperature setpoint. Use the **▲** or **▼ KEYS** while the **SET INDICATOR** is illuminated to adjust the alternate temperature setpoint to the desired value.
8. Start the shaker.

7.8 *Programmed Shake Mode*

The **PROGRAMMED SHAKE MODE** utilizes the electronic timer to start and stop the shaker at preset intervals (cycles) or at specific times. **PROG2** of the **ELECTRONIC TIMER** controls this function.

To operate the unit in **PROGRAMMED SHAKE MODE**, do the following:

1. Turn the unit on.
2. Verify that the shaker is **OFF**.
3. Verify that the keypad **HRS** function on the keypad is **OFF**.
4. Create a timed or cycle program for the shaker to be turned on and off in **PROG2** of the electronic timer.
5. Set **OUTPUT ON/OFF SWITCH** for **PROG2** of the **ELECTRONIC TIMER** to the **AUTO** position. If this switch is in the **ON** position, the timer will bypass all programming, and the shaker will operate. If the switch is in the **OFF** position, the unit will operate as though the lid were not closed. The shaker will not operate and the word **LID** will appear in the **LED DISPLAY**.
6. Press **SELECT KEY** until the **RPM INDICATOR** is illuminated
7. Press either **▲** or **▼ KEYS** to enter the **SET MODE** (**SET INDICATOR** will illuminate).
8. Set the speed by using the **▲** or **▼ KEYS** until the desired setpoint is displayed.
9. Press the **START/STOP KEY** to start the shaker.



NOTE:

The Innova 4335 can be operated in both PROGRAMMED SHAKE and PROGRAMMED TEMP MODES simultaneously. To operate the unit in this mode, follow the procedures for both modes. Set OUTPUT ON/OFF SWITCH for both PROG1 and PROG2 of the ELECTRONIC TIMER to the AUTO position.

7.9 *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 **°C FUNCTION 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**.

7.10 Total Running Time

The control module of the Innova 4335 totalizes the time the shaker has been **ON** to track hours of usage. The total running time of the unit is independent of the keypad **HRS** function. To display the accumulated running time:

1. Select **HRS** using the **SELECT KEY**.
2. Simultaneously press the **▲** and **▼ SELECT 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; "10" equals 10,200 hours). This display will continue for 10 seconds and then defaults to the previous mode readout.

7.11 *Maint Indicator*

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

To deactivate the **MAINT INDICATOR**, do the following:

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

7.12 *Power Failure*

In the event of a power failure, the Innova 4335 is 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, and the electronic timer will resume its operation as programmed after the power recovery. The **LED DISPLAY** on the keypad will flash indicating that a power failure has occurred. Press any key to cease the flashing in the display.

To start the shaker:

1. Press **SELECT KEY** until the **RPM INDICATOR** is illuminated
2. Press either **▲** or **▼ KEYS** to enter the **SET MODE** (the **SET INDICATOR** will illuminate).
3. Set the speed by using the **▲** or **▼ KEYS** until the desired setpoint is displayed.
4. Press the **START/STOP KEY** to start the shaker.

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8 PREVENTIVE MAINTENANCE

Preventive maintenance keeps the equipment in proper working condition. When periodically performed, maintenance results in a longer life of the equipment and reduces time lost due to equipment failure.



WARNING!
Always turn off the MAIN POWER SWITCH and disconnect the power cord before performing any adjustments or maintenance.

8.1 *Cleaning*

The exterior painted surfaces can normally be cleaned with a damp cloth and, if necessary, standard household or laboratory cleaners. DO NOT use any abrasive or corrosive compounds to clean this instrument, as they may damage the unit and void the warranty.

The viewing window is glass; it can be cleaned with any household or laboratory glass cleaner or polish.

8.2 *Condenser Coil*

The condenser coil is in the rear lower section of the unit. Like a household refrigerator, this coil will collect dust and reduce the cooling capacity. Every 3 months of usage, the back covers should be removed (after removing the power plug), and the coil and surrounding area should be vacuumed. If the unit is in a dusty environment, this should be done more often.

**WARNING!**

The following section describes basic troubleshooting service procedures that must be performed by a qualified service engineer **ONLY**.

8.3 Changing Fuses

The unit is designed utilizing a circuit breaker that is used as an **ON/OFF SWITCH**. There are two fuses on the left side of the unit. One is to protect the control circuitry, and the other is to protect the motor circuit.

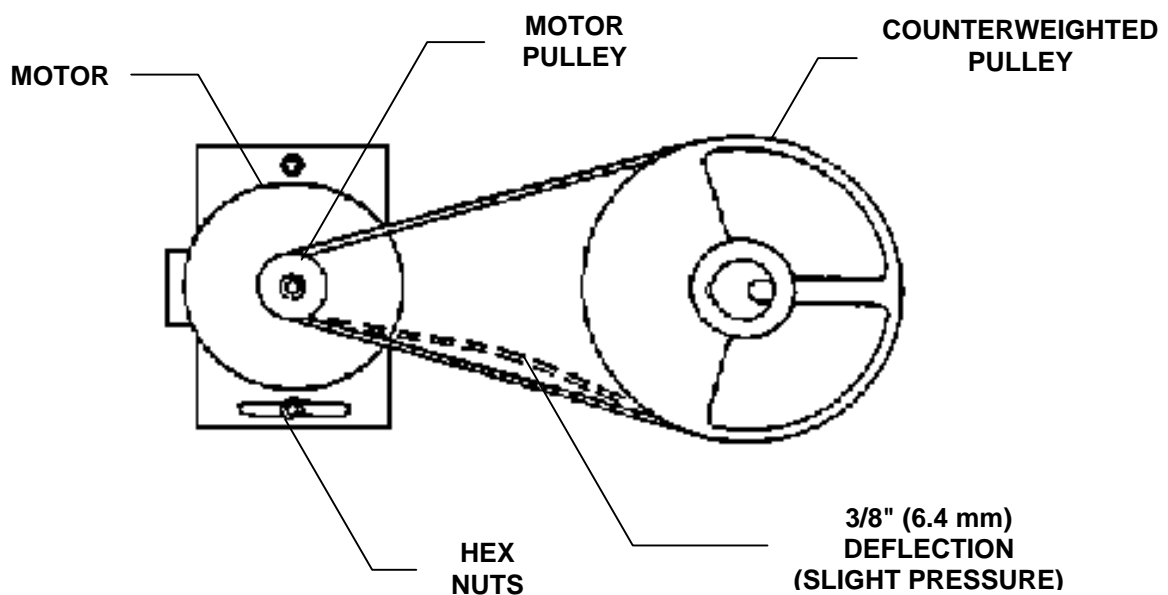
The third fuse holder, marked "lamp", is not used on the Innova 4335.

To remove either fuse, insert a small flat-bladed screwdriver and turn counterclockwise until it disengages and the fuse holder springs free. Check the fuse. If it has failed, replace the fuse with a like fuse as identified in the Spare Parts List. Spare fuses are supplied with the unit.

8.4 Belt Replacement

1. Turn off the power and remove the power cord.
2. Remove the lower front cover using a Phillips (+) screwdriver.

Figure 13: Belt Replacement



3. Rotate the large pulley and exert a light pressure to the belt so the belt feeds out of the pulley groove.
4. Install a new belt by feeding onto the motor pulley and guiding it onto the large pulley while rotating the small pulley.



WARNING!

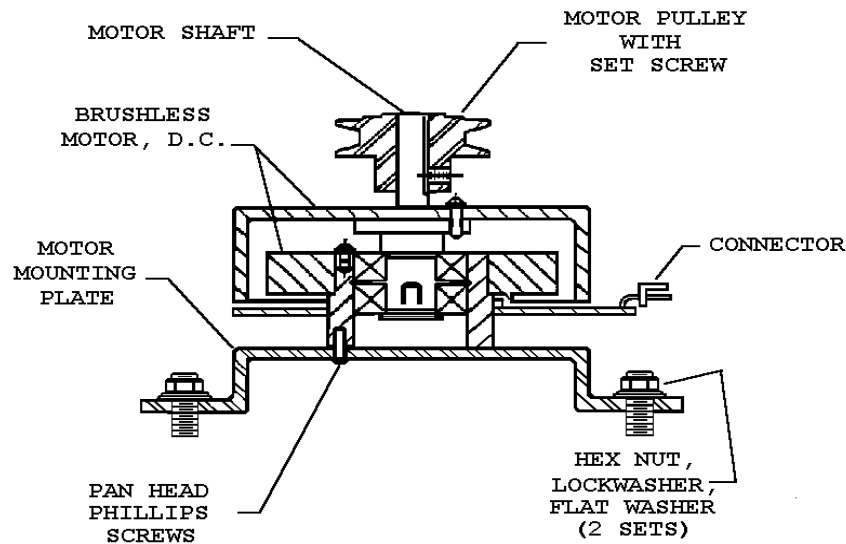
Keep fingers clear to avoid pinching them between the belt and the pulley(s).

5. Check the belt tension with a light side pressure near the center of the belt. It should deflect approximately 3/8 inch (6.4 mm). If adjustment is needed, loosen the two nuts holding the motor plate and move the plate to either loosen or tighten the belt. Tighten the nuts when the adjustment is correct.
6. Reinstall the lower front cover.
7. Reconnect the power cord.

8.5 Motor Assembly Replacement

1. Turn off the power and disconnect the power cord.
2. Remove the lower front cover using a Phillips (+) screwdriver.

Figure 14: Motor Assembly Replacement



3. Remove the connector from the motor assembly.
4. Remove the green ground wire going to the chassis (disconnect from the chassis side).
5. Remove the 2 hex nuts and washers and lift out the motor and plate assembly.
6. Position the new motor assembly back onto the unit.
7. Reinstall the 2 hex nuts with hardware. Do not tighten.

8. Reinstall the belt. Adjust the motor pulley height so that the belt is level as related to the drive pulley. Tighten the set screw.
9. Rotate the large pulley by hand and see that the belt tracks smoothly. Adjust the belt tension. Tighten the 2 hex nuts.
10. Reinstall the motor connector. Be sure the motor connector is positioned so that no pins are visible and the red stripes on the cable connector are facing down.
11. Reconnect the green wire from the motor assembly to the chassis.
12. Reinstall the lower front cover.
13. Reconnect the power cord.

8.6 ESD Precautions



WARNING!

Do NOT attempt to change boards or electronic components unless you are a qualified service technician.

Integrated circuits are extremely susceptible to damage from electrostatic discharge. Be sure to read and follow the precautions in the section below before proceeding.

1. Do not remove components from their antistatic packaging until you are ready to insert them into their sockets or to install the board.
2. Before handling components or boards, touch an unpainted portion of the system unit chassis for a few seconds.
3. Wear a wrist grounding strap, available from most electronic component stores.

8.7 Replacement of Main Control Board

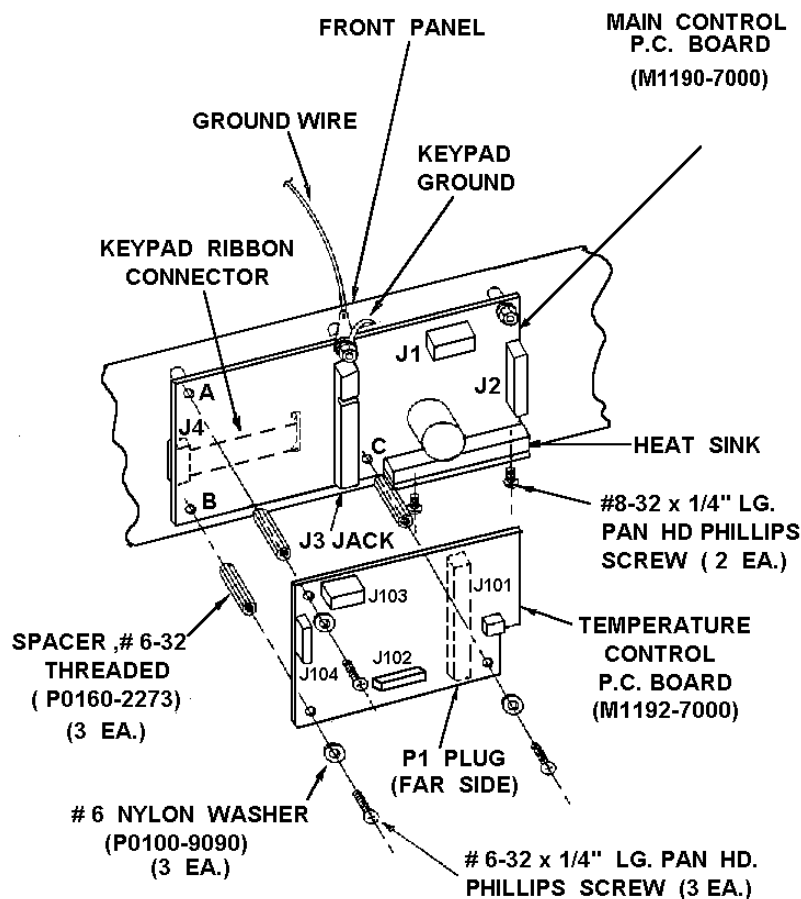


WARNING!

ESD precautions (see section above) must be followed when handling circuit boards and electronic components.

1. Switch the shaker off and disconnect the line cord.
2. Open the lid and remove the two 3/8 inch hex nuts. These nuts are located on the back side of the front panel.
3. Carefully push the now exposed two threaded studs so that the control panel eases out from the lid.

Figure 15: Control Board Replacement



4. Disconnect the harness wiring from connectors J1, J2, J101, J102, J103 and J104.
5. Remove the temperature control board:
 - a. Remove the three 1/4 inch screws and nylon flat washers.
 - b. Disconnect the temperature control board from the main control board being careful not to damage the board-to-board connectors. Apply force perpendicular to the plane of the board. Do not lift from one end.
6. Remove the three hex spacers and two 5/16 inch hex nuts.
7. Remove the green wire and keyboard ground lead.
8. Remove the two screws that fasten the heat sink to the front panel bracket.
9. Lift the board out of the bracket assembly and disconnect the keypad connector from J4.

**NOTE:**

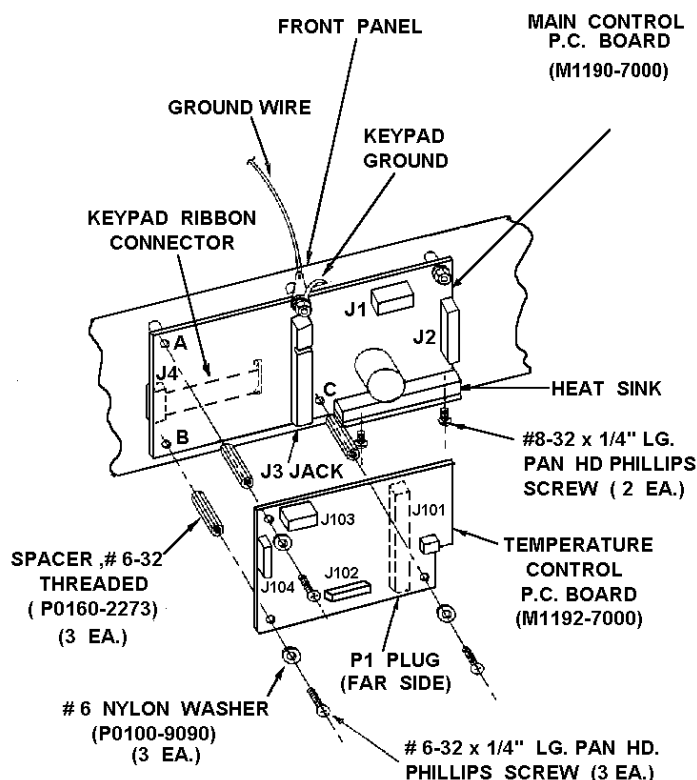
Be careful not to loose the five 1/4 inch spacers or the gray insulator.

10. Position the gray insulator on the solder side of the new main control board and connect the keypad connector to J4.
11. Make sure the five ¼ inch spacers are in place on the mounting studs and mount the new main control board.
12. Reinstall the two screws that fasten the heat sink to the bracket assembly. Do not tighten at this time.
13. Reinstall the three hex spacers, then tighten them.
14. Reinstall the keypad ground lead and the green wire from the main chassis.
15. Reinstall the two 5/16 inch hex nuts and tighten.
16. Tighten the two heat sink mounting screws.
17. Reconnect the harness wiring to connectors J1 and J2. Make sure that each connector is properly positioned (keys mate and no pins remain exposed).
18. Replace the temperature control board:
 - a. Snap the new temperature control board (M1192-7000) onto the main control board making sure the board-to-board connectors mate properly.
 - b. Reinstall the three nylon flat washers and ¼ inch screws.
 - c. Reconnect the harness wiring to connectors J101, J102, J103 and J104. Make sure that each connector is properly positioned (keys mate and no pins remain exposed).
 - d. Reinstall the panel and secure with the two 3/8 inch hex nuts.
19. Reinstall the panel and secure with the two 3/8 inch hex nuts.
20. Connect the power cord to the rear of the shaker.

8.8 *Temperature Control Board Replacement*

1. Switch the shaker **OFF** and disconnect the line cord from the rear of the shaker.
2. Open the lid and remove the two 3/8 inch hex nuts. These nuts are located on the back side of the front panel.
3. Carefully push the now exposed two threaded studs so that the control panel eases out from the lid.

Figure 15: Control Board Replacement



4. Disconnect the harness wiring from connectors J101, J102, J103 and J104.
5. Remove the three 1/4 inch screws and nylon flat washers.
6. Disconnect the temperature control board from the main control board being careful not to damage the board-to-board connectors. Apply force perpendicular to the plane of the board. Do not lift from one end.
7. Snap the new temperature control board (M1192-7000) onto the main control board making sure the board-to-board connectors mate properly.
8. Reinstall the three nylon flat washers and 1/4 inch screws.
9. Reconnect the harness wiring to connectors J101, J102, J103 and J104. Make sure that each connector is properly positioned (keys mate and no pins remain exposed).
10. Reinstall the panel and secure with the two 3/8 inch hex nuts.
11. Connect the line cord to the rear of the shaker.

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9 SPECIFICATIONS

Shaking	
Speed	25-500 rpm
Motion	1" (25.4 mm) diameter circular orbit
Indication	LED digital electric display, 1 rpm increments
Setpoint & Control	Digital adjustment with PI microprocessor control and instantaneous visual feed back ± 1 rpm.
Accuracy	± 1 rpm

Drive	
Triple eccentric counterbalanced ball bearing drive	

Shaking	
Speed	25-500 rpm
Motion	1" (25.4 mm) diameter circular orbit
Indication	LED digital electric display, 1 rpm increments
Setpoint & Control	Digital adjustment with PI microprocessor control and instantaneous visual feed back ± 1 rpm.
Accuracy	± 1 rpm

Temperature	
Range	15.0°C below ambient (4.0°C minimum) to 60.0°C (at 20°C ambient)
Control Stability	± 0.1 °C by use of PI microprocessor controller and pulse width modulation of heater
Setpoint	Digital adjustment increments within ± 0.1 °C instantaneous visual feedback
Accuracy	± 0.1 °C @ 30-40°C range ± 0.25 °C for remaining range
Uniformity	Better than $\pm .25$ °C over entire range
Safety	Heater shuts off if temperature exceeds operating range
Heater	Low watt density resistance - heater with high temperature safety thermostat
Refrigeration	1/5 HP hermetically sealed condensing unit automatically operated by digital temperature controller

Keypad Timer	
Programmable shaking periods from 0.1 hr. to 99.9 hr. by a digital timer that shuts off at the end of period and energizes status light.	
Timer counts down and digital display indicates remaining time. Can be deactivated for continuous operation. Additionally, unit will display total accumulated running time for service information.	

Operating Ambient Environment
0°C - 35°C, 90% humidity, non-condensing
Self-Diagnostic Status
Warning signal (audible and visible) indicates when shaking speed deviates more than 5 rpm or the temperature deviates more than 1.0°C from setpoint and when timer operation has expired. Audible alarm can be deactivated/activated by the operator.
Remote Monitoring
Chart recorder outputs for speed and temperature (0-5V). 1V per 100 rpm; 1V per 20°C, accuracy ± 25 mV.
Automatic Restart
Unit will automatically restart after undesired power interruption. Setpoints are maintained by non-volatile memory. Interruption is indicated by a flashing display.
Automatic Drive
Interrupt when lid is opened.
Motor
1/8 HP, 3 phase brushless ball bearing DC motor.
Electrical Service
100V, 120V, 220V, 240V; 50 OR 60 HZ; 1400 VA universal power entry system adapts to US or International requirements.
Dimensions
45" (114 cm) Wide x 28" (71 cm) Deep x 37" (94 cm) High.
Construction
Heavy gauge steel, phosphate coated and texture painted cabinet. 17" hermetically-sealed double-pane viewing window for complete chamber visibility. Stainless steel chamber (interior).
Weight
Net: 425 lb. (181 kg) Gross: 510 lb. (223 kg)
Platform Dimensions
18" x 30" (46 cm x 74.6 cm)
Inside Chamber Dimensions
34-3/4" (88.3 cm) wide x 22 1/4" (56.6 cm) deep x 19 1/4" (48.9 cm) above the platform.

10 REPLACEMENT PARTS & ACCESSORIES

When ordering replacement parts, accessory parts or requesting service information, please provide the Model Number, and Serial Number of the unit. This information is on the **ELECTRICAL SPECIFICATION PLATE**, located on the side panel of the unit.

10.1 Replacement Parts Descriptions and Part Numbers

Part Description	Ref. No.	NBS Part Number	Quantity
0.16A Fuse (Control Voltage)	F002	P0380-3710	1
1.6A Fuse (Motor Kit)	F001	P0380-3532	1
10 VA Transformer	T002	P0420-1610	1
130 VA Transformer	T001	M1191-5300	1
21000 uF Capacitor	C001	P0320-0350	1
Diode Bridge	BR001	P0460-4091	1
130V Varistor	MOV001,002	P0360-4040	2
Large Motor Assembly	M001	M1191-4000	1
Main Control Board		M1190-9941	1
Temperature Control Board		M1192-7000	1
Membrane Sw. Panel	S003-S005	M1190-5000	1
15 A Circuit Breaker	CB001	P0400-4305	1
10 A Solid State Relay	SSR001	P0400-3011	1
450 Watt Heater	HTR001,002	P0620-1381	2
RTD Assembly	RTD001	M1195-8001	1
Power Cord 120V 15A		P0720-2024	1
Power Cord 220V		P0720-2021	1
Bearing Upper Housing		B-162	3
Bearing Shielded		P0180-0282	6
Belt		R-337	1
Bearing Housing Assembly		M1193-6331	1
Lid Gasket		M1193-9901	1
Magnetic Switch	S002	P0400-1531	1
Magnet		P0400-1538	1
6" Fan Evaporator	M002	P0620-2561	1
Glass Window		M1193-9902	1
Gas Springs		P0640-0380	2
Power Entry Module		P0460-2205	1
Fuse Drawer		P0380-6640	1
45 Amp Solid State Relay	SSR002	P0400-3151	1
Condenser		M1164-0100	1
Automatic Expansion Valve		P0220-2081	1

Part Description	Ref. No.	NBS Part Number	Quantity
Filter Dryer		P0200-1210	1
Evaporator Coil		M1193-9949	1
Compressor 115V		P0620-0811	1
Electronic Timer		P0220-1971	1
Fan		P0620-2536	1
Temp. Controller		P0460-7150	1
Temp. Probe		P0720-6290	1
5 A Fuse (Timer)	F003	P0380-3450	1
6.25 A Fuse (Compressor)	F004	EF-118	1

10.2 Accessory Descriptions & Part Numbers

10.2.1 Easy-Load Platform Kit

A quick-change platform option is available for the Innova 4335. This easy-load accessory enables the user to snap in platforms without tools or hardware. The kit includes a subplatform with spring clips, an extra counterweight, and hardware. The kit does not include a platform. Once installed, a maximum speed of 400 rpm is recommended.

The package should be installed by a qualified service engineer.

Accessory Description	NBS Part Number
Innova 2300/4300 Easy-Loading Kit	M1193-9931

10.2.2 Interchangeable Platforms

Following are 18-inch x 30-inch (46 x 76 cm) platforms:

Size of Glassware	No. of Clamps	NBS Part Number
Universal Platform*	XX	M1250-9920
50 ml Erlenmeyer Flask	108	M1191-9908
125 ml Erlenmeyer Flask	60	M1191-9909
250 ml Erlenmeyer Flask	40	M1191-9910
500 ml Erlenmeyer Flask	24	M1191-9911
1L Erlenmeyer Flask	15	AG-1
2L Erlenmeyer Flask	12	AG-2
Utility Tray	XX	AG-00
4L Erlenmeyer Flask	6	AG-4
6L Erlenmeyer Flask	4	AG-6
2800 ml Fernbach Flask	6	AG-28

* Flask clamps must be ordered separately.

10.2.3 Test Tube Racks for Universal Platform

<i>Description</i>	<i>Tubes per Rack</i>	<i>Racks per Platform</i>	<i>NBS Part Number</i>
Rack for 13 mm Tubes	48	7	TTR-111
Rack for 20 mm Tubes	33	7	TTR-121
Rack for 25 mm Tubes	21	7	TTR-122
Adjustable Angle Slant Rack	15	4	TTR-199
Rack for 30 mm Tubes	15	7	TTR-208

10.2.4 Accessory Flask Clamps

All of the following clamps are constructed of stainless steel.

<i>Type of Clamp</i>	<i>NBS Part Number</i>
10 ml Erlenmeyer Clamp	ACE-10S
25 ml Erlenmeyer Clamp	M1190-9004
50 ml Erlenmeyer Clamp*	M1190-9000
125 ml Erlenmeyer Clamp*	M1190-9001
250 ml Erlenmeyer Clamp*	M1190-9002
500 ml Erlenmeyer Clamp*	M1190-9003
1.0L Erlenmeyer Clamp*	ACE-1000S
2.0L Erlenmeyer Clamp*	ACE-2000S
4.0L Erlenmeyer Clamp*	ACE-4000S
6.0L Erlenmeyer Clamp*	ACE-6000S
2800 ml Fernbach Flask Clamp*	ACE-2800S
500 ml Media Bottle Clamp*	ACSB-500S
1.0L Media Bottle Clamp*	ACSB-1000S




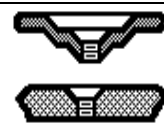


* with spring retainer

10.2.5 Clamp Mounting Hardware Kits




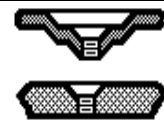


NBS flask clamps are used on a variety of shaker platforms. Flat head screws of different lengths and thread pitch are used to secure the clamp.

The tables below identify the proper screw for your shaker application by reference to the head style.

10 to 500 ml Clamp Hardware Application Chart

<i>Description</i>	<i>Part Number</i>	<i>Qty.</i>	<i>Application</i>
 10-24 x 5/8 (15.87 mm) flat Phillips (+) head screw	S2116-3101	1	3/4" (19.05 mm) thick wood platform 
 10-24 x 5/16 (7.9 mm) flat Phillips (+) head screw	S2116-3051	1	5/16" (7.9 mm) thick aluminum, phenolic and stainless steel platforms. 
 10-32 x 5/16 (7.9 mm) flat slotted (-) head screw	S2117-3050	1	all stainless steel platforms 

1- to 6-Liter Clamp Hardware Application Chart

<i>Description</i>	<i>Part Number</i>	<i>Qty.</i>	<i>Application</i>
 10-24 x 5/8 (15.87 mm) flat Phillips (+) head screw	S2116-3101	5	3/4" (19.05 mm) thick wood platform 
 10-24 x 5/16 (7.9 mm) flat Phillips (+) head screw	S2116-3051	5	5/16" (7.9 mm) thick aluminum, phenolic and stainless steel platforms. 
 10-32 x 5/16 (7.9 mm) flat slotted (-) head screw	S2117-3050	5	all stainless steel platforms 



NOTE:

2800 ml Fernbach Flask Clamp applicable to above chart

11 DRAWINGS

11.1 Control Schematic

Figure 16: Control Schematic—Overview

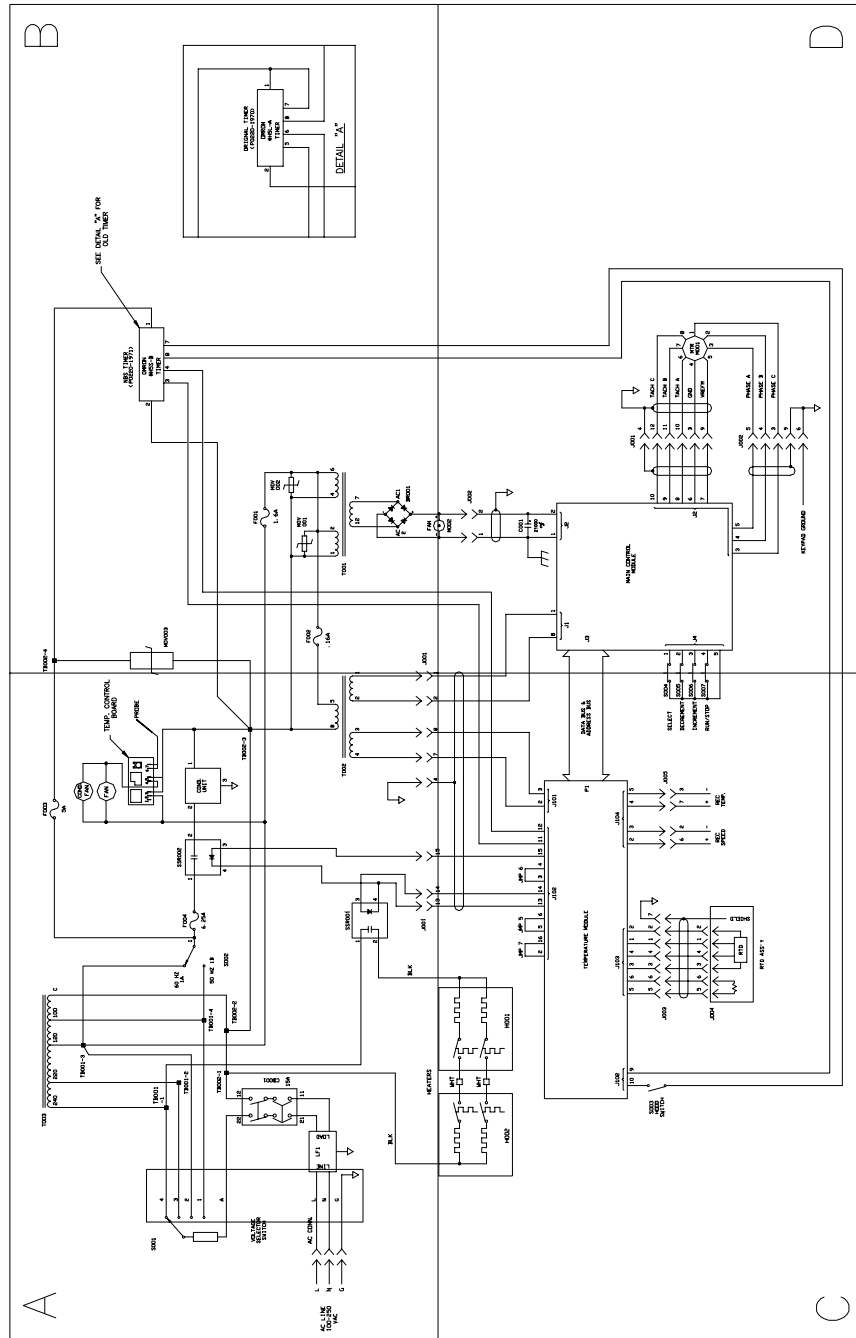


Figure 17: Control Schematic—Quadrant A

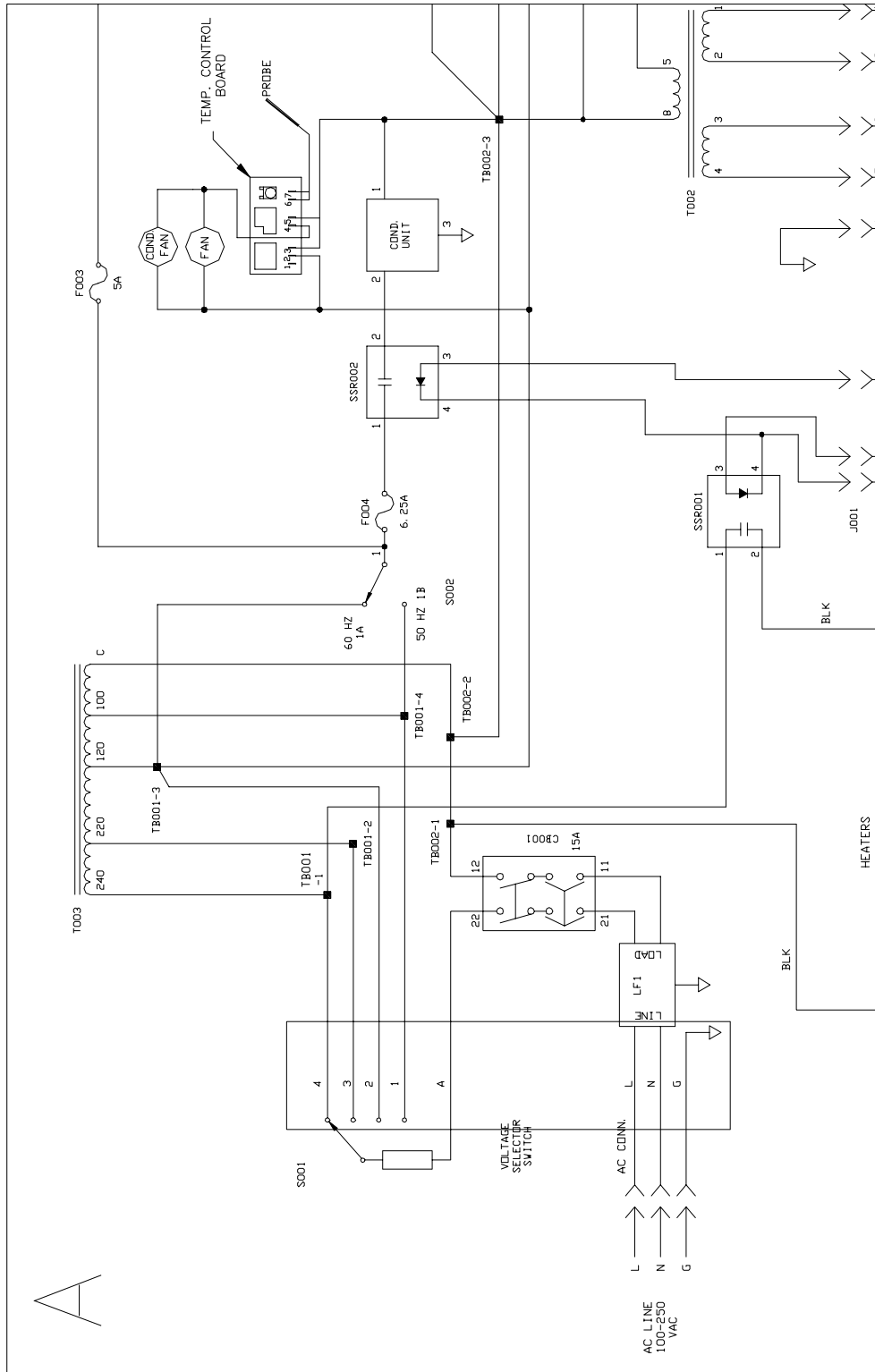


Figure 18: Control Schematic—Quadrant B

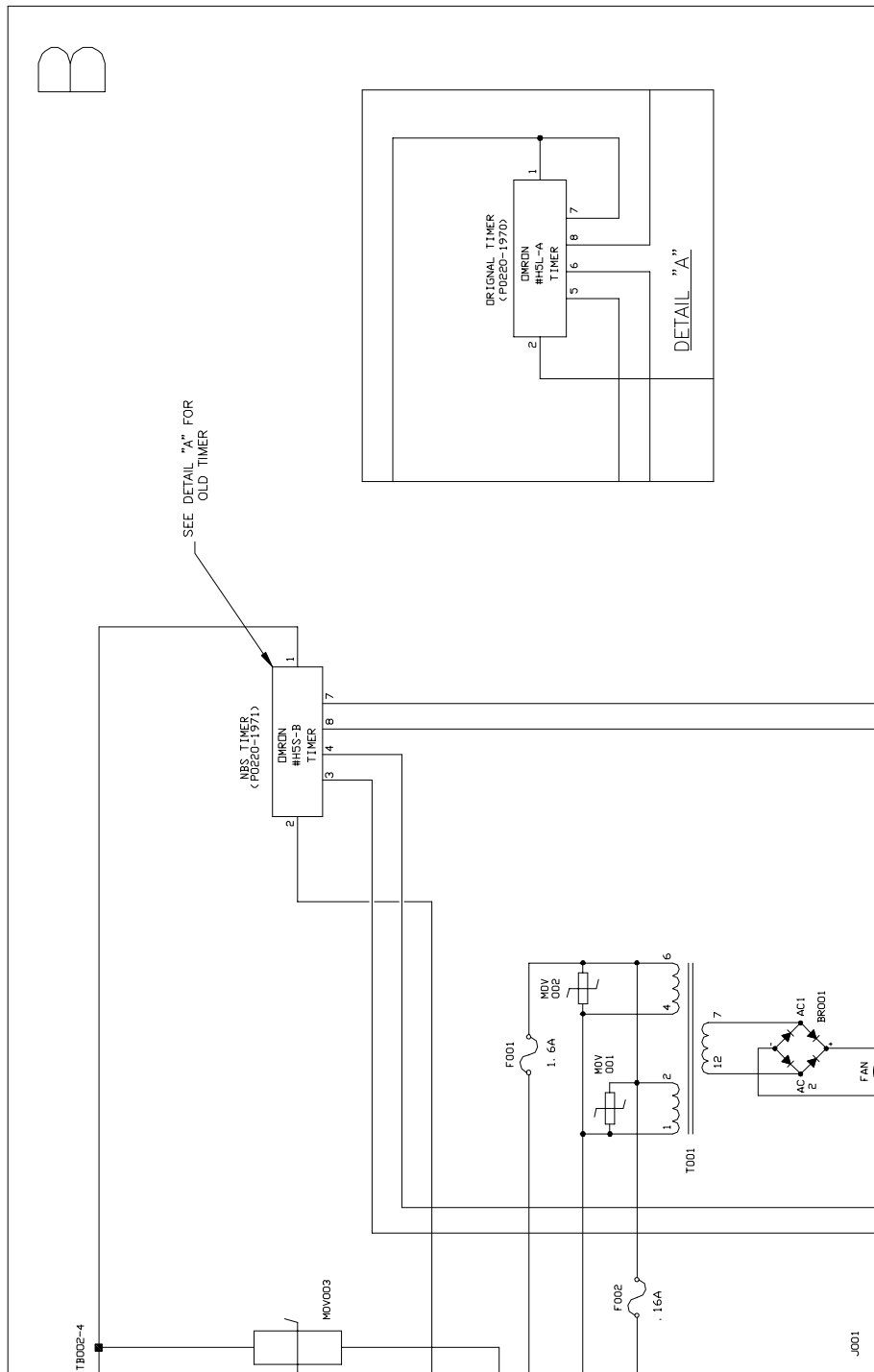


Figure 19: Control Schematic—Quadrant C

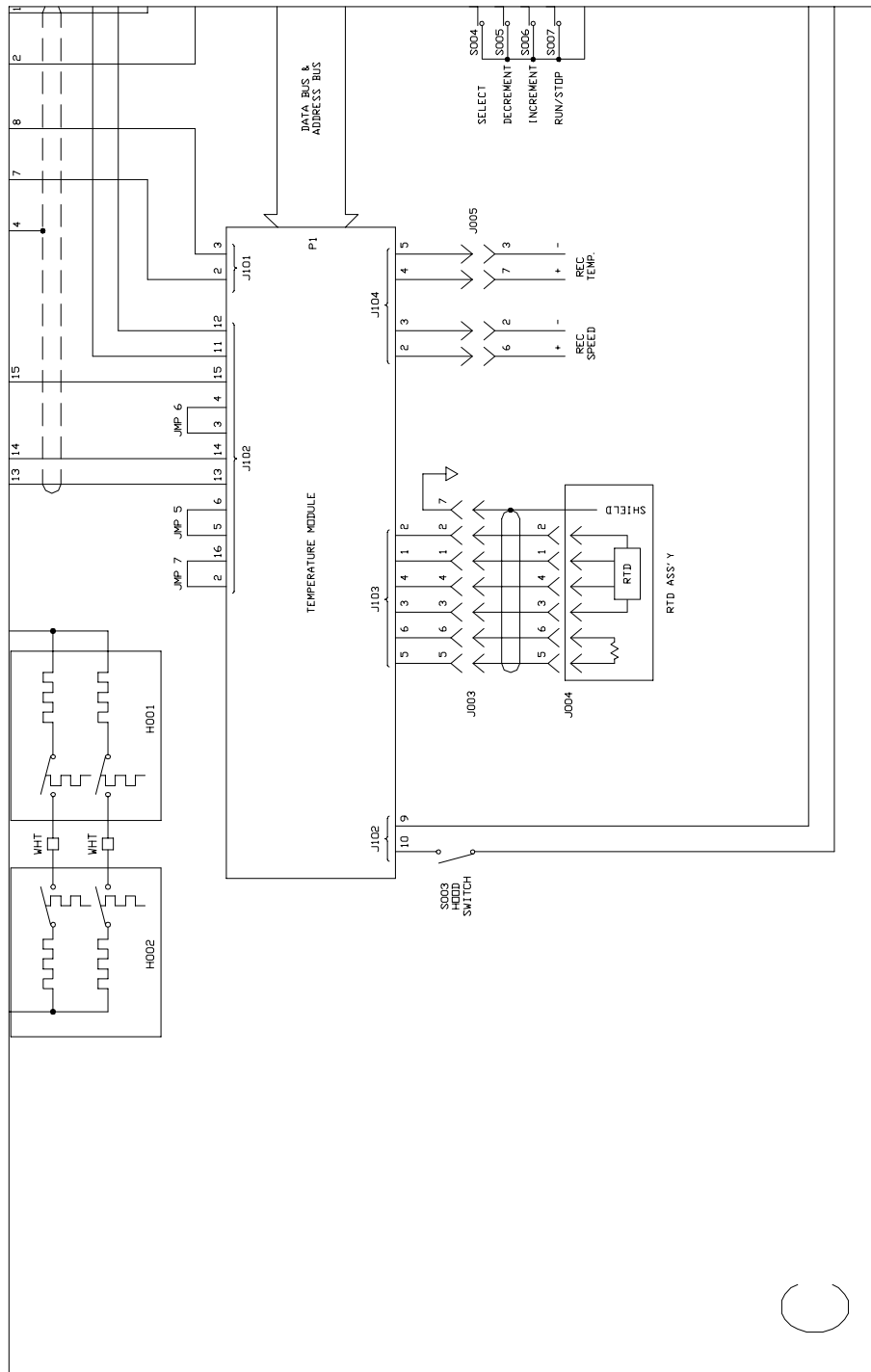


Figure 20: Control Schematic—Quadrant D

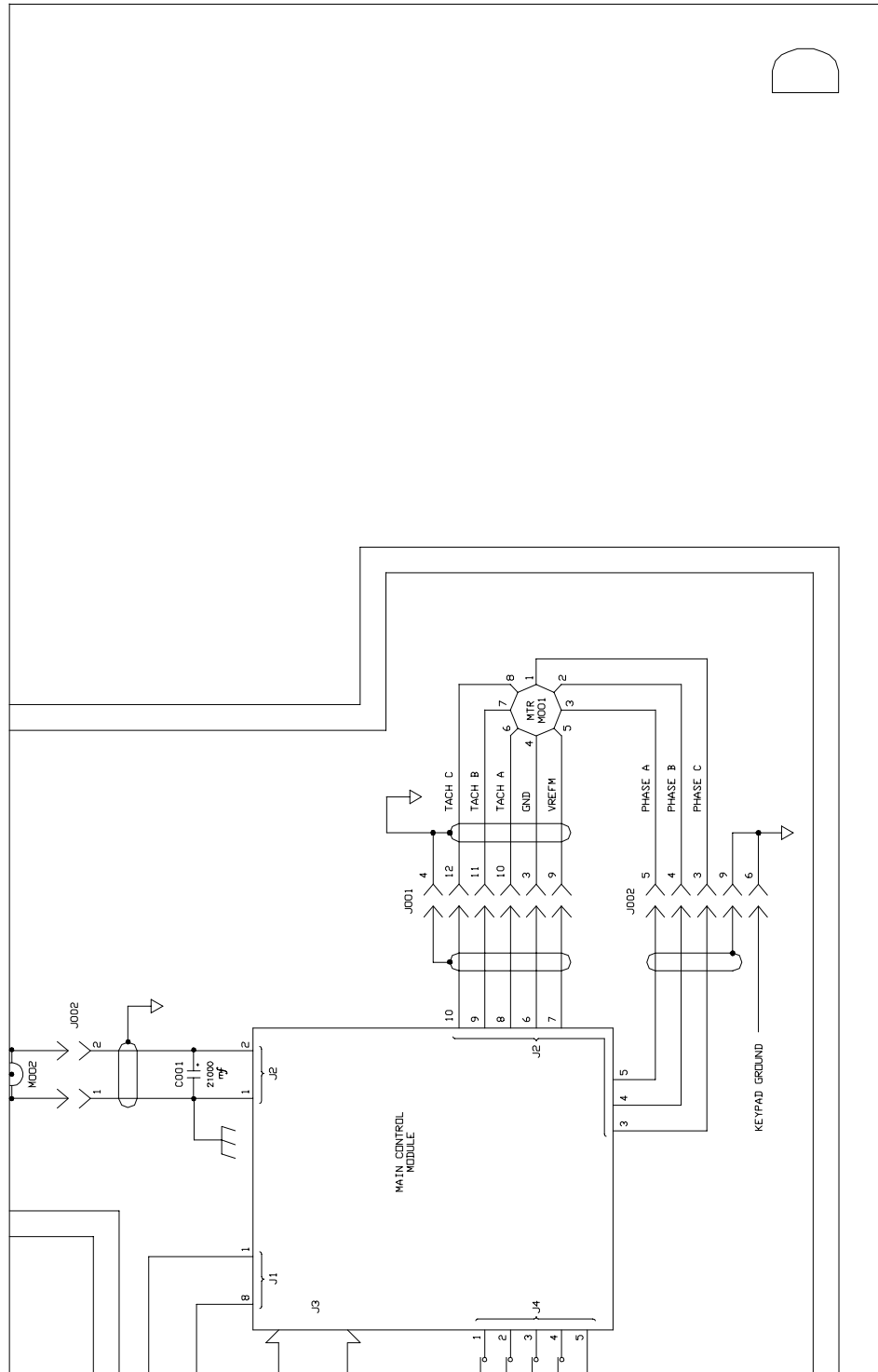


Figure 21: 100V Power Kit Schematic

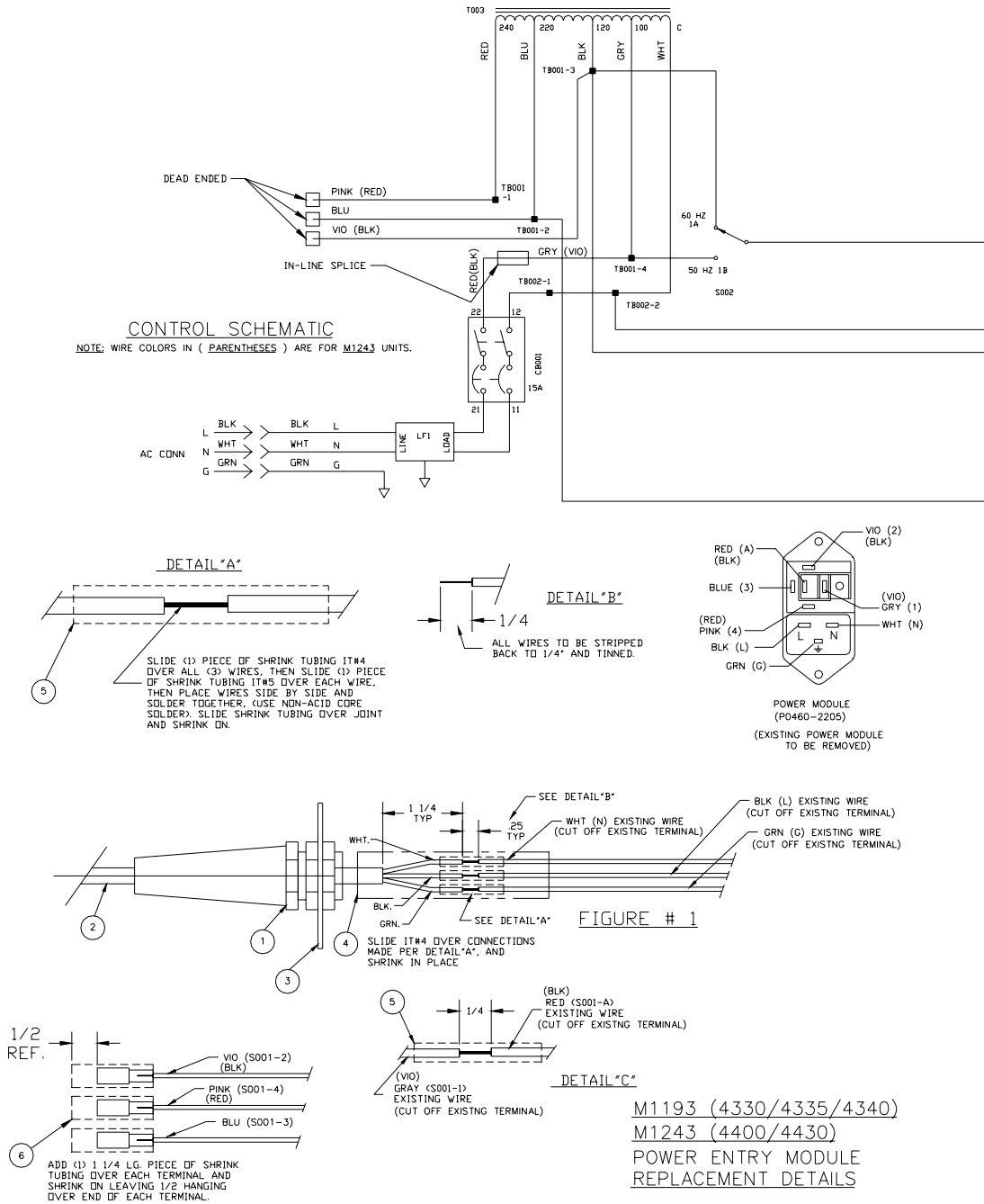
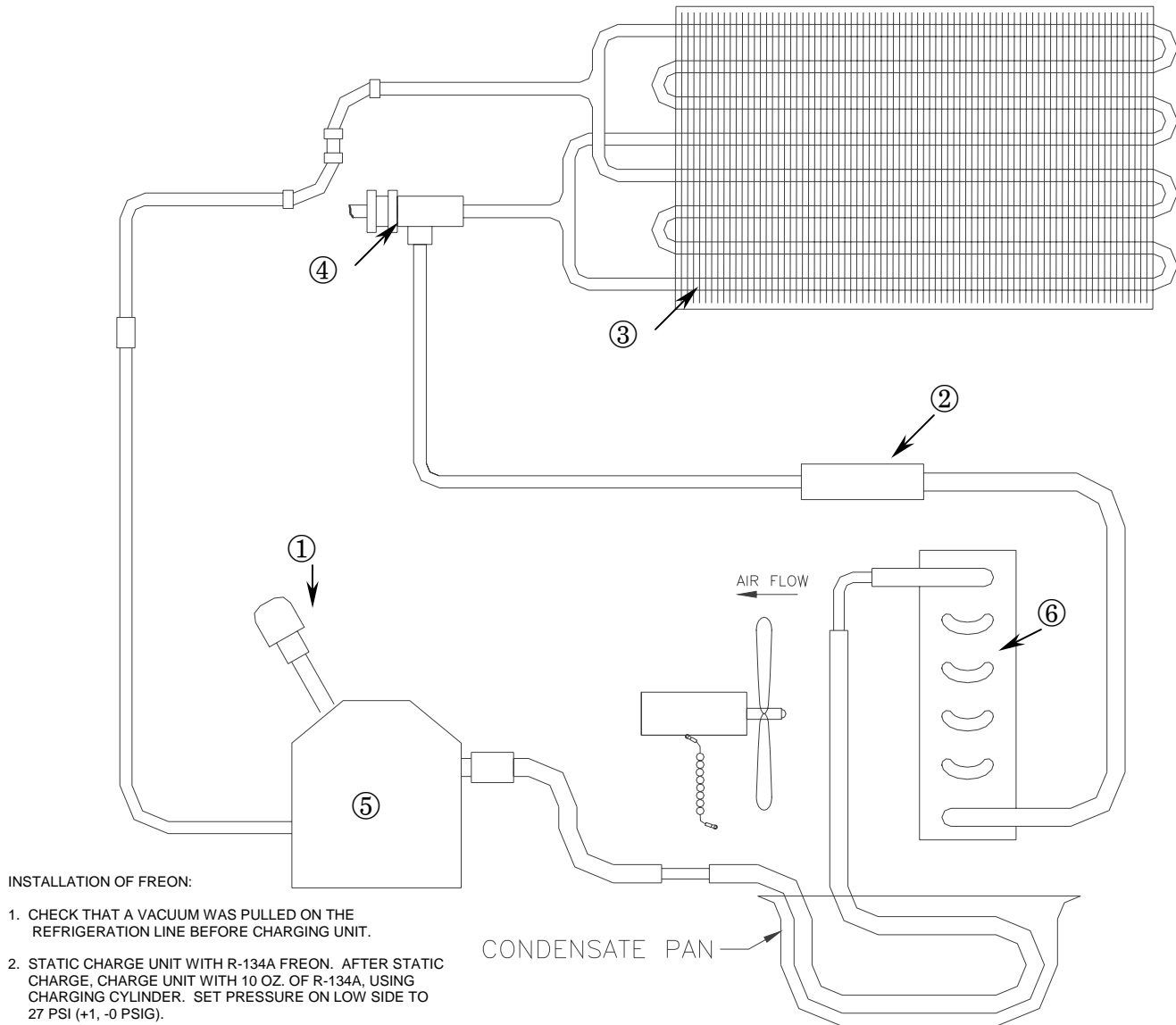


Figure 22: Refrigeration Schematic



Item Key	Description
1	Refrigerant Addition Port
2	Filter/Dryer
3	Evaporator
4	Auto-Expansion Valve
5	Compressor
6	Condenser

11.2 List of Drawings

Figure Number	Description	Page
1	Space Requirements	17
2	Front Panel	19
3	Control Panel	20
4	Electronic Timer Detail	22
5	Electronic Timer Display Detail	24
6	Counterbalanced Drive Mechanism	26
7	Side Panel	27
8	Rear Panel	29
9	Voltage Selector	30
10	Frequency Selector Detail	31
11	Quick Change Platform Installation	33
12	Electronic Timer Program On/Off Switches	34
13	Belt Replacement	64
14	Motor Assembly Replacement	65
15	Control Board Replacement	67, 69
16	Control Schematic—Overview	77
17	Control Schematic—Quadrant A	78
18	Control Schematic—Quadrant B	79
19	Control Schematic—Quadrant C	80
20	Control Schematic—Quadrant D	81
21	100V Power Kit Schematic	82
22	Refrigeration Schematic	83

12 INDEX

A

Accessory Descriptions and Part Numbers · 74
 Actual Temperature · 60
 Alarm
 Disabling · 57
 Alarm Functions · 57
 Ambient Operating Conditions · 18
 Audible Alarm
 Disabling · 57

C

Canceling Programs · 53
 CAUTION
 Symbol for · 7
 Checking Setpoints · 56
 Cleaning
 Exterior Surfaces · 63
 Window Glass · 63
 Clearing Programs · 53
 Continuous Operation Mode · 55
 Continuous Run · 56
 Control Schematics · 78, 79, 80, 81
 Copyright Notice · 7
 Cyclic Operation · 45

D

Day Override · 49
 Cancelling · 52
 Setting · 52
 Disclaimer Notice · 7
 Drawings
 Refrigeration System Diagram · 83

E

Electronic Timer · 22, 34
 Check Key · 49
 Checking Programs · 42
 Clearing Programs · 42
 Clearing/Canceling Programs · 53
 Clr Key · 53
 Copy Key · 51, 52
 Cursor · 36
 Cycle Key · 45
 Cycle Program Mode · 45
 Cyclic Operation · 45
 Day Override · 49, 52

Day/Time Settings · 35
 Display Features · 24
 Features · 23
 h Key · 36, 37, 38, 43, 46
 m Key · 36, 38, 43, 46
 m Key · 37
 Mode Switch · 36, 38, 44, 46, 47, 50, 52, 53
 Multiday Operation · 43
 Output On/Off Switch · 34, 55, 58, 59
 Prog1 Set Mode · 37, 43, 45, 46, 47, 48, 53
 Prog2 Set Mode · 37, 38, 44, 47, 48
 Run Mode · 48, 50, 52
 Sample Program · 39
 Set Key · 36, 43, 45, 49, 51
 Setting · 35
 Shift Key · 36, 43, 45, 48, 49, 51
 Time Adjust Mode · 35
 Viewing Programs · 42, 47, 48
 Write Key · 36, 37, 43, 45, 46, 47, 48, 52
 Electrostatic Discharge Precautions · 66
 ESD Precautions · 66

F

Features · 19
 Bearings · 26
 Keypad · 20, 39
 Motor · 26
 Platform Assemblies · 25
 Quick Change Platform · 25
 Recorder Output · 28
 Refrigeration System · 26
 Triple Eccentric Drive · 25
 Vent · 27
 Voltage Selector · 25
 Frequency Selector · 31
 Fuse
 Replacement · 64

I

Indicated Temperature · 60
 Initial Startup · 34
 Innova Timer Mode · 56
 Inspection of Boxes · 15
 International Offices
 List of · 3

K

Keypad

Function Indicators · 21
LED Display · 20
Status Indicators · 21
User Interface Keys · 20
Keypad Timer
 Cancelling · 57

L

Leveling the Unit · 29
Lid Indication · 42, 55

M

Main Control Board
 Replacement · 67, 69
Maintenance
 Condenser Coil · 64
 Preventive · 63
Manual Conventions · 7
Motor Assembly · 65
 Replacement · 65, 66
Multiday Operation · 43

N

NOTE
 Symbol for · 7

O

Operation · 55
Overview · 13

P

Physical Location · 17
Platforms
 Installation · 32
 Quick Change Platform · 32, 33, 34
 Installation · 32, 33
 Removal · 34
Power Failure · 61
Programmed Shake Mode · 59
Programmed Temp. Mode · 58

Q

Quick Change Platform · 74
 Installation · 32, 33
 Removal · 34

R

Refrigeration System
 Diagram of · 83
Replacement Parts and Accessory Information · 73
Replacement Parts Descriptions and Part Numbers · 73

S

Setpoints
 Checking · 56
Specifications · 71
Starting the Shaker · 56, 61
Starting the Unit · 55

T

Temperature Control
 Disabling · 58
Temperature Correction Value · 60
Temperature Offset Calibration · 59
Temperature Setpoint · 58
Timed Functions · 56
Total Running Time · 60

U

Unlimited Run · 56

V

Viewing Programs · 42, 47, 48
Visual Alarm
 Disabling · 57
Voltage Selector · 29
 Setting · 29, 30

W

WARNING
 Symbol for · 7
Warranty · 9