

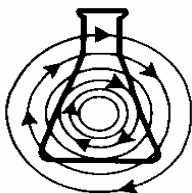


Guide to Operations

innova[™] 4340

Digital Illuminated Refrigerated Incubator Shaker

MANUAL No. M1193-1056
Revision E
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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Manual Conventions



NOTE:

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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1 OVERVIEW

1.1 **General Description**

The Innova 4340 Digital Illuminated Refrigerated Incubator Shaker will provide you with reliable and maintenance-free operation which is characteristic of all NBS shakers. The Innova 4340 is among the newest generation of NBS shakers. It incorporates a variety of state-of-the-art components and features to permit the precision operation necessary for your exacting scientific experiments.

The Innova 4340 shaker has a triple eccentric counterbalanced drive to provide horizontal plane rotary motion in a 1 inch (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°C to 60°C (at 20°C ambient). The internal chamber is 34 ³/₄ inches (88.3 cm) wide, 22¹/₄ inches (56.6 cm) deep, 19¹/₄ inches (48.9 cm) above the platform and will accept flasks up to 4 liters. It is equipped with a foot pedal lid lift assist.

The Innova 4340 has an illuminated cover that allows up to six grow lamps to be operated manually or by a programmable electronic timer. An auxiliary channel of the electronic timer may be used to program the temperature controller to switch to an alternate setpoint at desired times.

The shaker may be operated either continuously or in a timed mode for shaking periods of 0.1 to 99.9 hours via the main control microprocessor.

The Innova 4340 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 4340. Dedicated platforms are available for a variety of flask sizes. A Universal platform and test tube racks are available (*see Section 9 for Accessories*).

Additionally, the Innova 4340 has analog outputs for a chart recorder that will record speed and/or temperature. (*See Section 7, Service, for Recorder Adaptation.*)

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2 FEATURES

Figure 1: Front View

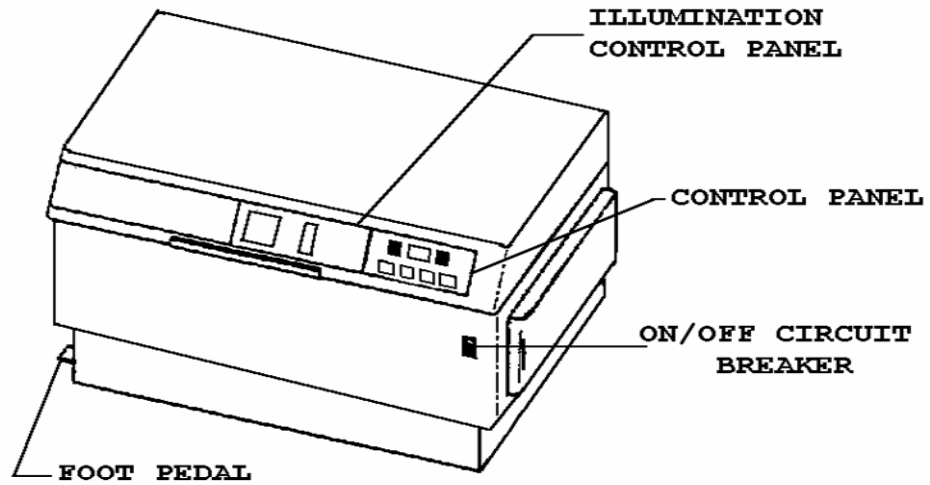


Figure 2: Rear View

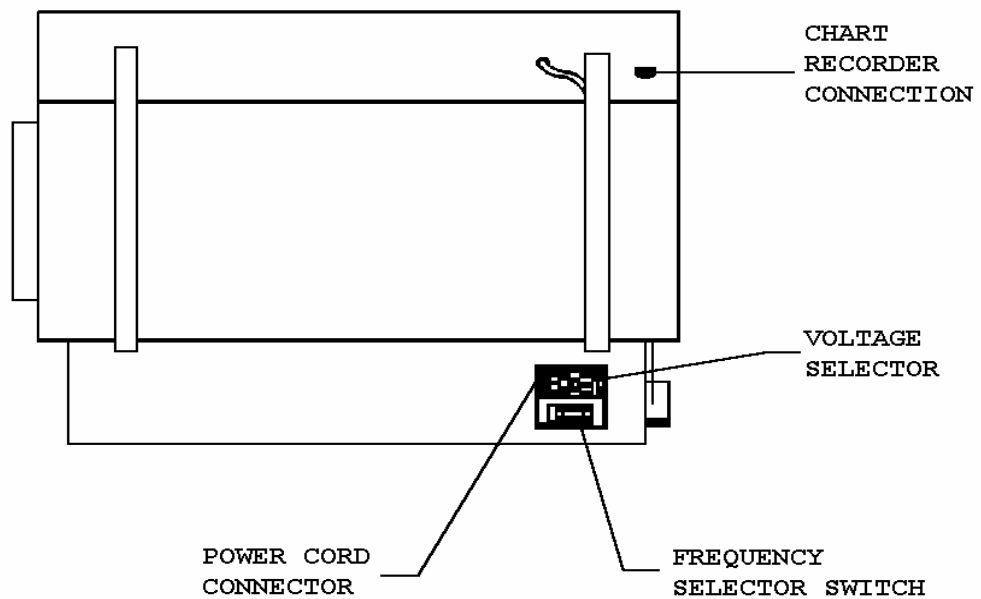
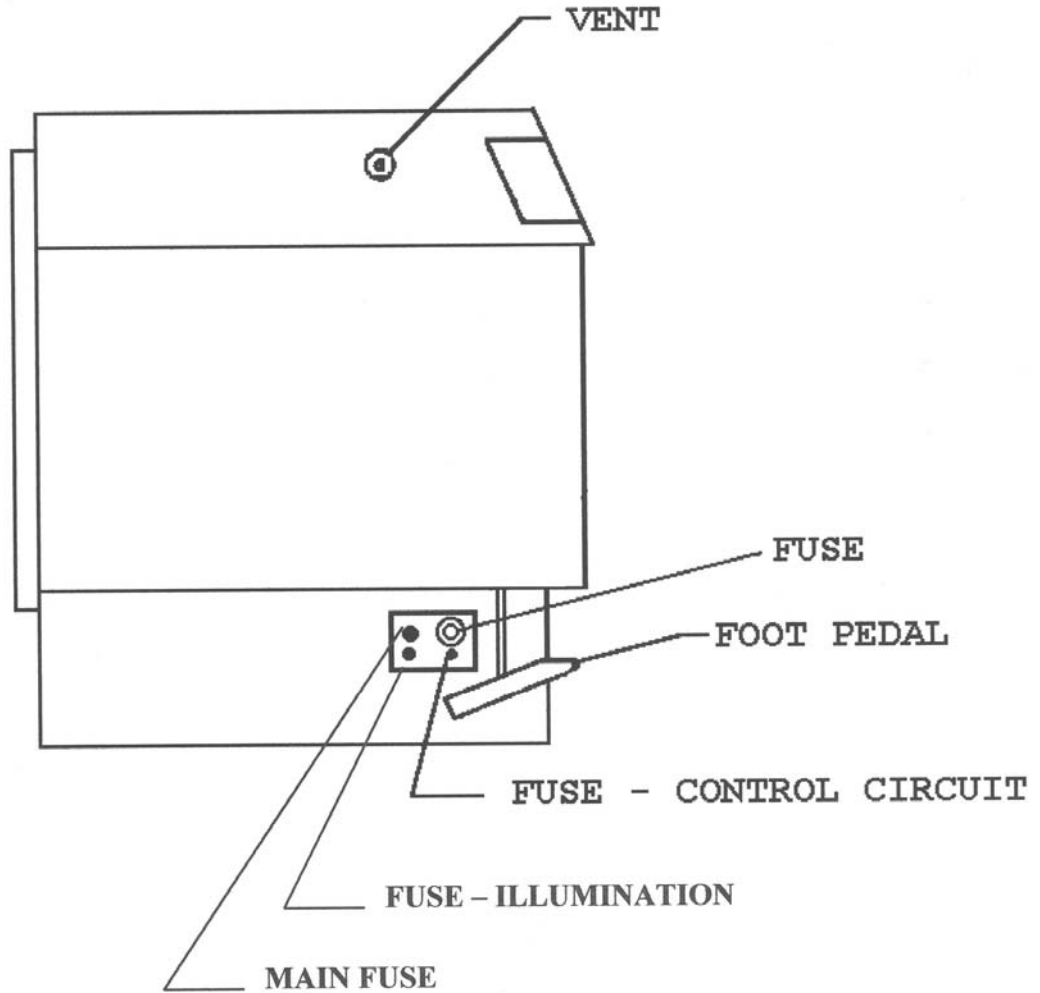


Figure 3: Side View



2.1 *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.

Innova shakers are available in 100V, 120V, 220V and 240V, and accommodate both 50 and 60 Hz frequencies. Voltage and frequency have been set prior to shipment.



WARNING!

It is **CRITICAL** to check the voltage and frequency settings before you plug the unit into a power source.

- Confirm that the voltage setting is correct by checking the voltage selection on the Power Entry Module (see *Figure 2*) and the caution label located over the power cord connection.
- Confirm that the frequency setting is correct by checking the position of the Frequency Selection Switch (see *Figure 2*).

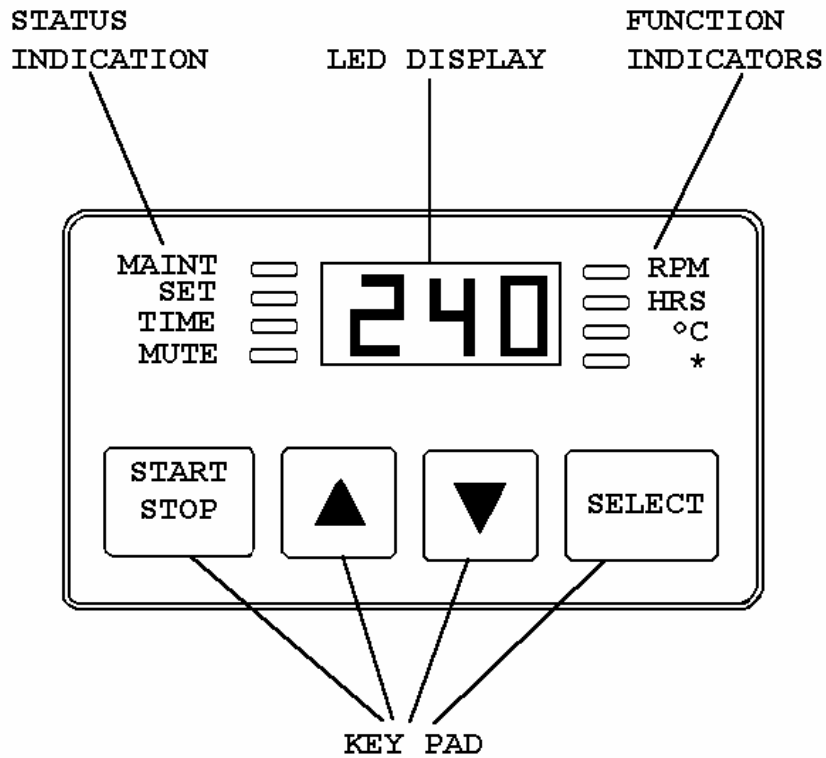
If either setting needs to be changed, refer to Section 7.2 regarding Changing Voltages & Frequency.

2.2 Main Control Panel

The main control panel (see *Figure 4 below*) is located on the front of the instrument. It serves as the operator interface.

The keypad has four keys: Start/Stop, Δ , ∇ and Select. A three-digit LED display provides numeric values as well as some letter codes. There are also four **function indicator lights** and four **status indicator lights** on the control panel. A general description of the display, user interface keys and indicator lights is provided below. For operation of the control panel, see *Section 4, Operation*.

Figure 4: Control Panel



2.2.1 LED Display

The display on the Innova control panel is a 3-digit LED display. During normal shaker operation, the display will indicate:

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

2.2.2 User Interface Keys

- START/STOP
This key is used to start or stop the shaking motion. It will also activate or stop the timer when a timed run is desired.

- SELECT
This key is used to change the displayed parameter.
- Δ, ∇
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.

2.2.3 Indicator Lights

Status Indicators

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

- MAINT
Lights to indicate that 10,000 hours have elapsed since the unit was last serviced.
- SET
Indicates that the shaker is in the SET mode, and setpoints are being displayed. Setpoints can be altered in this mode.
- TIME
Indicates that the timer is in operation. Innova shakers can be programmed to run for a preset time from 0.1 to 99.9 hours without stopping an ongoing run. The timer can be disengaged or reset.
- MUTE
Indicates the status of the audible alarm. When the MUTE indicator is illuminated, the audible alarm device is disabled.

Function Indicators

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
- °C: temperature
- * alternate temperature setpoint

2.3 Illumination Control Panel

The illumination control panel (*see Figure 7*) is located on the front of the instrument. It controls the cover illumination. Three switches allow selection of the illumination pattern. The programmable electronic timer allows the operator to program illumination periods on a daily or weekly basis with up to 16 steps of memory or continuous cycles. In addition, the timer may be used to activate or deactivate the alternate temperature setpoint for the incubator. Illumination and alternate temperature are controlled by separate channels and are independent of one another. Each channel has a manual override switch that allows the channel to be overridden, on or off. The timer tracks the time of day and the day of week even when the Innova 4340 is turned off.

Detailed information for programming and operating the timer is available in Section 4, Operation.

2.4 Platform Assemblies

The Innova 4340 can be used with a wide variety of NBS 18 inch x 30 inch (46 cm x 76 cm) platforms, which will accept a variety of clamps for flasks and test tubes (*see Section 9 for Accessories*).

2.5 Quick-Change Platform Kit

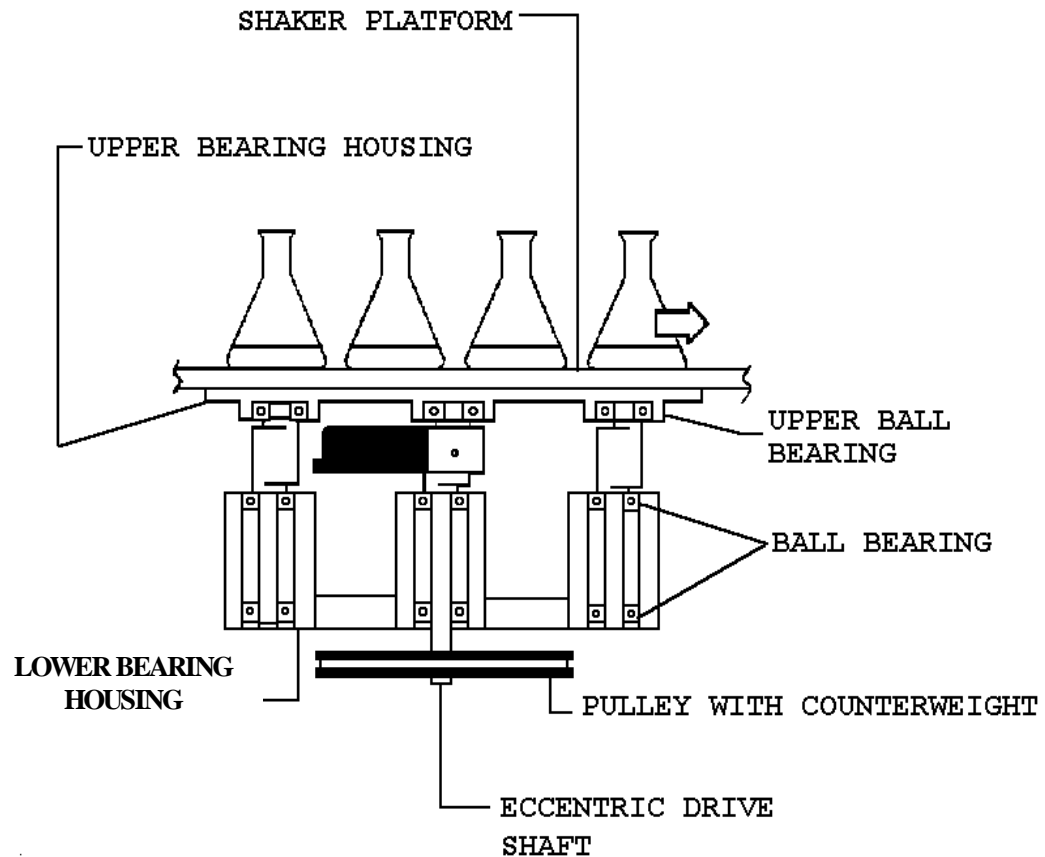
This easy-load accessory enables the user to snap in platforms without tools or hardware (M1193-9931). Recommended for speeds up to 400 rpm.

2.6 Heavy Duty Construction

2.6.1 Triple Eccentric Drive

The Triple Eccentric Drive (*See Figure 5 below*) used in the Innova Shakers employs the same proven technology that 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 5: Counterbalanced Drive Mechanism



2.6.2 Bearings

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

2.6.3 Motor

The Innova 4340 Shaker uses a 3-phase brushless ball bearing DC motor. This low profile motor provides high torque along with quiet, efficient operation and low maintenance. It has a rating of 1/8 horsepower.

2.7 *Refrigeration System*

The Innova 4340 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.

2.8 *Illuminated Cover*

The Innova 4340 is equipped with an illuminated cover. It contains six 30-watt fluorescent “grow-spectrum” lamps designed specifically for photosynthetic investigations. The lamps can be selectively operated in pairs and controlled via the programmable electronic timer. This allows two, four or six lamps to be lit at the operator’s option.

2.9 *Electronic Boards*

The Main Control board for the Innova shaker has the following functions:

- Non-volatile memory for storage of key parameters during power interruption;
- Speed sensing, electronic commutation, and power control for the brushless DC drive motor;
- Maintains an elapsed running time clock;
- Contains firmware for shaker control as well as recognition of an expansion connector for option modules;
- Provides an operator interface via displays, audible alarm, and connection to the keypad module (keypad buttons and display graphics).

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;
- Controls the refrigeration system.

3 INSTALLATION & SET-UP

The Innova 4340 is a versatile instrument that can be operated in a continuous fashion or set for a timed run. The following section describes set up and installation procedures.

3.1 Unpacking & Inspection

Upon unpacking the unit, inspect it carefully for any apparent damage which may have occurred during transit. Report any damage to the carrier and to the New Brunswick Scientific Co., Inc. Service Department (in the USA, call 1-800-631-5417) or to your NBS Service Representative. **Do not discard the crate or packing material.**

3.2 Voltage Configuration

Determine the voltage and frequency of your unit by checking the voltage selector, frequency switch and label on the rear of the unit.



WARNING!

It is CRITICAL to check the voltage and frequency settings before you plug the unit into a power source.

- **Confirm that the voltage setting is correct by checking the voltage selection on the Power Entry Module (see Figure 2) and the caution label located over the power cord connection.**
- **Confirm that the frequency setting is correct by checking the position of the Frequency Selection Switch (see Figure 2).**

If either setting needs to be changed, refer to Section 7.2, regarding Changing Voltages & Frequency.

Confirm that the correct electrical service package is included with the unit by comparing the part number on the electrical service package to the following table:

Voltage Configuration Table

Innova 4340 Catalog Number	Voltage	Electrical Service Package
M1193-1021	100V 50Hz	M1193-0072
M1193-1020	120V 60Hz	M1193-0072
M1193-1022	220V 50Hz	M1193-0073
M1193-1023	240V 50Hz	M1193-0073

3.3 Leveling

The Innova 4340 should be installed on an even surface. The eight feet can be adjusted for leveling, if necessary. Adjust the feet by loosening the locking nuts on the threaded studs attached to the feet, then retightening when the unit is level.



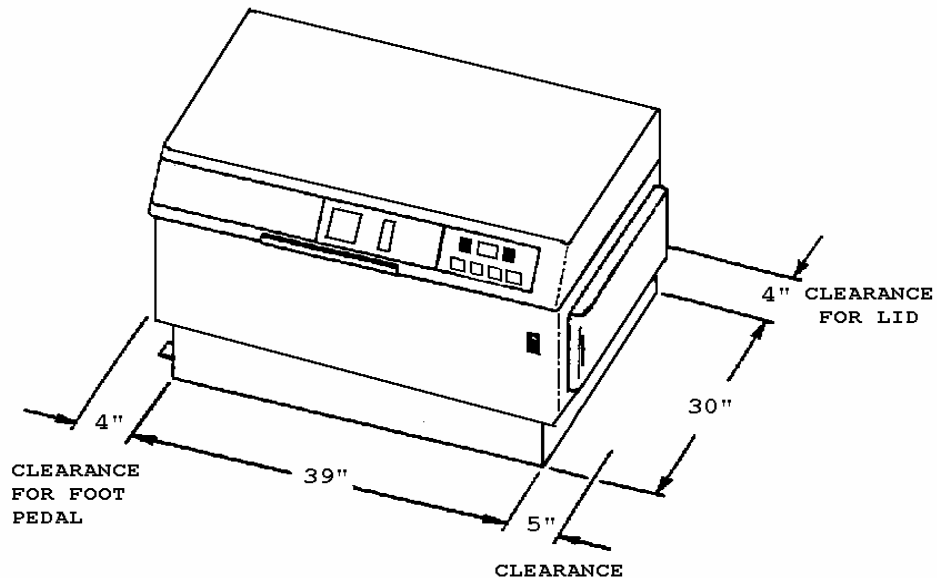
NOTE:

Use of the Innova shakers requires a platform, which is a separate item. Please see Section 9, Accessories, for a listing of available platforms.

3.4 Space Requirements

It is essential that the instrument be situated in an area where there is sufficient space for the shaker and service lines (*see Figure 6 below*).

Figure 6: Space Requirements



The outside dimensions of the Innova 4340 are:

OUTSIDE DIMENSIONS	Inches	Centimeters
Width	45	114
Depth	28	71
Height	37	94

The effective surface area required for operation is:

REQUIRED SURFACE AREA	Inches	Centimeters
Width	48	122
Depth	30	76

3.5 *Electrical Connections*



CAUTION!

Be sure to use the following checklist BEFORE making electrical connections.

1. If you have not already done, so, check the voltage and frequency selector switches on the rear of the unit to ensure that it is 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.

ONLY THEN:

4. Connect the power cord to the power cord connection and to a grounded electrical outlet.



CAUTION!

A grounded electrical outlet is necessary for the safe operation of this instrument.

3.6 *Installation of Platform*

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

1. Set the power switch to 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:

1. Slip the platform between the side guides and push the platform to the rear retainer.
2. Press down on the front edge of the platform. The platform 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 clip.



NOTE:

With the Quick Change platform, maximum speed should not exceed 400 rpm.

4 OPERATION

4.1 *Starting the Innova 4340*

To initially start the instrument, push the ON/OFF switch (located on the right side of the shaker) to the ON position.



NOTE:

The LED display will flash to indicate that the shaker has been off or the power to the shaker has been interrupted. To stop the flashing display, press any key.

Press the **SELECT** key until the RPM indicator lights. If the shaker is running, 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.

The shaker motor stops when the cover is opened. While the cover is open and the display mode is RPM, the display will read “Lid”.

At higher speed ranges, it is recommended that the platform have a 30 percent minimum load to maintain a good balance condition.

4.2 *Continuous (Unlimited) Run*

To set up a continuous run:

1. If the LED displays “OFF” press the **START/STOP** key.
2. Press **SELECT** until RPM is lit.
3. Press either Δ or ∇ to enter SET mode (SET indicator will light).
4. Set the speed by using the Δ or ∇ key until the desired setpoint is displayed.



NOTE:

Holding the Δ or ∇ key down will cause the setting to change more rapidly.

The setpoint may be changed during a run without stopping the shaker by following steps 2-4 above. During speed changes, the alarm will flash until the speed returns to within 5 rpm of the setpoint; do not be concerned.

4.3 *Checking a Setpoint*

To check any setpoint:

1. Press **SELECT** until the desired indicator is lit.
2. Press either Δ or ∇ to enter the SET mode, which will display the current setpoint.



NOTE:

Holding the Δ or ∇ key down for more than 0.5 second will cause the speed, time or temperature setpoint to change. Should this occur, resetting will be necessary.

4.4 *Timed Shaking*

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

4.4.1 **Setting the Timer**

To set the timer:

1. Press the **SELECT** key to light HRS.
2. Set the time by pressing Δ or ∇ key until the desired setpoint is displayed (0.1 - 99.9 hours).
3. To start the timer operation, press the Δ or ∇ key once. The SET indicator should light. While the SET indicator is on, press the **START/STOP** key. The time indicator will light and remain lit 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 sound (if it is enabled).
4. The setpoint may be changed during a run without stopping the shaker by following steps 1 and 2 above.
5. To stop the alarm, press the **SELECT** key and change to any other function.

4.4.2 **Cancelling the Timer**

To cancel the timer **WITHOUT** stopping the shaker:

1. Press the **SELECT** key to light HRS.

2. Set the time by pressing Δ or ∇ key until the desired setpoint is displayed (0.1 - 99.9 hours).
3. While the SET LED is lit, press the **START/STOP** key. The TIME indicator will go out and the display will read "OFF".

4.5 Alarm Functions

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

1. Press **SELECT** to light HRS.
2. **Simultaneously** press the Δ and ∇ keys. The SET and MAINT indicators will flash.
3. While the SET and MAINT indicators are flashing, press the **START/STOP** key. The MUTE indicator will light to advise that the audible alarm is deactivated.

To reactivate the alarm, repeat steps 1-3. The MUTE indicator will be extinguished when the alarm has been reactivated.

4.6 Temperature

This control consists of an internal electrical interface, an RTD temperature probe, and an analog output for chart recorder or computer.

4.6.1 Setting the Temperature

To set the temperature setpoint:

1. Press the **SELECT** key until the function indicator lights on the °C mode. The temperature can be set from the 4.0°C to 60.0°C. 4.0°C is the minimum when the ambient temperature is 15°C.
2. Increase or decrease the setpoint by pressing the Δ or ∇ key.

The temperature alarms, both audible and flashing light, are activated if the temperature is more than 1.0°C higher or lower than the temperature setpoint. The alarm will automatically deactivate as the unit achieves the set temperature.

4.6.2 Deactivating Temperature Control

If desired, the temperature control system may be shut off during set-up or for special investigations.

To deactivate the temperature control system:

1. Press and hold the ∇ key until the setpoint is 4.0°C.
2. While holding the ∇ key, simultaneously press the **START/STOP** key. The temperature setpoint display shows “OFF” and both the heater and the refrigeration system will be deactivated.

To reactivate the temperature control:

- Press the Δ key until the desired temperature setpoint is displayed.

4.7 Alternate Temperature Setpoint

The Innova 4340 allows a secondary or alternate temperature setpoint to be entered.

To set an alternate temperature setpoint:

1. Press the **SELECT** key until the * function indicator lights. The display shows the current incubator temperature.
2. Press the Δ or ∇ key to display the alternate temperature setpoint. Use the Δ or ∇ key while the **SET** indicator is lit to adjust the alternate temperature setpoint to the desired value.



NOTE:

PROGRAM #1 of the programmable electronic timer determines whether the Innova 4340 operates on the primary or alternate temperature setpoint. When the electronic timer display shows **PROGRAM #1**, the alternate setpoint is active. See the Section 5, **Electronic Timer Operation**, for detailed instructions on use of the programmable timer.



NOTE:

The shaker may be started or stopped by pressing the **START/STOP** key. When starting, the unit will automatically return to the last function and setting. The alarms will be activated until the speed is within 5 rpm or the temperature is within 1.0°C of the setpoint. The alarm will **NOT** sound when the shaker is accelerating or the temperature is changing to satisfy a new setpoint.

4.8 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: $\text{Actual Temperature} - \text{Indicated Temperature} = \text{Temperature Correction Value}$.
4. Press the **SELECT** key until the °C function indicator illuminates.
5. Simultaneously press the Δ and ∇ keys. The SET and MAINT indicators will light.
6. While the SET and MAINT indicators are illuminated, use the Δ 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 Δ and ∇ keys. The SET and MAINT indicators will light.
3. While the SET and MAINT indicators are illuminated, press the **START/STOP** key.

4.9 Total Running Time

The control module of the Innova 4340 totals the time the shaker has been “ON” to track hours of usage. To display the accumulated running time:

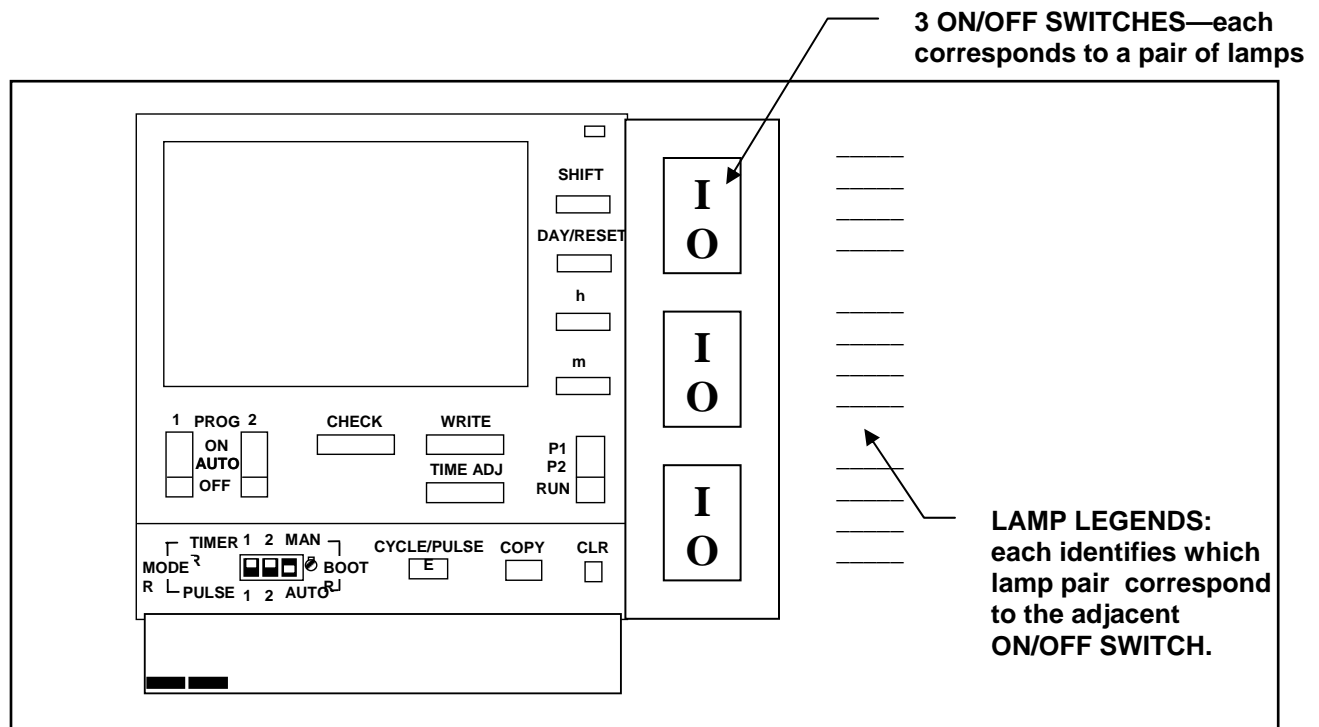
1. Select HRS using the **SELECT** key.
2. **Simultaneously** press the Δ and ∇ keys.

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

After 10,000 hours of operation, the MAINT indicator will light. Preventive maintenance is recommended at this point. Only NBS Service Personnel may deactivate the light. Alteration of the internal clock by unauthorized personnel will void the warranty.

4.10 Illumination Control

Figure 7: Illumination Control Panel



4.10.1 Manual Operation

To turn on lamps manually:

1. Set the PROGRAM #2 switch (*see Figure 8 below*) on the electronic timer to the OFF position.
2. Activate the light switch(s) for the desired pair(s) of lamps. The lamp legend identifies which two lamps are activated by each switch.

4.10.2 Programmed Operation

To set up programmed operation of lamps:

1. Activate the light switch(s) for the desired pair(s) of lamps. The lamp legend identifies which two lamps are activated by each switch.
2. Set the PROGRAM #2 switch to the AUTO position.



NOTE:

It is necessary to program the timer prior to use in the programmed mode. See the programming instructions in the following section.

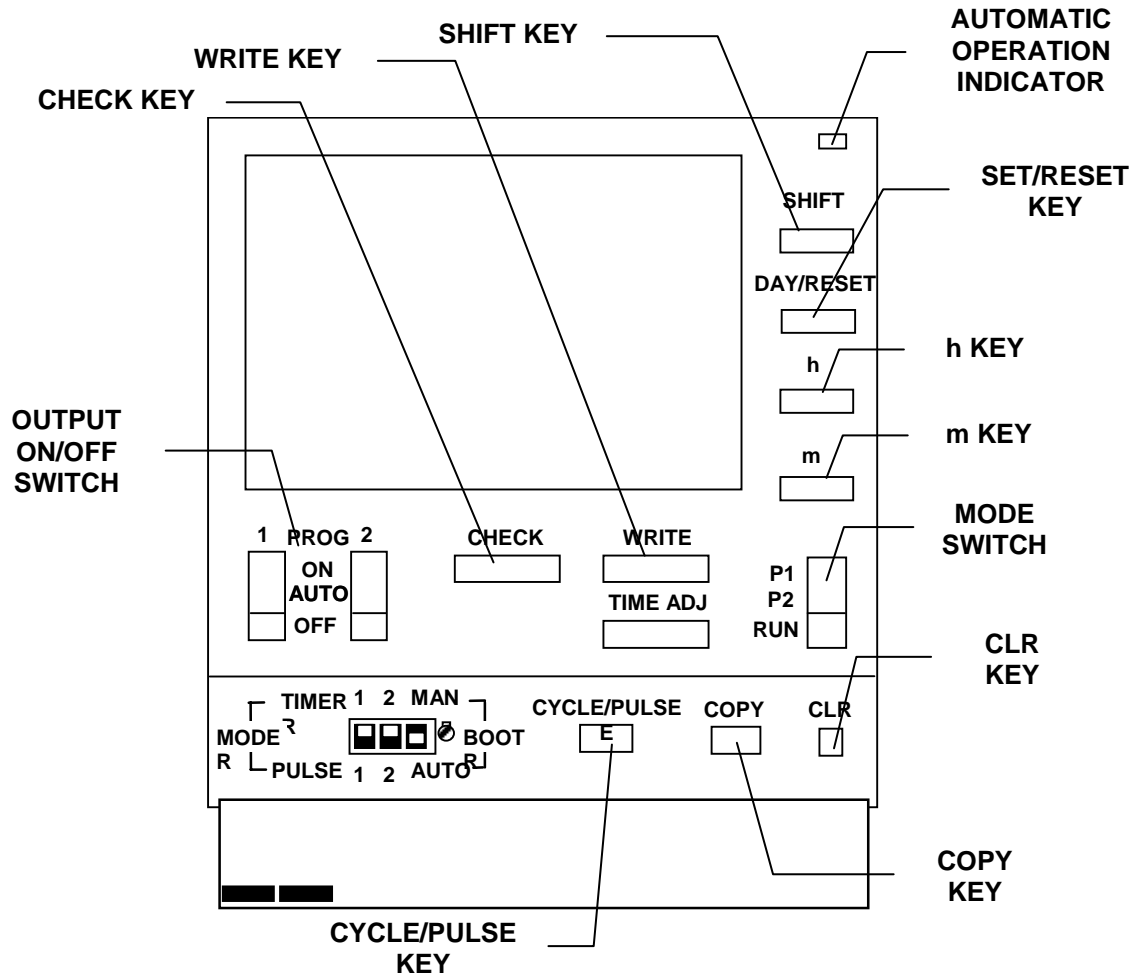
4.11 *Introduction to the Electronic Timer*

The electronic timer is used to set programmed times to control the operation of the shaker. **PROG1** enables the unit to alternate between primary (lower, °C setting on the keypad) and secondary (higher, *) temperature setpoints at preset intervals (cycles) or at specific times. **PROG2** controls the operation of the light bank.

See Figure 8 below for a detailed look at the Electronic Timer's control panel, and Figure 8a (which follows) for a detailed look at the Electronic Timer's display.

Detailed instructions for setting the timer, complete with sample programs, are provided in Section 5.

Figure 8: Electronic Timer Detail



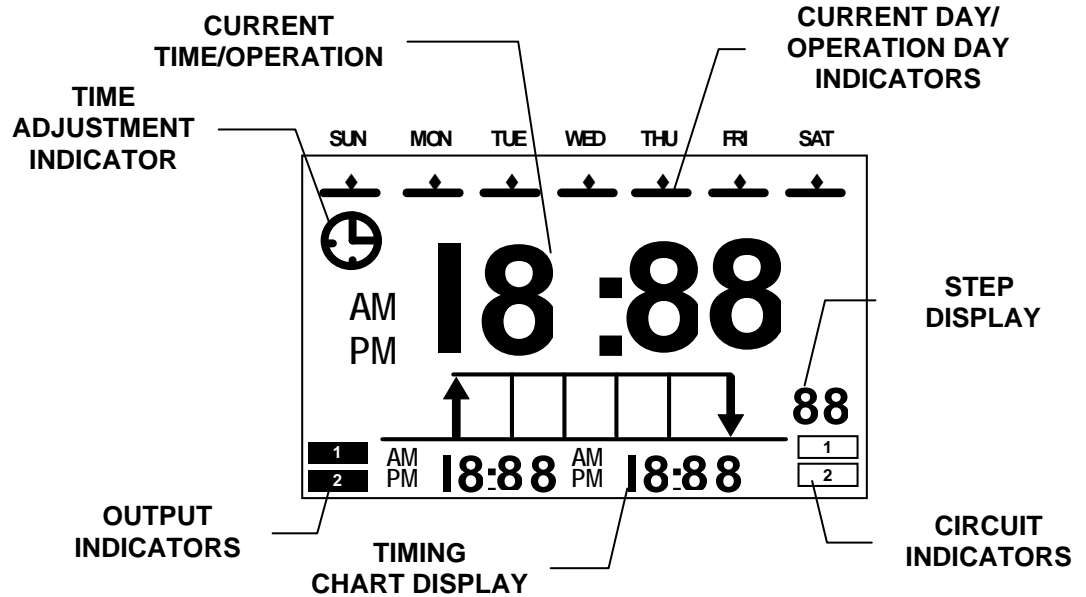
The following is a brief description of the electronic timer's features and functions:

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 override day operation.
COPY KEY	Specifies a override day.
CYCLE/PULSE KEY	Specifies a cyclic operation.
h KEY	Sets hours.
m KEY	Sets minutes.

Component	Function
------------------	-----------------

<p style="text-align: center;">MODE SWITCH</p>	<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>
<p style="text-align: center;">OUTPUT ON/OFF SWITCH</p>	<p>Allows the user to operate PROG1 and PROG2 separately:</p> <p>ON: The switch contact on the specified program is closed. This position will cause the shaker to stop for PROG2 and cause the unit to operate at the alternate (higher, *) temperature setpoint for PROG1.</p> <p>OFF: The switch contact on the specified program is open. This position will allow manual operation of the illumination timer. It will also allow operation of PROG2 and cause the unit operate at the primary (lower, °C) temperature for PROG1.</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>
<p style="text-align: center;">SET/RESET KEY</p>	<p>Selects or cancels the day selected by the SHIFT KEY.</p>
<p style="text-align: center;">SHIFT KEY</p>	<p>Moves the cursor () to specify a day.</p>
<p style="text-align: center;">TIME ADJ</p>	<p>Allows the user to adjust the time.</p>
<p style="text-align: center;">WRITE KEY</p>	<p>Sets in the specific time in RUN MODE or PROGRAMMING MODE.</p>

Figure 8a: Electronic Timer Display Detail



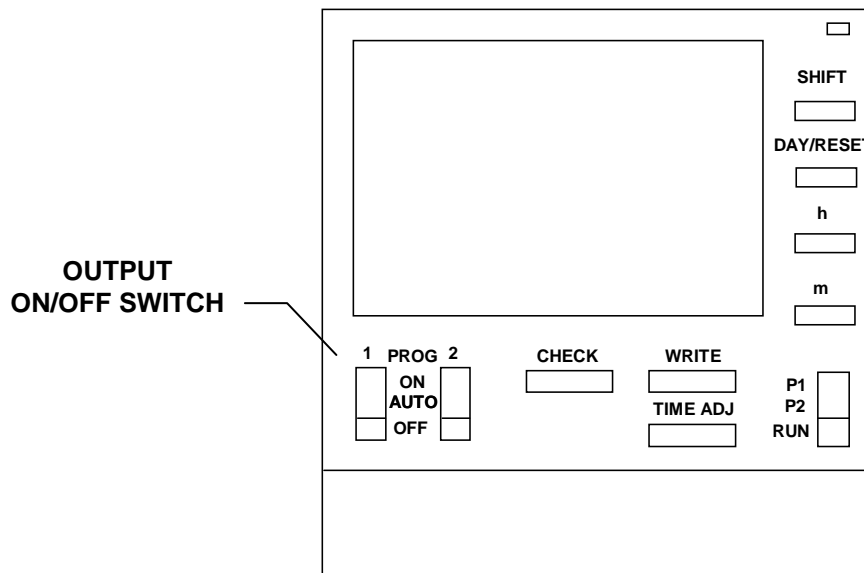
Component	Function
Current Time/Operation	Displays current set time when the MODE SWITCH is in the RUN position. Displays programmed time, and/or time width when the MODE SWITCH is in the P1 or P2 position.
Time Adjustment Indicator	Indicates that the timer is TIME ADJUST MODE when the TIME ADJUST KEY 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.

Component	Function
Circuit Indicators	<p>When the MODE SWITCH is in the RUN position, this indicates that there are programmed operations for PROG1 or PROG2.</p> <p>Indicates the position of the MODE SWITCH when it is in the P1 or P2 position.</p>

4.12 Initial Start-Up

Before initially turning on the unit, run through the following checklist:

1. Be sure that the lid is in the closed position.
2. Set the **OUTPUT ON/OFF SWITCH** for **PROG1** to the **OFF** position and the switch for **PROG2** to the **ON** position.



PROGRAM #1: TEMP / PROGRAM #2: LIGHTS

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

5 ELECTRONIC TIMER OPERATION

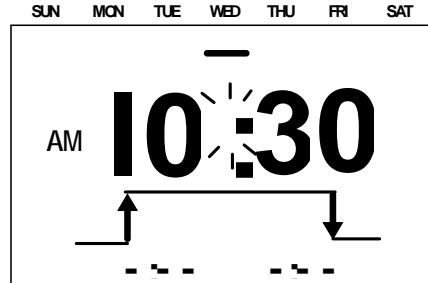
Before operation, verify that the **ELECTRONIC TIMER** is displaying the current day of the week and time. If it is not, the timer must be set to the current day/time in the order of “**DAY OF THE WEEK**”, “**HOUR**”, and “**MINUTE**”. If the day/time settings are correct, proceed to the next section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

Once the timer is set, it does not have to be continually reset. It should, however, be 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 4340 is turned **OFF**.

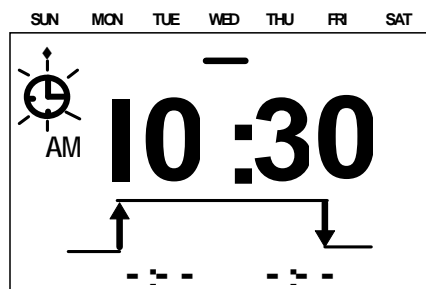
5.1 Changing Day/Time Settings

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

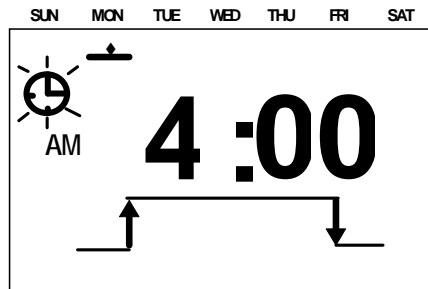
1. Verify that the Innova 4340 is in the “initial start-up” condition as described in the previous section.



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** (see sample screen below). 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.



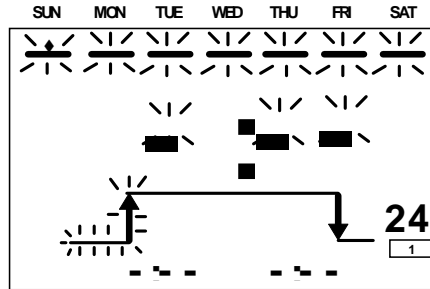
6. Verify that the settings entered are correct, and press the **WRITE KEY** to set the day and time. When the **WRITE KEY** is pressed, the arrow and flashing clock disappear from the display, and the timer is set to the displayed time at 0 seconds.



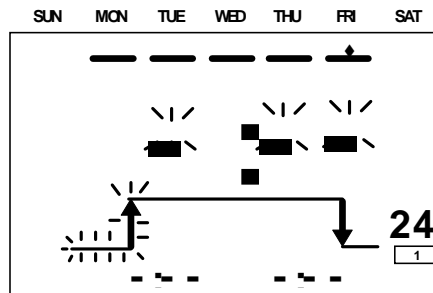
5.2 Ordinary Timer Operation

In the following example, **PROG1** will operate at 8:30 am and stop at 5:15 pm from Monday through Friday. To accomplish this:

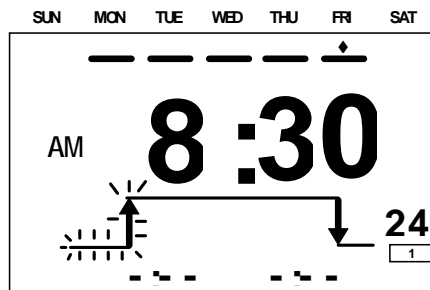
1. Enter the set **PROG1 SET MODE** by setting the **MODE SWITCH** in the **P1** position. The initial **PROG1** display will appear:



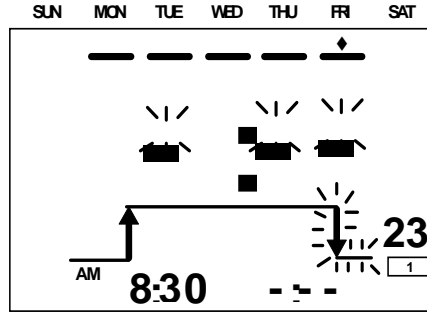
2. Using the **SHIFT** and **SET** keys, select Monday through Friday. All bars at the positions of Monday through Friday indicate that they are turned on.



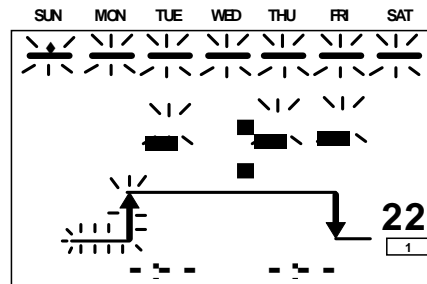
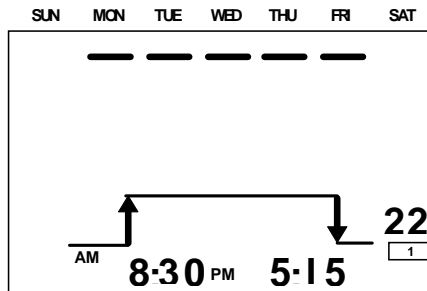
3. Using the **h** and **m** KEYS, set the time the program will begin to operate to 8:30 am.



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**, with the number of programmable operation steps remaining displayed in the lower right hand corner.



 **NOTE:**

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

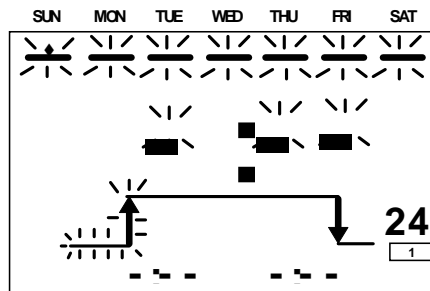
 **NOTE:**

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.

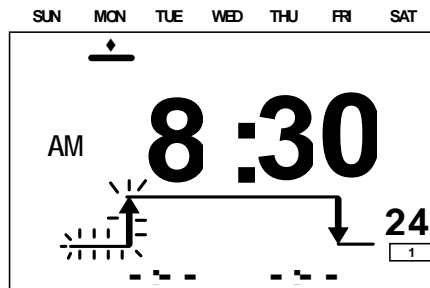
5.3 Multiday Operation

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

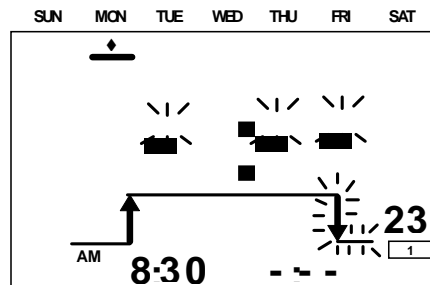
1. Enter the set **PROG1 SET MODE** by setting the **MODE SWITCH** in the **P1** position. The initial **PROG1** display will appear:



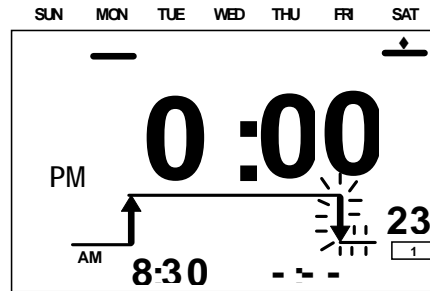
2. Using the **SHIFT** and **SET KEYS**, select Monday as the day of the week that this operation will start. A bar displayed in the Monday position signifies that the day of the week is turned on. Using the **h** and **m KEYS**, set the time the program will begin to operate to 8:30 am.



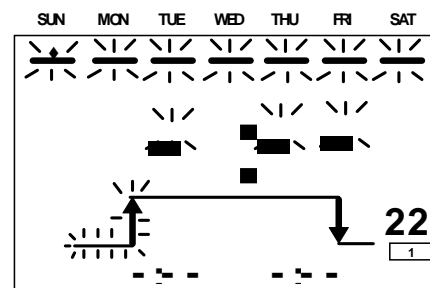
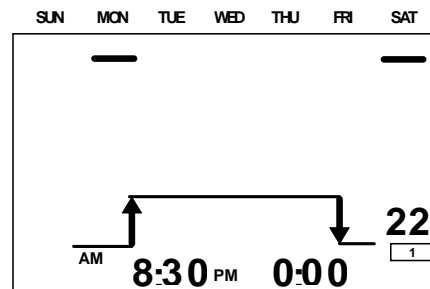
3. Press the **WRITE KEY** to enter this operation in memory. The timer will display the next operation to be programmed.



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



- 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:**

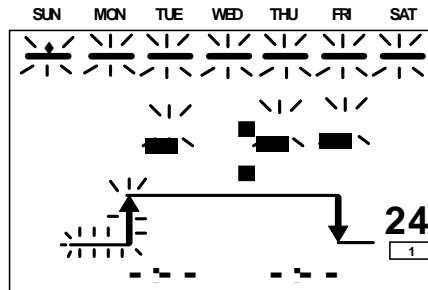
The procedure is identical for PROG2. To perform this procedure for PROG2, set the **MODE SWITCH** in the P2 position.

- After setting PROGRAM #2, set **MODE SWITCH** to **RUN** position.
- Set **OUTPUT ON/OFF** switch to **AUTO** mode to run the unit with programmed control.

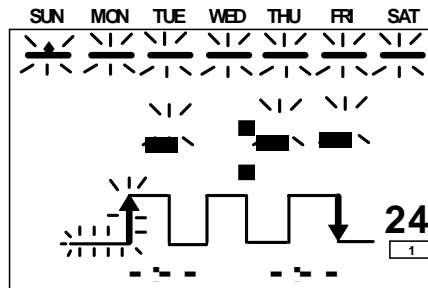
5.4 Cyclic Operation

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:

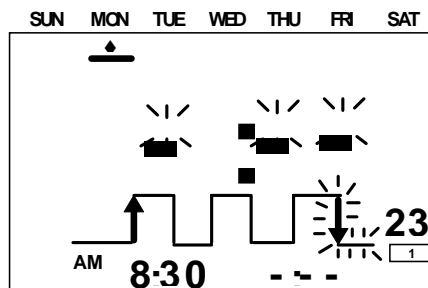
1. Enter the set **PROG1 SET MODE** by setting the **MODE SWITCH** in the **P1** position. The initial **PROG1** display will appear:



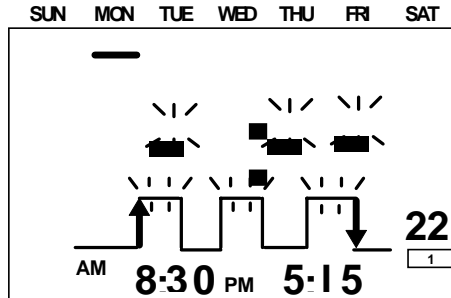
2. Open the lower drawer of the timer, and press the **CYCLE KEY**. The timer will enter the **CYCLE PROGRAM MODE**.



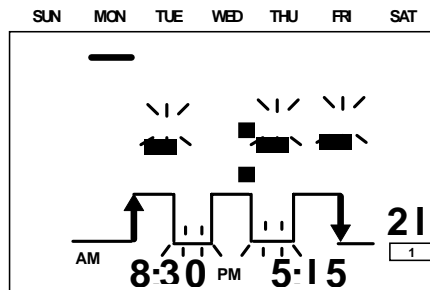
3. Using the **SHIFT** and **SET KEYS**, select the day of the week that the cycle operation is to start. In this example, the cycle is to be performed on Monday. Using the **h** and **m KEYS**, set the time the cycle operation will begin on Monday to 8:30 am. Press the **WRITE KEY** to enter this setting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



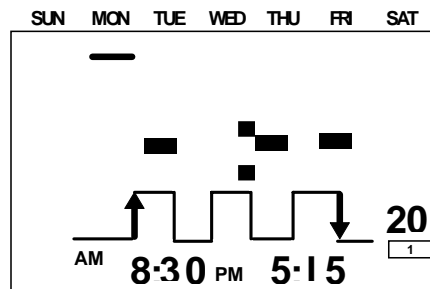
4. Using the **SHIFT**, **SET**, **h** and **m** **KEYS**, set the day and time the timer will stop the cycle operation. In this example, the timer will cease to cycle on Monday at 5:15 pm. Press the **WRITE KEY** to enter these settings into memory. The timer will then prompt you to enter in the on-cycle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

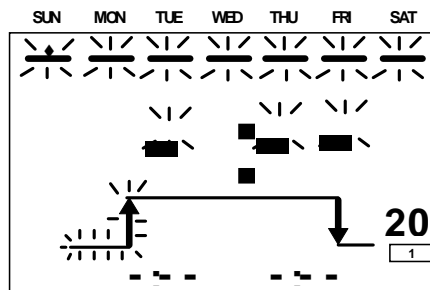
The procedure is identical for **PROG2**. To perform this procedure for **PROG2**, set the **MODE SWITCH** in the **P2** position.

5.5 Viewing Programs

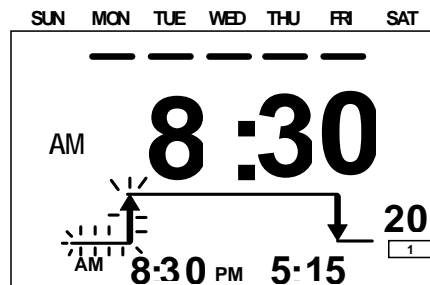
The timed operations for **PROG1** or **PROG2** can be viewed in either the **PROG1** and **PROG2 SET MODE**, or in **RUN MODE**. To view previously set programs in the **ELECTRONIC TIMER**:

◆ PROG1 or PROG2 SET MODE

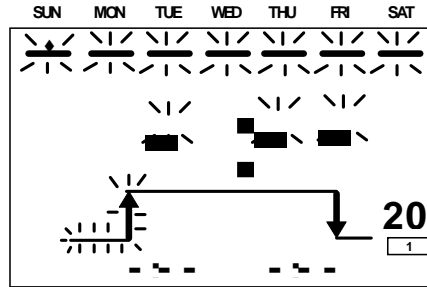
1. Enter the set **PROG1 SET MODE** by setting the **MODE SWITCH** in the **P1** position. The initial **PROG1** display will appear:



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.

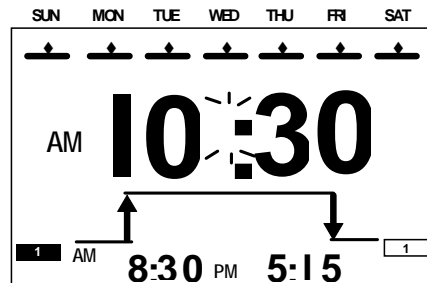


 **NOTE:**

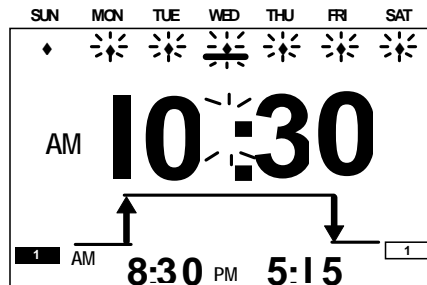
This procedure is identical for PROG2. To perform this procedure for PROG2, set the MODE SWITCH in the P2 position.

◆ **RUN MODE**

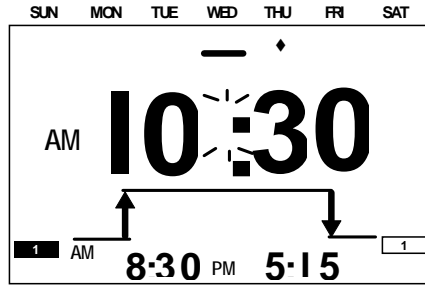
1. In **RUN MODE**, the operations for both **PROG1** and **PROG2** can be viewed by the day. In the following example, the current day of the week is Wednesday, and the timer operations to be performed on Thursday will be checked.



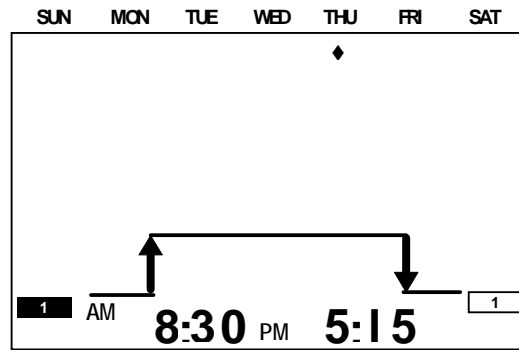
2. Press the **SHIFT KEY**. The cursor (denoted by a solid \blacklozenge) will initially appear in the Sunday position. In all other days of the week the \blacklozenge will be blinking.



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

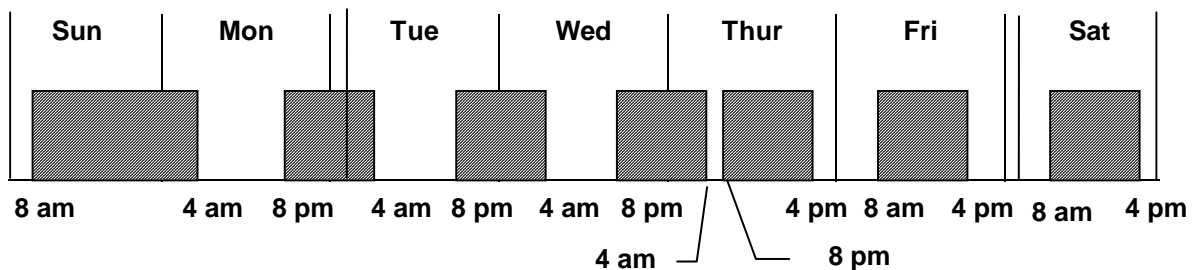


4. Open the lower drawer of the timer and press the **CHECK KEY**. Each time this key is pressed, the operation schedule is displayed in the sequence the operations are to be executed. The **ON** and **OFF** times for **PROG1** are displayed, starting with the earliest **ON** time. Then the times set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

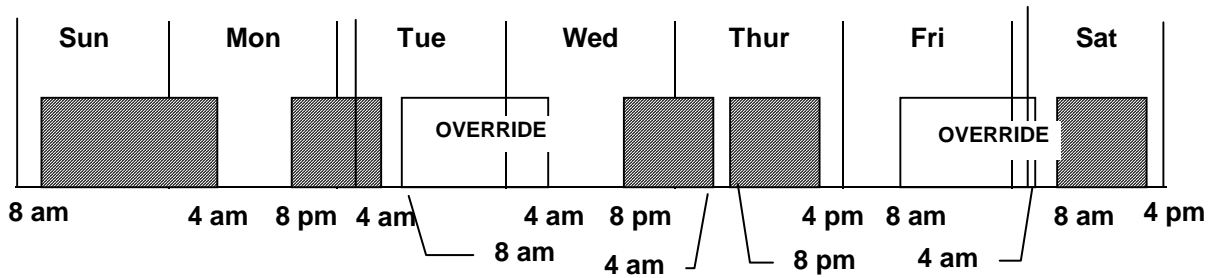


5.6 Day Override

Circumstances may require that the timer operations for a given day be executed on another. The override function effects both **PROG1** and **PROG2**. If an override is executed for a particular day, the settings of both programs are transferred to that day. When using the day override function, the operation that is transposed on another takes precedence. For example, consider the following control scheme:



You wish to perform Sunday-Monday’s programming on both Tuesday and Friday. Using the day override function, the control scheme becomes:



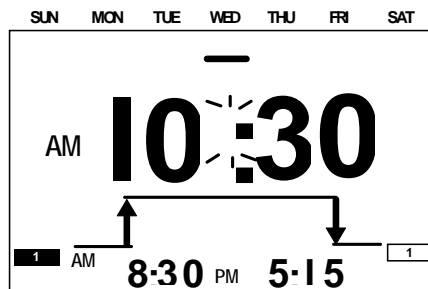
In this case, the programmed operation of Sunday-Monday is transposed upon Tuesday and Friday. On Tuesday, the switch output of the timer is turned on at 8:00 am (Sunday's time) instead of the original programmed time of 8:00 pm. The switch output of the timer is then turned off the following day, Wednesday, 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, after which the timer operates to the previous programming scheme.

5.6.1 Setting an Override

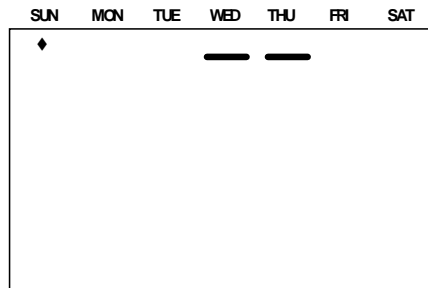
In the following example, the timer operations for Wednesday and Thursday will be overridden with Sunday's. To transpose Sunday's operations onto Wednesday and Thursday:

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

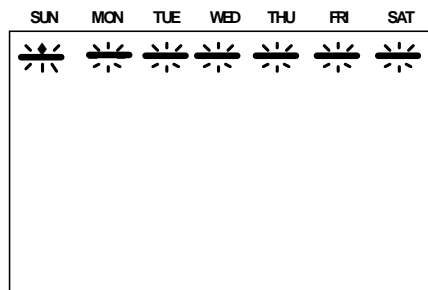


2. Open the lower drawer of the timer and hold down the **COPY KEY** for one second or more.

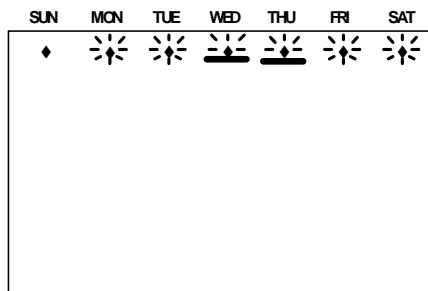
3. If an override has been previously set, the following display will appear. To change the setting of that day, cancel it once and specify the new setting using the **SHIFT** and **SET KEYS**.



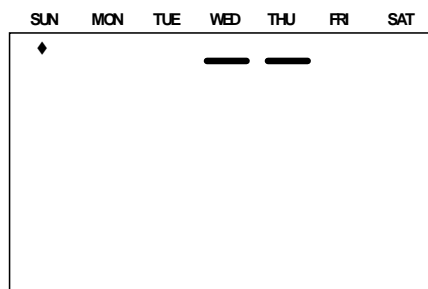
4. If no override has been previously set, the following display will appear:



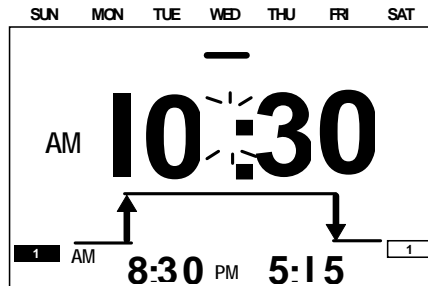
5. Using the **SHIFT** and **SET KEYS**, select both Wednesday and Thursday as the days to be overridden.



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



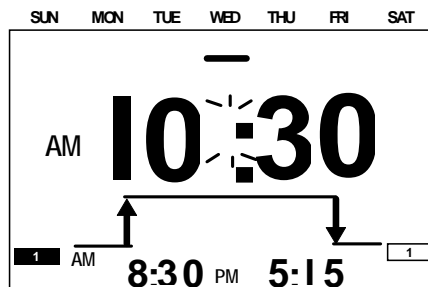
- Press the **WRITE KEY** to enter this override into memory. The override will stay in the timer's memory for one week and a day (until the following Monday), after which the timer will operate at its previously set programming scheme.



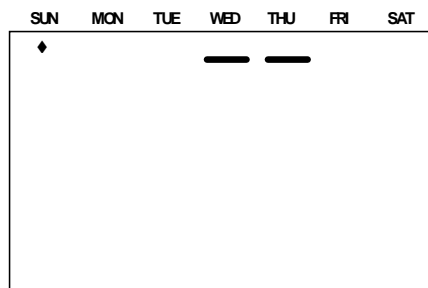
5.6.2 Canceling an Override

To cancel a day override:

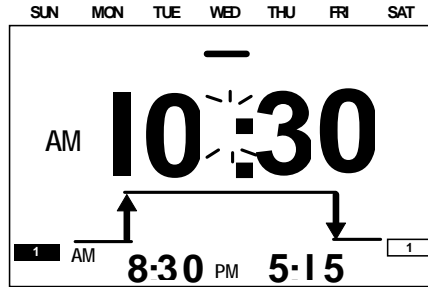
- Verify that the timer is in **RUN MODE**. If it is not, place the **MODE SWITCH** in the **RUN** position.



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



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

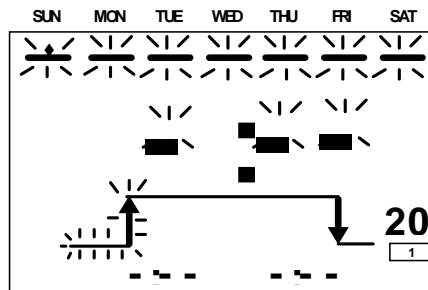


5.7 Clearing/Canceling Programs

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

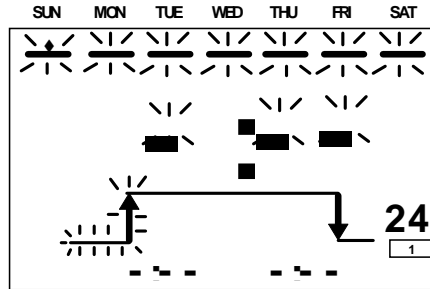
◆ PROG1 or PROG2 SET MODE

1. Enter the set **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:**

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

6 CLEANING & MAINTENANCE

6.1 *Maintenance*

The Innova Shaker requires no routine mechanical maintenance on the part of the user.

The MAINT indicator light goes on 10,000 hours after the unit was last serviced. At that time, contact your local NBS Service Engineer or call the NBS Service Department (in the USA, call 1-800-631-5417). This periodic maintenance will keep your unit in premium condition.

6.2 *Cleaning*

The outside 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 condenser coil is in the rear lower section of the unit. Like the coil on a household refrigerator, this coil will collect dust and reduce the cooling capacity. After every 3 months of use, to clean the coil:

1. Unplug and remove the power cord.
2. Remove the back covers.
3. Vacuum the coil and its surrounding areas.

Perform this cleaning more frequently if the unit is in a dusty environment.

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7 SERVICE

The following section describes basic troubleshooting service procedures, provides instructions to install optional feature, and lists service parts.

With the exception of Lamp Replacement and Lamp Starter Replacement in Sections 7.10 and 7.11, all of the instructions in this chapter are ONLY for use by a qualified service engineer.

**WARNING!**

Before a Qualified Service Engineer performs any service or maintenance on the instrument, be sure (1) to turn the power off using the ON/OFF switch on the front right of the shaker, and (2) to disconnect the power cord.

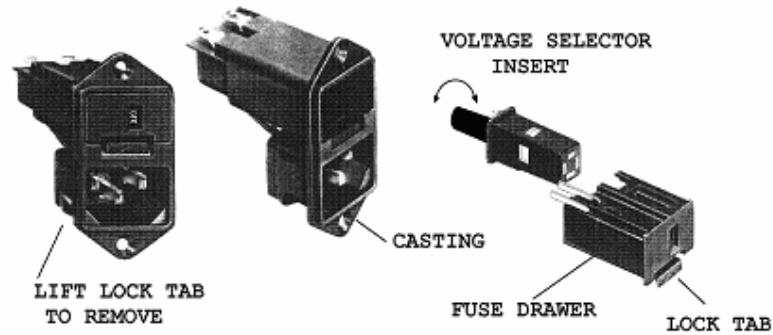
7.1 Changing Fuses

The unit is designed with a circuit breaker that is used as an ON/OFF switch. There are four fuses on the left side of the unit (*see Figure 3*). One is to protect the control circuitry, one is to protect the motor circuit and the one is to protect the illumination system, and one to protect compressor.

To remove a fuse, insert a small, flat-bladed screwdriver and turn counter-clockwise 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.

7.2 Changing Voltages & Frequency

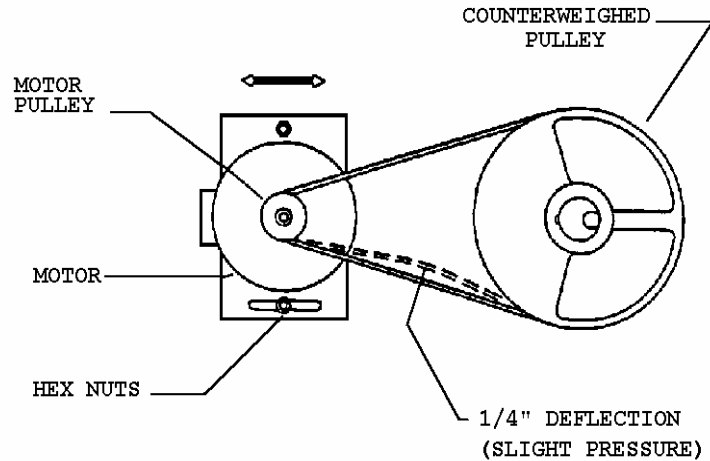
Innova 4340 is set to the appropriate line voltage and frequency prior to shipment. The voltage selector switch (*see Figure 2*) is a universal power-entry device that can be reset to adapt to worldwide power requirements. Should it become necessary to set the unit to a different voltage or frequency, use the following procedure with reference to Figure 9 below.

Figure 9: Power Entry Module

1. Set the ON/OFF switch (located on the right front panel of the unit) to OFF.
2. Disconnect the unit from the power source.
3. Using a flat-bladed screwdriver, raise the lock tab under the voltage selector and remove the fuse drawer portion of the power entry module.
4. Remove the fuse holder, rotate it until the appropriate voltage appears in the fuse drawer window, and replace the fuse holder.
5. Replace the fuse drawer into the power entry module.
6. Set the frequency slide switch to the appropriate position.
7. Check that the proper power cord is available for the voltage selected.
8. Plug the appropriate power cord into the power cord connection on the unit, then plug it into the power source.
9. Set the ON/OFF switch to the ON position. The unit is ready for operation.

7.3 Belt Replacement Procedure

Figure 10: Belt Replacement & Adjustment



1. Turn off the power and remove the power cord.
2. Remove the lower front cover using a Phillips head (+) screwdriver.
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 (part number R-338) by feeding it onto the motor pulley and guiding it onto the large pulley while rotating the small pulley.



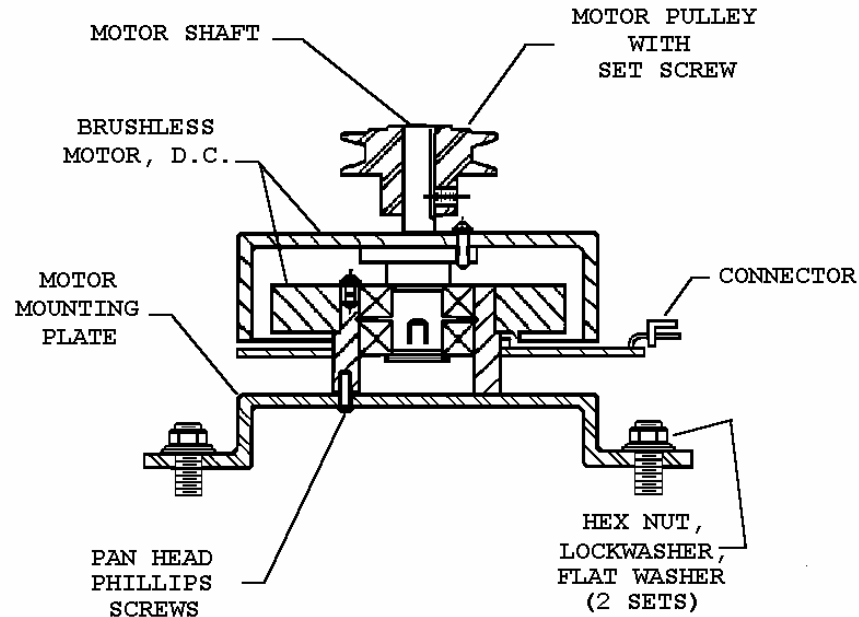
WARNING!

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 $\frac{1}{4}$ 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. Replace the lower front cover.
7. Connect the power cord.
8. Set the circuit breaker to the “ON” position. The unit is ready for operation.

7.4 Motor Assembly Replacement

Figure 11: Motor Assembly Replacement



1. Turn off the power and disconnect the power cord.
2. Remove the lower front cover using a Phillips head (+) screwdriver.
3. Remove the connector from the motor assembly. Remove the green ground wire going to the chassis (disconnect it from the chassis side).
4. Remove the 2 hex nuts and washers, then lift out the motor and plate assembly.
5. Position the new motor assembly (part number M1191-4000) back onto the unit. Replace the 2 hex nuts with hardware. Do not tighten.
6. Connect the green wire coming from the motor assembly to the chassis.
7. Replace the belt. Adjust the motor pulley height so that the belt is level as related to the drive pulley, then tighten the set screw.
8. Adjust the belt tension as shown in Figure 10. Tighten the 2 hex nuts.
9. Rotate the large pulley by hand and see that the belt tracks smoothly.

10. Replace the motor connector. Be sure the motor connector is positioned with no pins visible and the red stripes on the cable connector are facing **down**. Reconnect the green wire from the motor assembly to the chassis.
11. Replace the lower front cover.
12. Connect the power cord and turn the circuit breaker to the ON position. The unit is ready for operation.

7.5 *MAINT Indicator*

After the shaker has been operating for 10,000 hours accumulated running time, the MAINT indicator light on the control panel will light. This indicates that a routine maintenance check is recommended. Only an NBS Service Engineer can turn off the MAINT light.

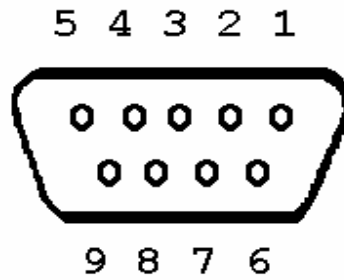
A regular schedule of routine maintenance is an excellent way to keep your valuable equipment performing optimally for years of reliable service.

7.6 *Recorder Adaptation*

To record speed and temperature, a recorder (not supplied) can be used. The recorder must have the following capabilities:

- For speed and temperature, two channels are required. Each channel should have signal conditioning that accepts 0-5 volt DC input.
- The pin-out diagram and scale below identifies the application.
- A mating connector is required on the recorder cable (not supplied). This is a 9-pin male D subminiature connector, AMP Amplimite HDP-20 series or equivalent.

Figure 12: Pin-Out Diagram for Chart Recorder



Note: As seen from back of unit.

Pin Number	Signal Name	Scale
6	Speed	1V = 100 rpm
2	Ground	
7	Temperature	1V = 20° C
3	Ground	

7.7 ESD Precautions



WARNING!

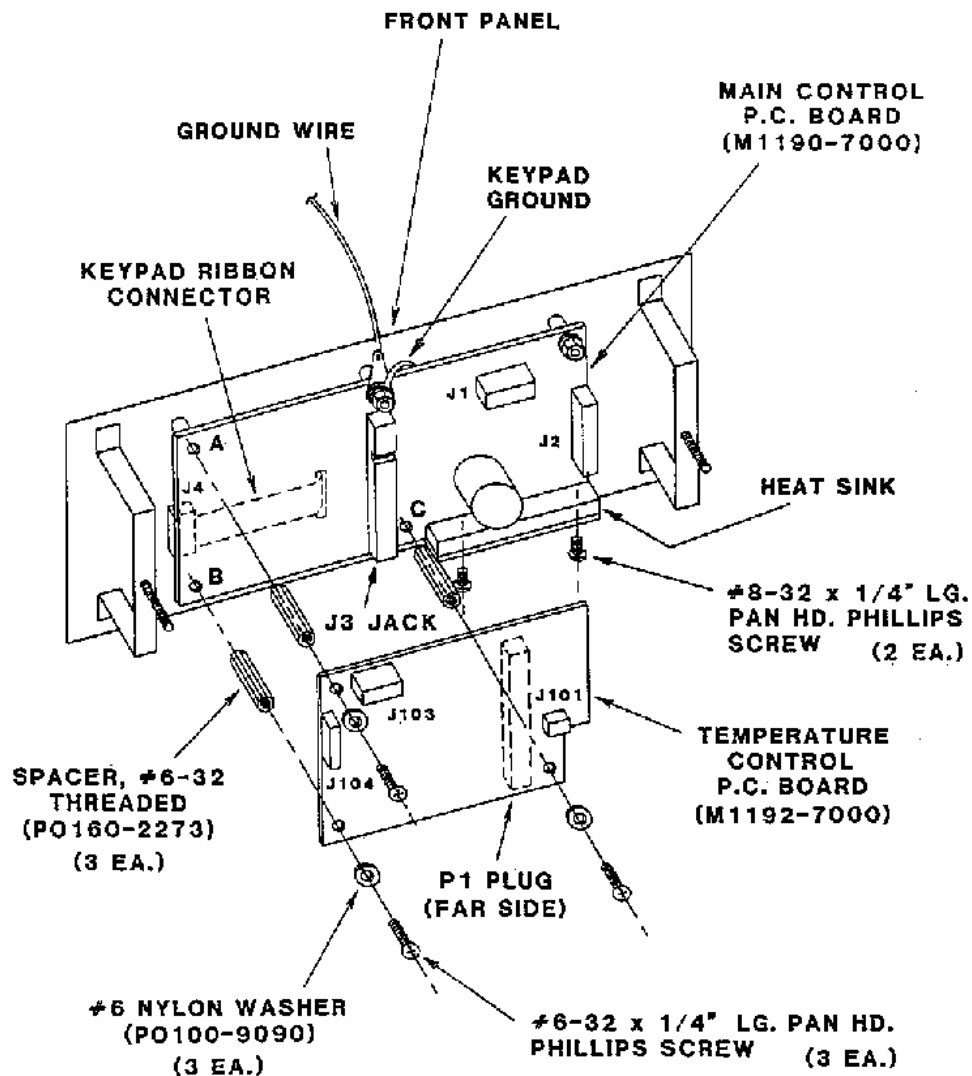
Do NOT attempt to change boards or electronic components unless you are a qualified service technician.

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.

7.8 Replacement of Main Control Board

Figure 13: Control Board Replacement



1. Switch the shaker off and disconnect the power cord.
2. Open the lid and remove the diffuser panel. Then remove the two 3/8 inch hex nuts. These nuts are located on the back of the front panel.
3. Carefully push the two threaded studs, now exposed, so that the control panel eases out from the lid.
4. Disconnect the harness wiring from connectors J1, J2, J101, J102, J103 and J104.

5. Remove the temperature control board:
 - a. Remove the three ¼ 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 lose the five ¼ inch spacers or the gray insulator.

10. Position the gray insulator on the solder side of the new main control board (part number M1190-7000) 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. Replace the two screws that fasten the heat sink to the bracket assembly. Do not tighten at this time.
13. Replace the three hex spacers, tighten.
14. Replace the keypad ground lead and the green wire from the main chassis.
15. Replace 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. Replace the three nylon flat washers and ¼ inch screws.

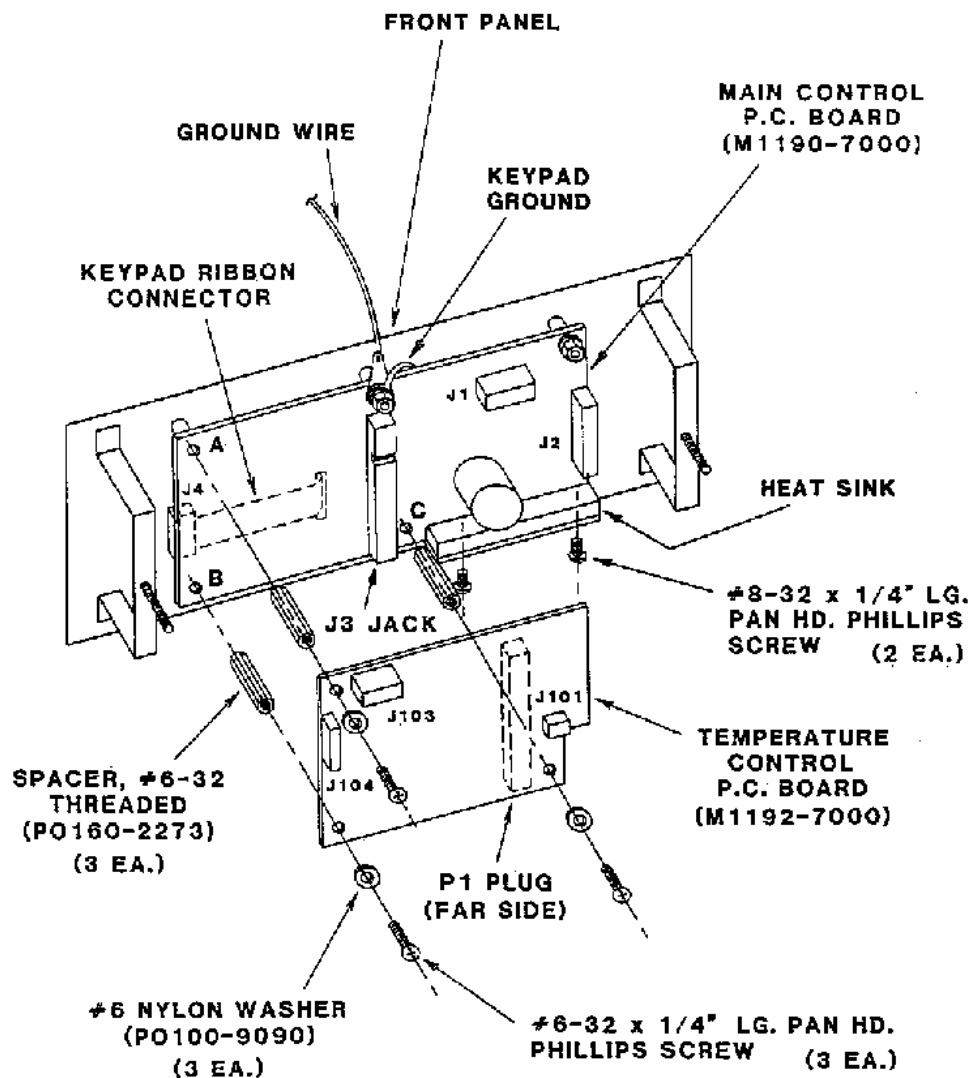
- c. Reconnect the harness wiring to connectors J101, J102, J103 and J104. Make sure that each connector is properly positioned (keys mate and no pins remain exposed).
- d. Replace the panel and secure with the two 3/8 inch hex nuts.

19. Replace the diffuser panel.

20. Connect the power cord to the rear of the shaker.

7.9 Replacement of Temperature Control Board

Figure 13: Control Board Replacement



1. Switch the shaker OFF and disconnect the power cord from the rear of the shaker.
2. Open the lid and remove the diffuser panel, then remove the two 3/8 inch hex nuts. These nuts are located on the back of the front panel.
3. Carefully push the two threaded studs, now exposed, so that the control panel eases out from the lid.
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. Replace 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. Replace the panel and secure with the two 3/8 inch hex nuts.
11. Replace the diffuser panel.
12. Connect the power cord to the rear of the shaker.

7.10 Lamp Replacement

The user can perform this procedure. To replace one of the lamps:

1. **Turn the unit OFF and unplug the power cord.**
2. Open the lid and remove the diffuser panel.
3. Carefully rotate the lamp to remove it from its sockets.
4. Install the new lamp by sliding it into the slots on the sockets and rotating it until it snaps into place.
5. Replace the diffuser panel.

7.11 **Lamp Starter Replacement**

The user can perform this procedure. To replace one of the lamp starters:

1. **Turn the unit OFF and unplug the power cord.**
2. Open the lid and remove the diffuser panel.
3. Rotate the starter counter-clockwise and remove it from its socket.
4. Install the new starter and rotate it clockwise to latch it in place.
5. Replace the diffuser panel.

7.12 **Quick Change Platform Option**

The Easy Loading Platform Kit (part number M1193-9931) enables the user to change or mount the series of 18 inch x 30 inch (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 are included in the kit:

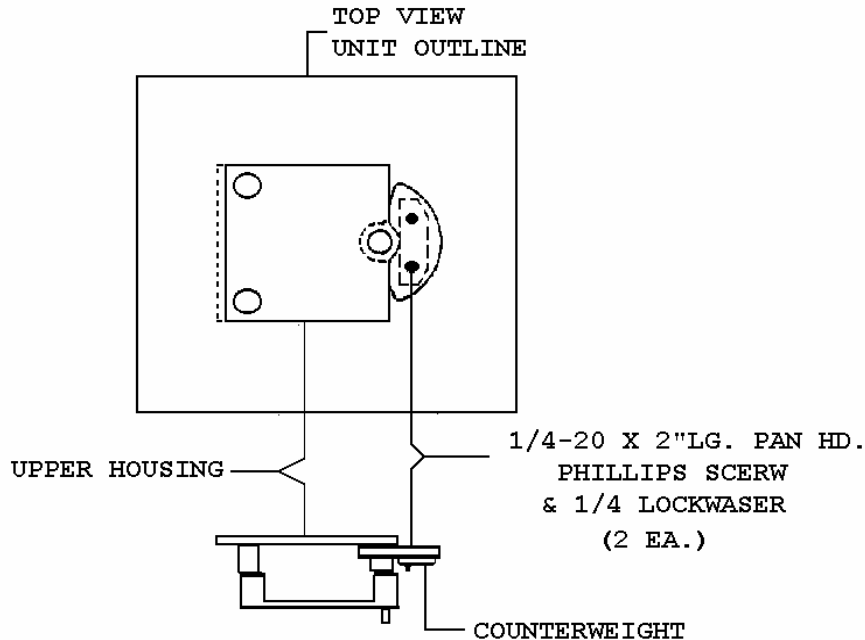
Quick Change/Easy-Loading Platform Kit (M1193-9931)	
1	Plastic subplatform with springs, retainers & friction pads attached
1	Counterweight with tapped holes
1	Counterweight with clearance holes
2	¼-20 x 2-inch long pan head Phillips screws and lockwashers
4	3/8-16 x 1-inch long Allen socket flat head screws
1	7/32 inch Allen key wrench

7.12.1 **Installation**

1. Turn the power off using the power switch and disconnect the power 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's counterweight, keeping the part with the clearance holes on top and the one with the tapped holes below. Mount with the two $\frac{1}{4}$ inch x 2 inch long screws and lockwashers supplied (see Figure 14 below). Be sure to tighten the screws securely.

Figure 14: Quick Change Platform Option



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 inch x 30 inch (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. Plug in the power cord and switch on the power. The unit is ready for operation.

7.12.2 Removal

1. Stop the machine by pressing the START/STOP key.
2. Face the machine squarely. 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 with index fingers, lift the platform from its retained position.



NOTE:

With the Quick Change Platform installed, Recommended Maximum Speed is 400 rpm.

7.13 Service Parts List

Part Number	Description	Quantity
P0380-3710	0.16A Fuse (Control Voltage)	1
P0380-3532	1.6A Fuse (Motor Ckt) (Main)	1
P0420-1610	10VA Transformer	1
M1191-5300	130VA Transformer	1
P0320-0350	21000 μ F Capacitor	1
P0460-4091	Diode Bridge	1
P0360-4040	130V Varistor	2
M1191-4000	Large Motor Assembly	1
M1190-9941	Main Control Board	1
M1192-7000	Temperature Control Board	1
M1190-5000	Membrane Sw. Panel	1
P0400-4305	15A Circuit Breaker	1
P0400-3011	10A Solid State Relay	1
P0620-1381	450 Watt Heater	2
M1195-8001	RTD Assembly	1
P0720-2024	Power Cord 120V 15A	1
P0720-2021	Power Cord 220V	1
B-162	Bearing Upper Housing	3
P0180-0282	Bearing Shielded	6
R-337	Belt	1
M1193-6331	Bearing Housing Assembly	1
M1193-9933	Lid Gasket	1
P0400-1531	Magnetic Switch	1
P0400-1538	Magnet	1
P0620-2561	6-inch Fan	1
P0640-0380	Gas Springs	2

Part Number	Description	Quantity
P0220-1971	Electronic Timer	1
P0400-0990	Lamp Switch	3
P0380-0210	Lamp Socket	12
P0380-3450	5A Fuse (Illumination)	1
P0260-0310	Fan Guard	1
P0460-2205	Power Entry Module	1
P0380-6640	Fuse Drawer	1
P0300-0040	Gro-Lux Lamp	6
P0400-1421	Lamp Starter	6
P0420-1670	1KVA Auto Transformer	1
P0400-3151	45A Solid State Relay	1
M1164-0100	Condenser	1
P0220-2081	Automatic Expansion Valve	1
P0200-1210	Filter Dryer	1
M1193-9949	Evaporator Coil	1
P0420-5200	Dual Lamp Ballast	6
P0620-2536	Fan	1
P0460-7150	Temp. Controller	1
P0720-6290	Temp. Probe	1
EF-118	6.25A Fuse Compressor (Slow Blow)	1
P0620-2511	Fan Compressor	1

8 SPECIFICATIONS

This chapter provides technical details of interest, but not necessarily essential for operation of the instrument.

SHAKING	
Speed	25-500 RPM
Motion	1 inch (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 feedback
Accuracy	± 1 RPM
DRIVE	
Triple eccentric counterbalanced ball bearing drive.	
TEMPERATURE	
Range	17.0°C below ambient (4.0°C minimum at 20°C ambient) to 60.0°C with full illumination
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
Alternate Setpoint	Digitally adjustable secondary temperature setpoint is activated by the auxiliary channel of the programmable illumination timer
Accuracy	± 0.1° @ 30-40°C range ± 0.25°C for remaining range
Uniformity	Better than ± 0.25°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
TIMER (Shaker)	
<ul style="list-style-type: none"> • Programmable shaking periods from 0.1 hour to 99.9 hours 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. 	
ILLUMINATION	
Lamps	Six 30-watt Gro-Lux® fluorescent lamps designed specifically for photosynthetic investigations.
Controls	Three switches allow selective operation of lamp pairs.
Programmable Illumination Timer	24-hour x 7-day digital electronic timer allows control of lamps with up to 16 program steps or cycle operations. Timer maintains correct time of day, even when unit is off. A second, independent timer channel allows programmable activation of an alternative temperature setpoint.

AMBIENT OPERATING ENVIRONMENT		
0° - 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. The audible alarm can be deactivated/activated by the operator.		
REMOTE MONITORING		
<ul style="list-style-type: none"> • Chart recorder outputs for speed and temperature (0-5V). • 1V per 100 RPM; 1V per 20°C, accuracy ± 25mV. 		
AUTOMATIC RESTART		
<ul style="list-style-type: none"> • 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		
<ul style="list-style-type: none"> • 100V, 120V, 220V, 240V • 50 or 60 Hz • 1600 VA Universal power entry system adapts to U.S. or International requirements. 		
DIMENSIONS		
Width	45 inches	114 cm
Depth	28 inches	71 cm
Height	37 inches	94 cm
PLATFORM DIMENSIONS		
	18 inches x 30 inches	46 cm x 74.6 cm
CHAMBER DIMENSIONS (Interior)		
Width	34¾ inches	88.3 cm
Depth	22¼ inches	56.6 cm
Clearance (above platform)	19¼ inches	48.9 cm
CONSTRUCTION		
<ul style="list-style-type: none"> • Heavy gauge steel, phosphate-coated and texture-painted cabinet. • Stainless steel chamber (interior). 		
WEIGHT		
Net	430 lbs	195 kg
Gross	520 lbs	236 kg

9 OPTIONS & ACCESSORIES

9.1 *Easy-Load Platform Option*

The Quick-Change Platform option is available for the Innova 4340. This easy-load accessory enables the user to snap in platforms without tools or hardware.

The kit includes a subplatform with spring clips, and extra counterweights 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.

Catalog Number	Description
M1193-9931	Easy-Loading Kit

9.2 *Interchangeable Platforms*

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

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

*Flask clamps must be ordered separately.

9.3 Test Tube Racks for Universal Platform

Test tube racks must be used on the Universal Platform (part number M1250-9920). The following choices are available:

Catalog Number	Description	Tubes per Rack	Racks per Platform
TTR-111	Rack for 13 mm tubes	48	7
TTR-121	Rack for 20 mm tubes	33	7
TTR-122	Rack for 25 mm tubes	21	7
TTR-199	Adjustable-angle slant rack	15	4
TTR-208	Rack for 30 mm tubes	15	7

9.4 Accessory Flask Clamps

All of the following clamps are constructed of stainless steel.

Catalog Number	Type of Clamp
ACE-10S	10mL Erlenmeyer
M1190-9004	25mL Erlenmeyer
M1190-9000	50mL Erlenmeyer, with spring retainer
M1190-9001	125mL Erlenmeyer, with spring retainer
M1190-9002	250mL Erlenmeyer, with spring retainer
M1190-9003	500mL Erlenmeyer, with spring retainer
ACE-1000S	1.0L Erlenmeyer, with spring retainer
ACE-2000S	2.0L Erlenmeyer, with spring retainer
ACE-4000S	4.0L Erlenmeyer, with spring retainer
ACE-6000S	6.0L Erlenmeyer, with spring retainer
ACFE-2800S	2800mL Fernbach Flask, with spring retainer
ACSB-500S	500mL Media Bottle, with spring retainer
ACSB-1000S	1.0L Media Bottle, with spring retainer

9.5 Installation of Clamps

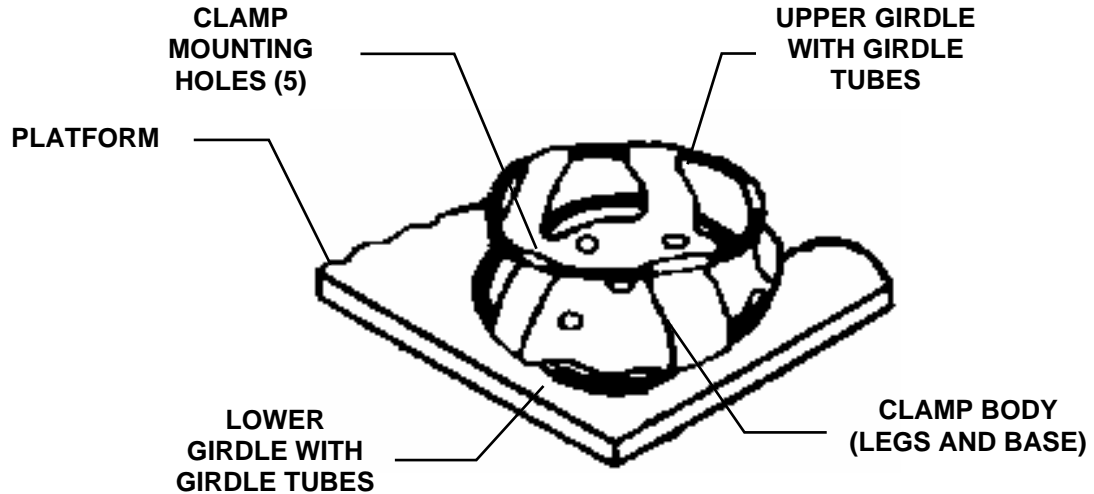
Flask clamps purchased for use with universal platforms require installation. Clamps are installed by securing the base of the clamp to the platform with the correct type and number of screws (refer to clamp hardware application charts below).

All clamps are shipped complete with hardware. Clamps for 2- to 6-liter flasks are shipped with an additional girdle to keep the flasks in place. To install 2- to 6-liter clamps (*with reference to Figure 15 below*):

1. Place clamp on platform, secure in place with correct type of screws (refer to clamp hardware application charts below).
2. Place the loose girdle around the upper portion of clamp body so that it is held in place by the legs of the clamp.

3. Insert the flask into the clamp.

Figure 15: 2- to 6-Liter Clamp Installation






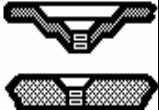


NOTE:

2800 ml Fernbach Flask Clamp applicable to above.







9.6 Clamp Mounting Hardware

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

	Description	Part Number	Qty.	Application
	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

10 DRAWINGS

10.1 Control Schematics

Figure 16: Control Schematics—Overview

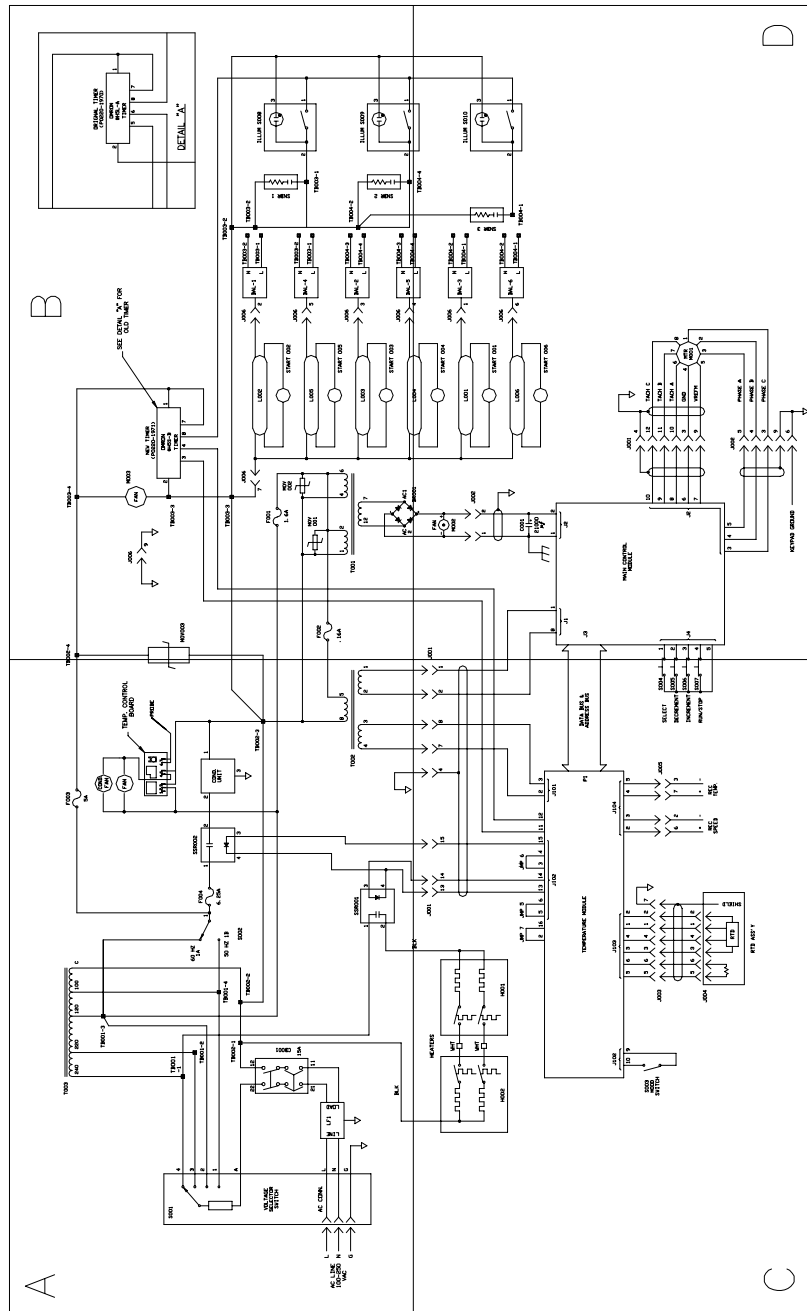


Figure 17: Control Schematics—Quadrant A

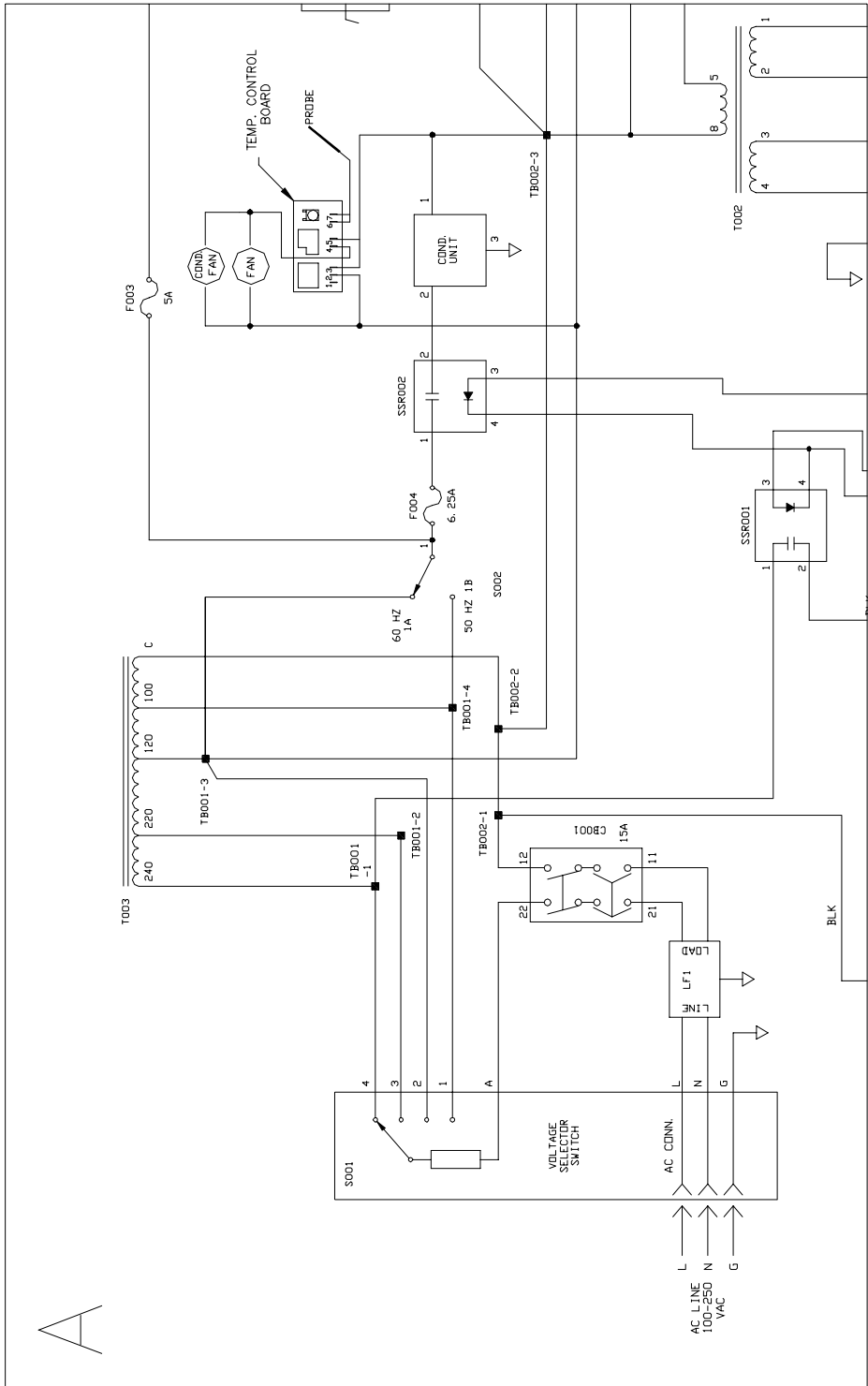


Figure 18: Control Schematics—Quadrant B

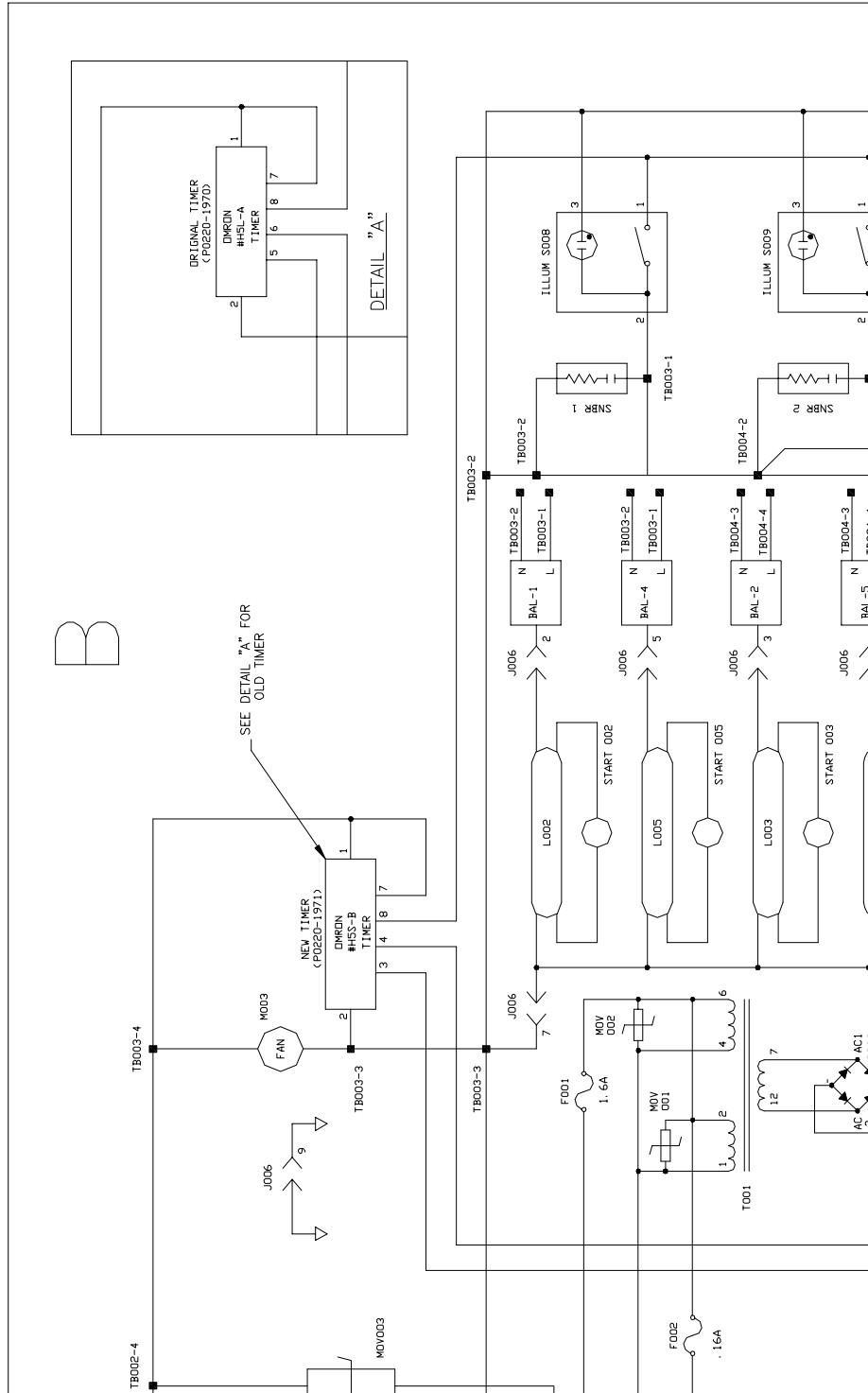


Figure 19: Control Schematics—Quadrant C

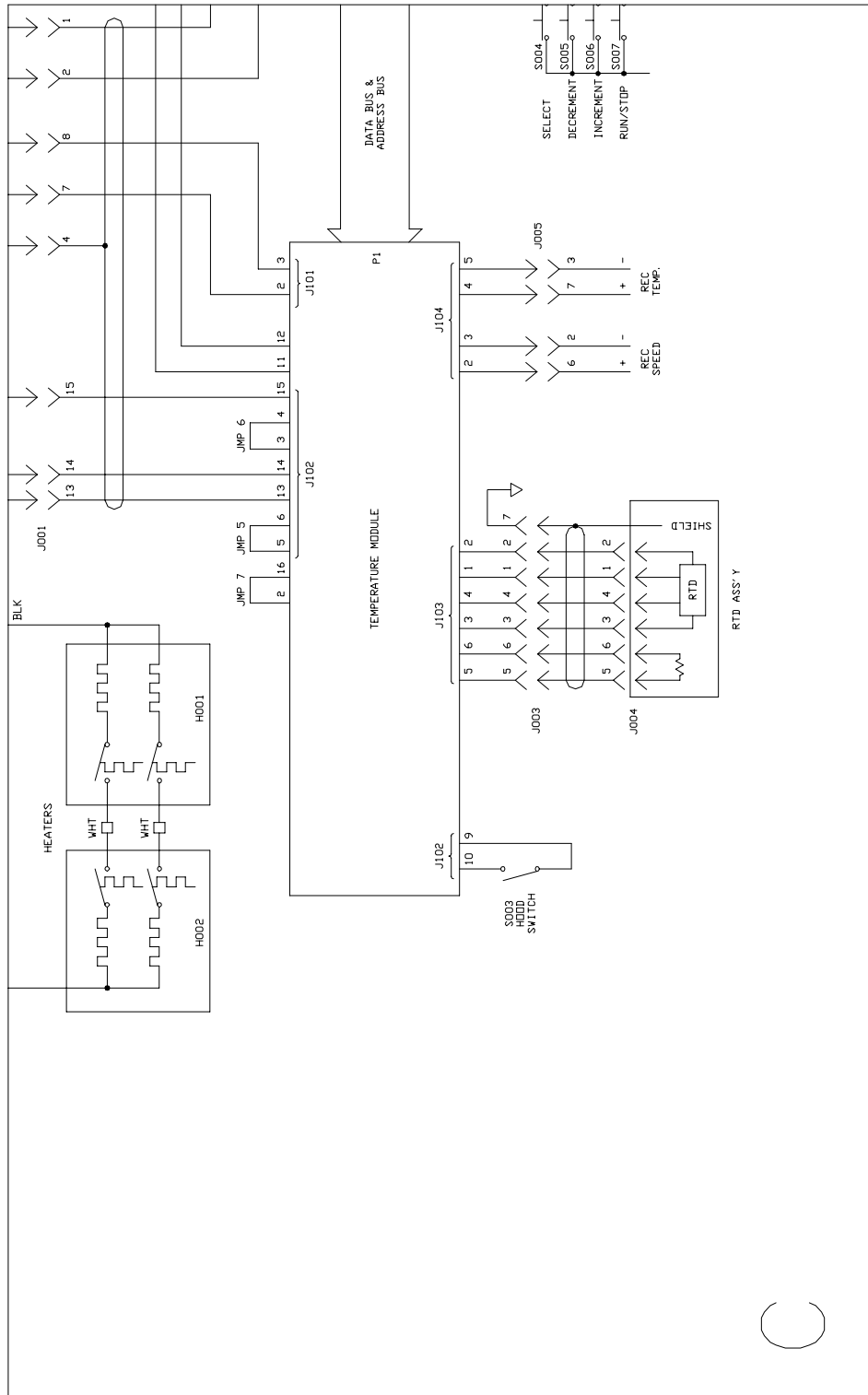


Figure 20: Control Schematics—Quadrant D

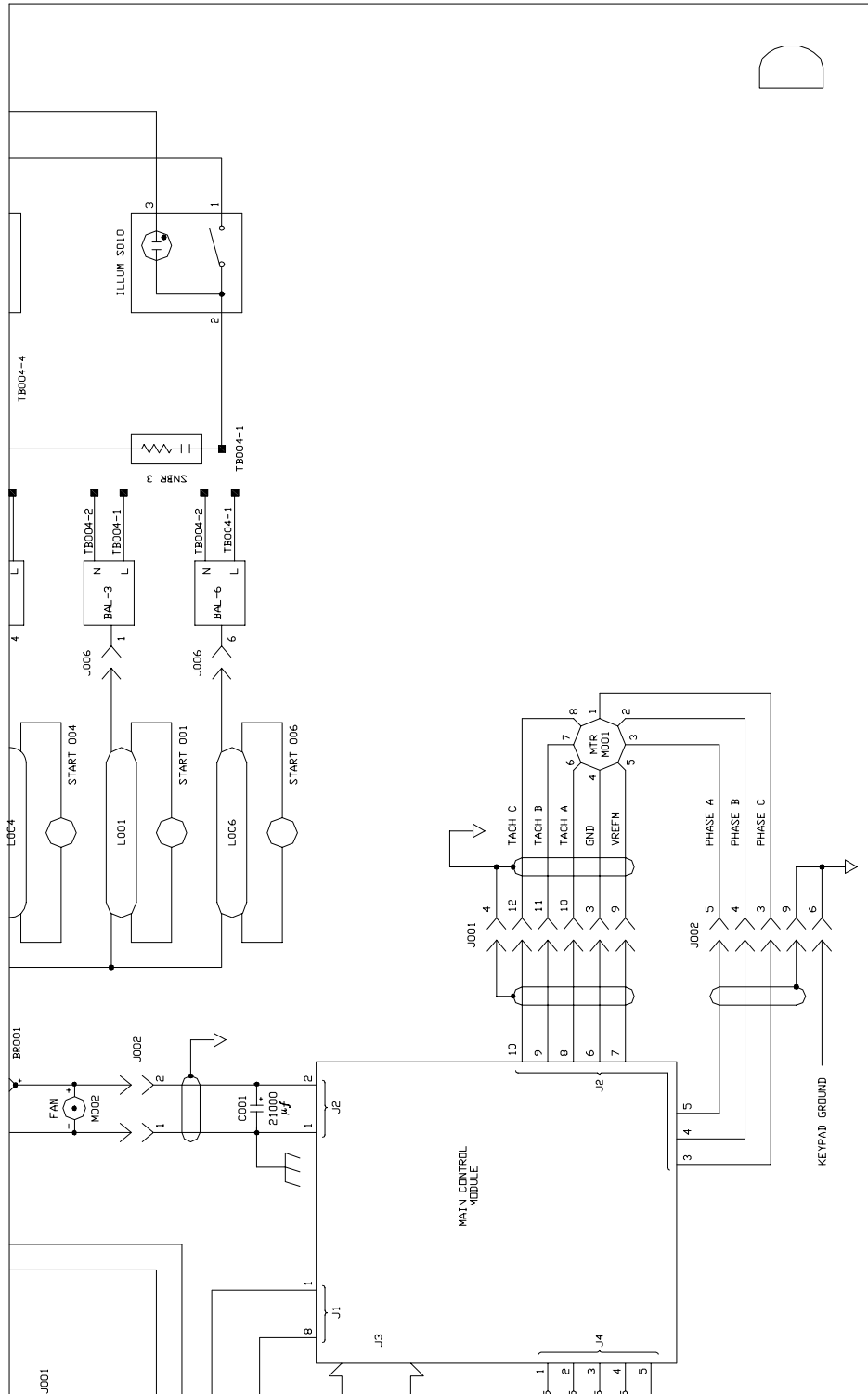


Figure 21: 100V Power Kit Schematic

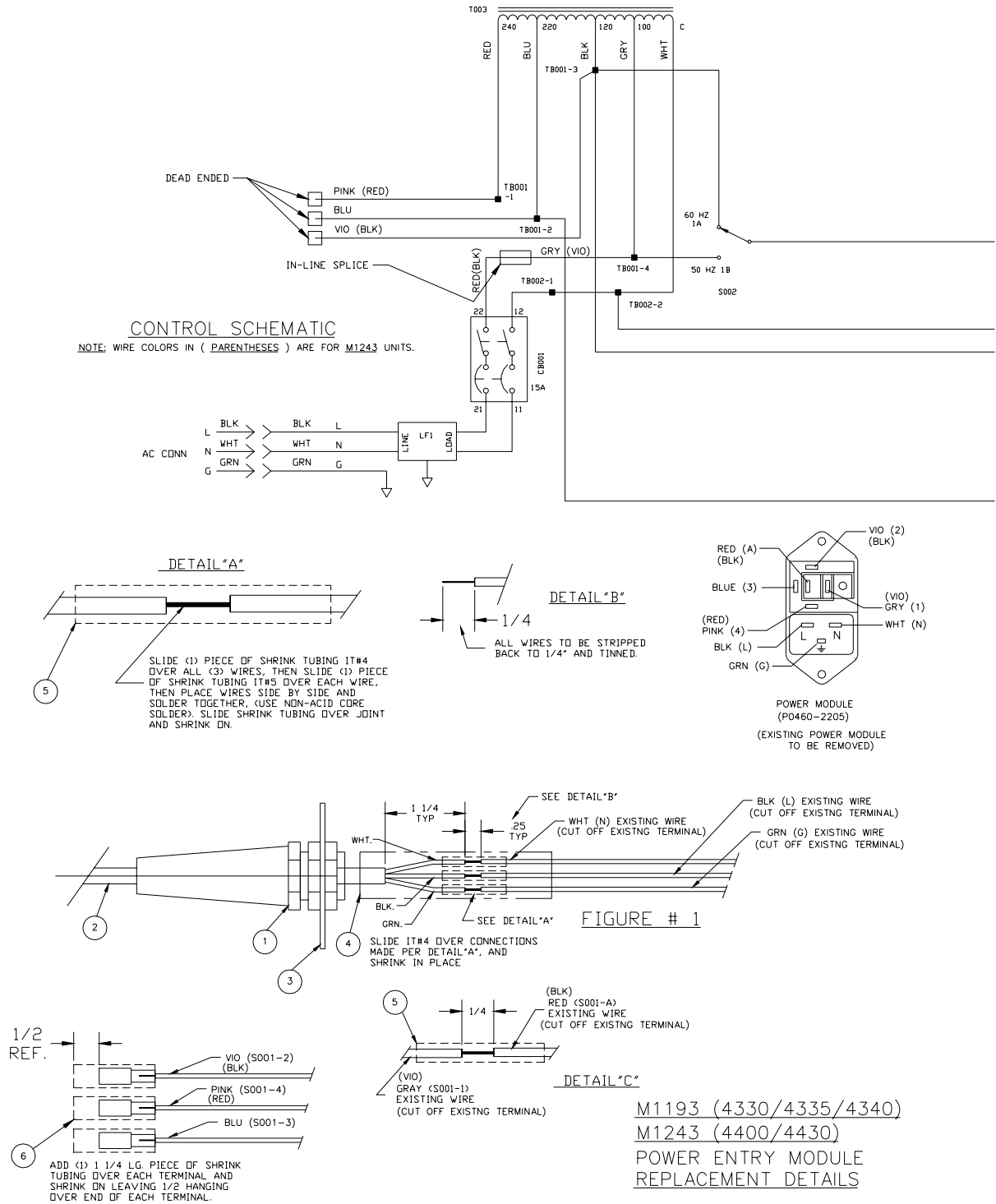
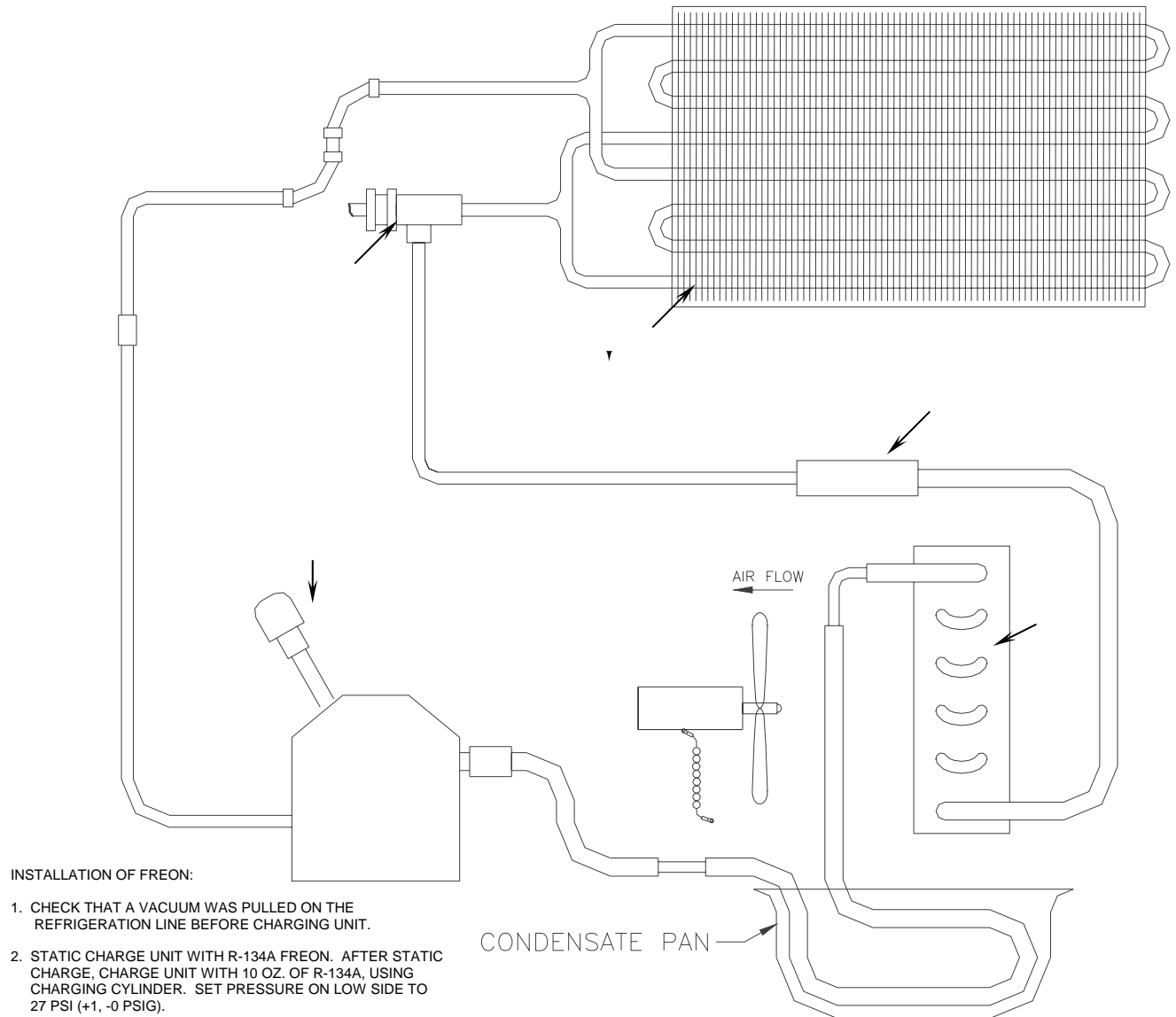


Figure 22: Refrigeration Schematic



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

10.2 List of Drawings

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