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New Brunswick™ Products

Operating Manual M1233-0054 Revision N+

The enclosed Operating Manual was originally produced by the New Brunswick Scientific Company, Inc.

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Guide to Operations

innOva™ 4230

Refrigerated Incubator Shaker

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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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New Brunswick Scientific Co., Inc. reserves the right to change information in this document without notice. Updates to information in this document reflect our commitment to continuing product development and improvement.

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 boldface type emphasizes key words or phrases.**
	This particular *Warning* message, whether found in the manual or on the unit, means HOT SURFACE–and therefore represents a potential danger to touch.
CRUSH WARNING!	***Crush Warning* messages alert you to specific procedures or practices <u>regarding heavy objects</u> which, if not followed correctly, could result in serious personal injury .**

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

New Brunswick Scientific's Innova 4230 Incubated/Refrigerated Biological Shaker is a very versatile shaker for the biological research laboratory. The Innova 4230 provides a temperature-controlled environment that can be equipped with various accessories to adapt it for the culture of microorganisms, photosynthetic microbial growth, cell culture and hybridization. The 4230 shaker, equipped with an integral refrigeration system, allows precise temperature control at or below ambient temperature, and a non-refrigerated version is also available.

The Innova 4230 is totally CFC-Free and has some of the most advanced safety features. Automatic features include an interlock door that shuts off the shaker when the door is open, chamber temperature shutoff, and overload/unbalanced sensor that automatically limits the speed of the shaker when an unbalanced or overloaded condition is detected. Audible and visual alarms alert the user when the temperature or speed is out of range.

Microprocessor controller with feedback controls the temperature and speed of the shaker. Temperature and speed setpoints are entered and changed using the membrane switch keypad. Setpoints and the actual values are displayed on the 3/8 inch (9.5 mm) bright LED display. The shaker operates continuously, or in a timed mode via an *hour timer* for shaking periods of 0.1 hour–99.9 hours. An audible and visual alarm indicates the end of a timed cycle. The triple eccentric drive is counterbalanced and provides horizontal plane rotary motion in ¼ inch (19 mm) circular motion. A 1inch (25.4 mm) model is also available.

The Innova 4230 has a (0–5 Volt) analog chart recorder outputs for speed or temperature. It may also be equipped with an optional programmable *electronic timer* that offers a wide variety of choice for automatic runs: type of operation (standard, multiday or cyclic), temperature control (at one level or alternation between two setpoints), and shaker control (on or off).

The 4230 is stackable (up to two units), and accommodates routine laboratory accessories like Rollers, Magnetic Stirrers, Rockers, and Shakers. A wide variety of platforms and accessories are available for the Innova 4230.

1.1 Specifications

Innova 4230 Incubated/Refrigerated Shaker		
Cabinet	**Construction**	Heavy gauge stainless steel
	Door	26 3/8″H x 22″W (670 mm x 559 mm)
	Double paned glass window	19 ¼′″H x 11 3/8″W (489 mm x 289 mm)
	Fluorescent light	13 watt–provides illumination inside chamber
	Shelves	2 Stainless Steel 20″W x 20″L (508 mm x 508 mm)–adjustable–(½″ (12.7 mm) centers)
	Internal AC receptacle	200W AC–waterproof w/ mating connector–can be used w/ magnetic stirrer, spinner flask, rocker, roller & shakers
Dimensions	**Platform**	18″W x 18″L (457 mm x 457 mm)
	Overall†	24.4″W x 28.7″L x 36.4″H (620 mm x 729 mm x 925 mm)
	Chamber	20½″W x 20½″L x 24.8″H (520 mm x 520 mm x 630 mm)
Electrical		1500 Watts–120/100/200/240V–50/60 Hz
Indicator		3 digit LED
Refrigeration		1/5 HP uses CFC-Free (R134A) Refrigerant
Recorder Output		Two 0-5 Volt–tracks temperature & speed w/ optional recorder
Shaking	**Alarm**	Audible & visible indicates when speed deviates ±5 rpm–audible alarm can be deactivated
	Control	±1 rpm–acceleration control minimizes splashing caused by sudden starts and stops
	Display	1 rpm increments
	Drive	Triple-eccentric counterbalanced drive w/ 9 sealed for life, ball bearings
	Motion	¾″(19 mm) circular–standard 1″(25.4) optional
	Motor	1/15 HP, 3-phase solid-state, brushless ball bearing DC motor
	Range	25–400 rpm, 25-300 rpm for stacked unit
	Hour Timer*	Programmable shaking continuous → 99.9 hours–setable in 0.1 hr. increments–alarm sounds at end of shaking period
Safety	**Automatic restart**	Setpoints & operating status retained by non-volatile memory–auto restart after power is restored
	Door interlock	Shaker shuts off when door is open
	Unbalanced/ overload sensor	Limits speed automatically when unbalanced or overload condition is detected
	Chamber temperature	Heater shuts off if temperature exceeds operating range

† 51.2 (130 cm) front to back w/ door open

*** this simple timer is accessed through the control panel keypad; there is also an electronic timer which can be programmed with multiple instructions (see Section 4.3 and Chapter 7 for details)**

Innova 4230 Incubated/Refrigerated Shaker		
Options	**Photosynthetic light bank**	Provides light that follows the photosynthetic curve of photosynthetic organisms
	Electronic Timer	Programmable to turn shaker on & off and to switch between two temperature setpoints. Multiday or cyclic programming.
	Stacking kit	Provides stacking for up to 2 Innova 4230 shakers
Temperature	**Alarms**	Audible & Visual–when temperature deviates > 1.0°C–audible alarm can be deactivated
	Ambient	15–35°C/Humidity–up to 90% non-condensing
	Control	±0.1°C—alternation between two setpoints programmable via electronic timer
	Heaters	Resistance w/ high temperature safety cutoff
	Range	20°C below ambient with a minimum of 4°C to maximum of 75°C for 50 Hz units or 80°C for 60 Hz units
	Refrigeration	1/5 HP/CFC-Free (R134A) Refrigerant
	Uniformity	±.3°C NOM.
Weight	**Net**	300 lb. (136 kg.)
	Gross	360 lb. (163 kg.)

CAUTION!

Do not set the temperature above 75°C for 50 Hz units or 80°C for 60 Hz units.

2 INSPECTION & VERIFICATION

2.1 Inspection of Boxes

After you have received your order from New Brunswick Scientific, inspect the boxes carefully for any damage that may have occurred during shipping. Report any damage immediately to the carrier and to your local NBS Sales Order Department or local NBS distributor.

2.2 Packing List Verification

Verify on your NBS packing list that you have received the correct materials. Report any errors to your local NBS Sales Order Department or local NBS distributor.

3 PREPARING THE LOCATION

3.1 Physical Location

The surface where you place the Innova 4230 should be smooth, level and sturdy, and must be able to accommodate 300-400 lbs. for single units, or 650 lbs. for stacked units. The feet can be adjusted for necessary leveling. Loosen the locking nuts on the threaded studs attached to the feet of the shaker. Retighten when you have achieved the correct level for your shaker.

3.2 Environment

The Innova 4230 operates properly under the following conditions:

- ambient operating temperature range: 15°C–35°C
- relative humidity up to 90% non-condensing
- main voltage fluctuation not to exceed 10 %
- indoor use only

CAUTION!

The Innova 4230 is very heavy and may require special equipment to transport. *Never* try to lift or move it by yourself.

3.3 Unpacking of Equipment

Save all packing materials and the User's Guide.

If any part of your order was damaged during shipping, is missing pieces, or fails to operate properly, please fill out the *Customer Service Form 6300* and return it by fax. This form can be found in the envelope that contains the warranty card.

3.4 Inspection of Equipment

Verify against the packing list that you have received everything you ordered. If anything is missing, contact your NBS sales representative.

4 INNOVA 4230 FEATURES

4.1 Keypad Features

- **LED DISPLAY** — 3-digit LED display shows shaker **ON/OFF** status, speed, setpoints, hours remaining & measured temperature
- **START/STOP KEY** — Start/stops the shaking motion–activates or stops the hour timer when a timed run is desired
- **SELECT KEY** — Allows users to enter the **SET** mode for setpoint changes
- **▲ KEY** — Adjusts setpoint of a displayed parameter *up*
- **▼ KEY** — Adjusts setpoint of a displayed parameter *down*
- **STATUS INDICATORS** — 4 indicator lights–located to the left of the LED display–display status for the following:

  MAINT — Remains lit after 10,000 hours of use–accumulated running time is internally monitored and may be displayed as a guideline. Refer to Section 8.1 on disabling.

  SET — Indicates that the shaker is in the **SET** mode. Setpoints are displayed and can be altered.

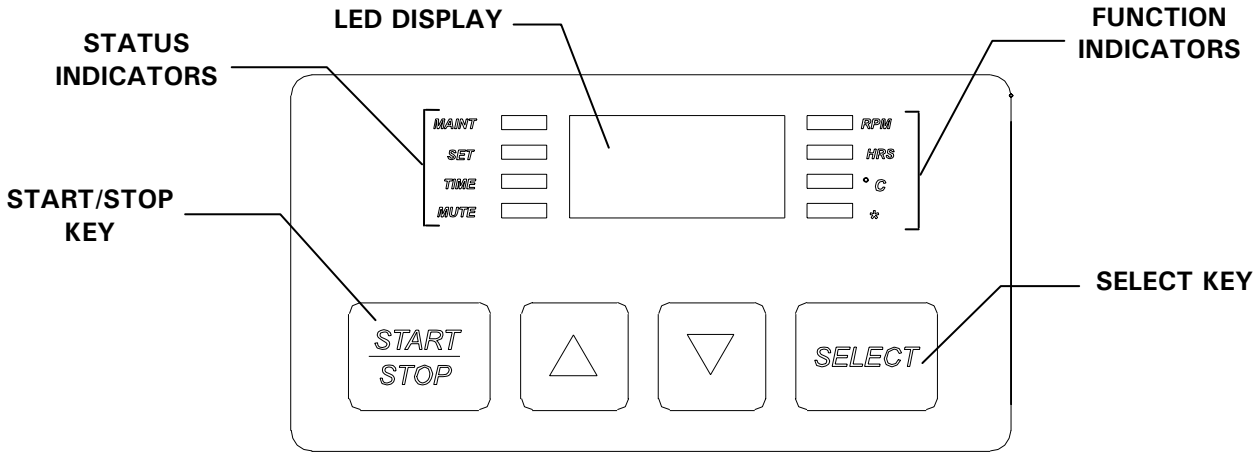
  TIME — Indicates that the hour timer is in operation–programmable to run for pre-set time from 0.1 hour to 99.9 hours without stopping an ongoing run. Hour timer can be disengaged or reset.

  MUTE — Indicates the status of the audible alarm–when **MUTE** indicator is illuminated, the audible alarm device is disabled.

- **FUNCTION INDICATORS** — 4 indicator lights–located to the right of the LED display–display the following parameters:

RPM	Revolutions per minute
HOURS	Time remaining in cycle
°C	Current temperature of chamber
*****	Not used at this time

Figure 1: Keypad Detail



4.2 Locking Cabinet

The Innova 4230 is equipped with a locking cabinet door to keep the contents of the chamber secure. A set of two keys is shipped with the unit. The lock is located on the door handle.

Figure 2: Innova 4230 Front Panel

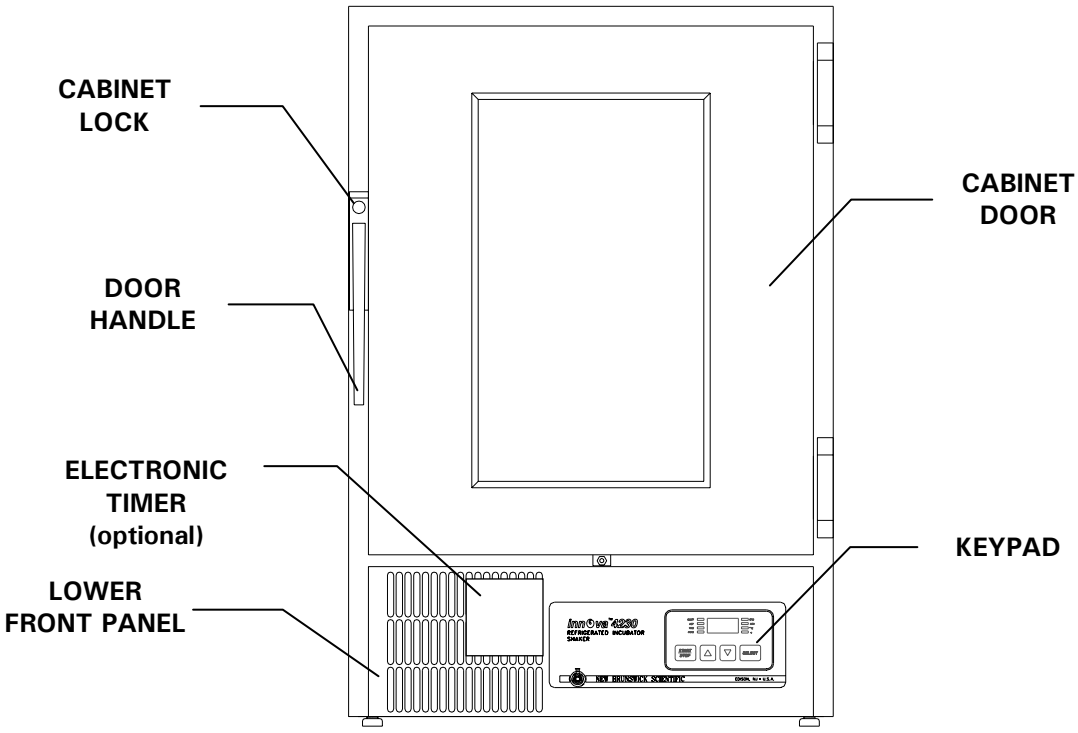


Figure 3: Innova 4230 Side Panel

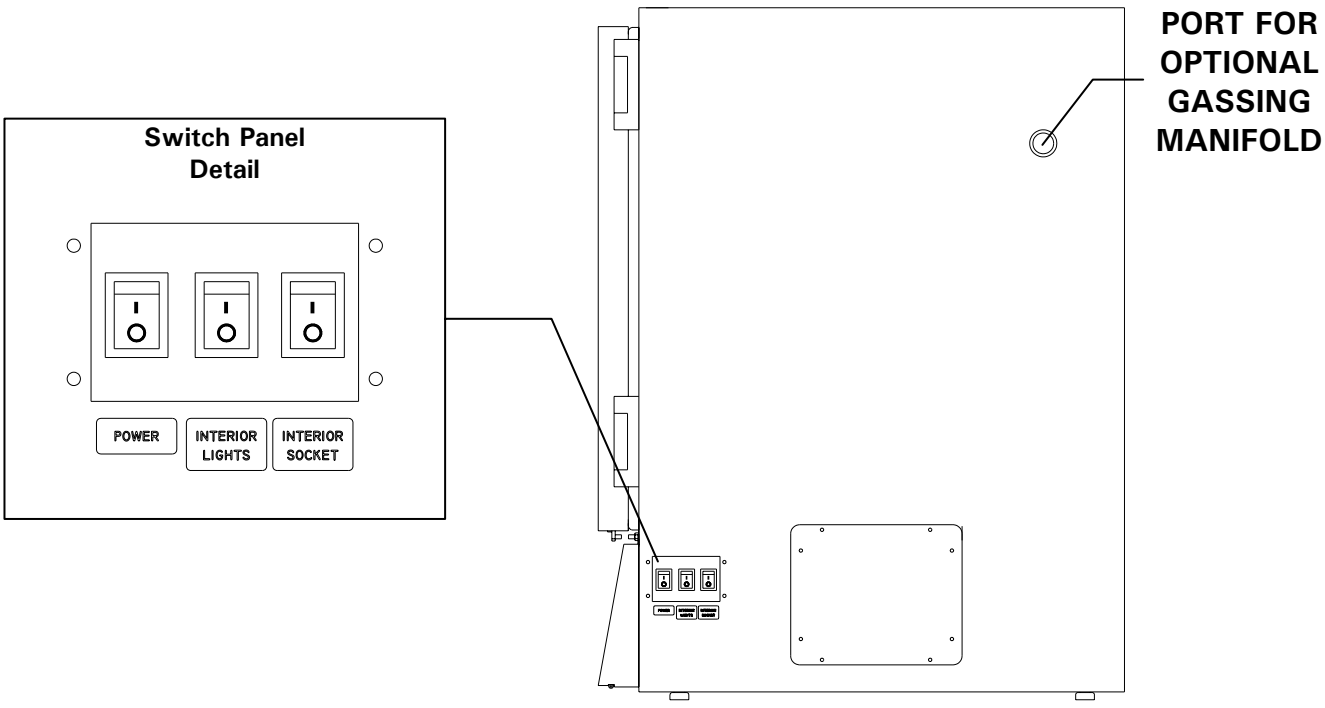
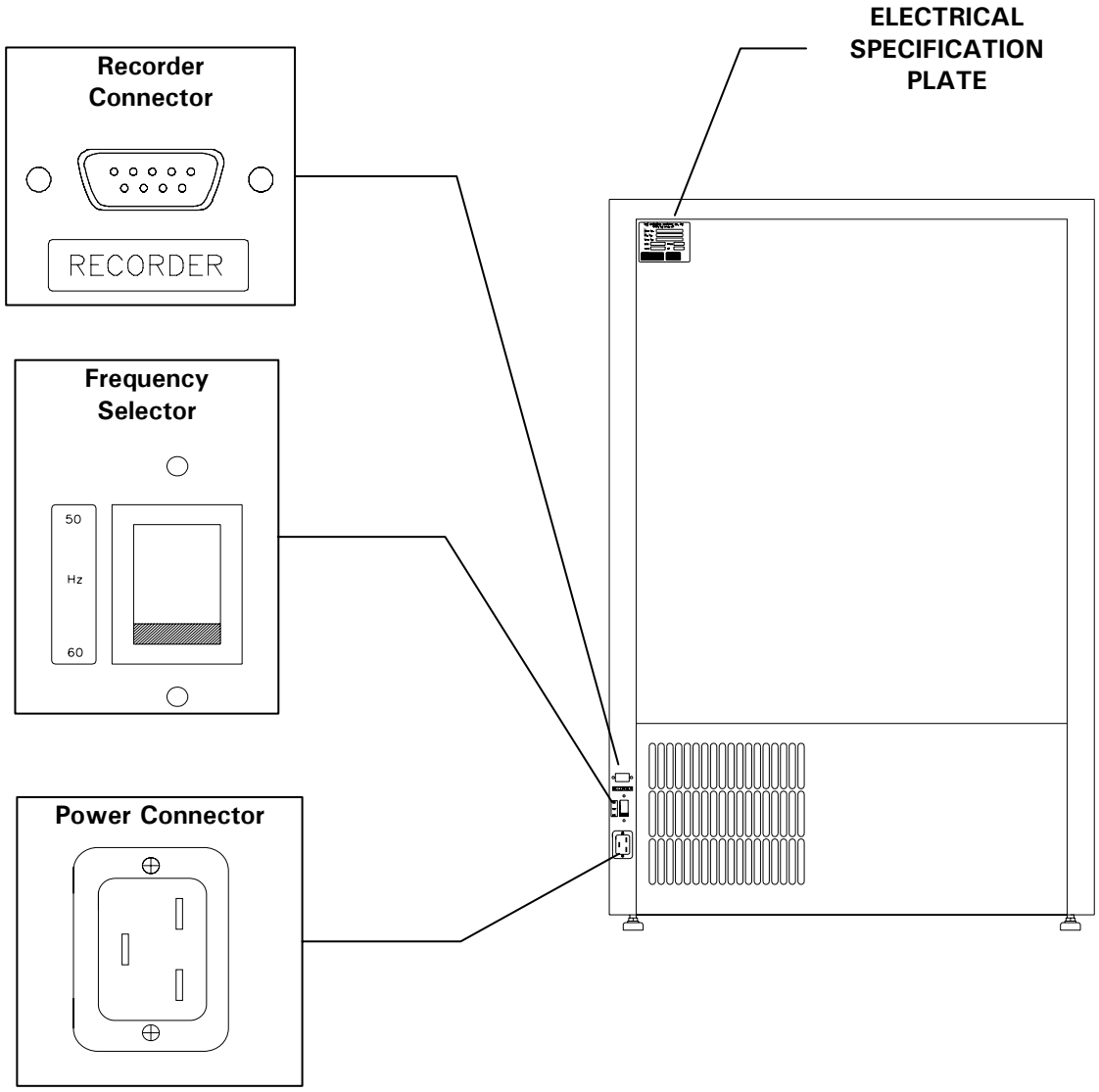


Figure 4: Innova 4230 Rear Panel



WARNING!

Always verify the voltage of the Innova 4230 before making the electrical connection.

4.3 Optional Electronic Timer

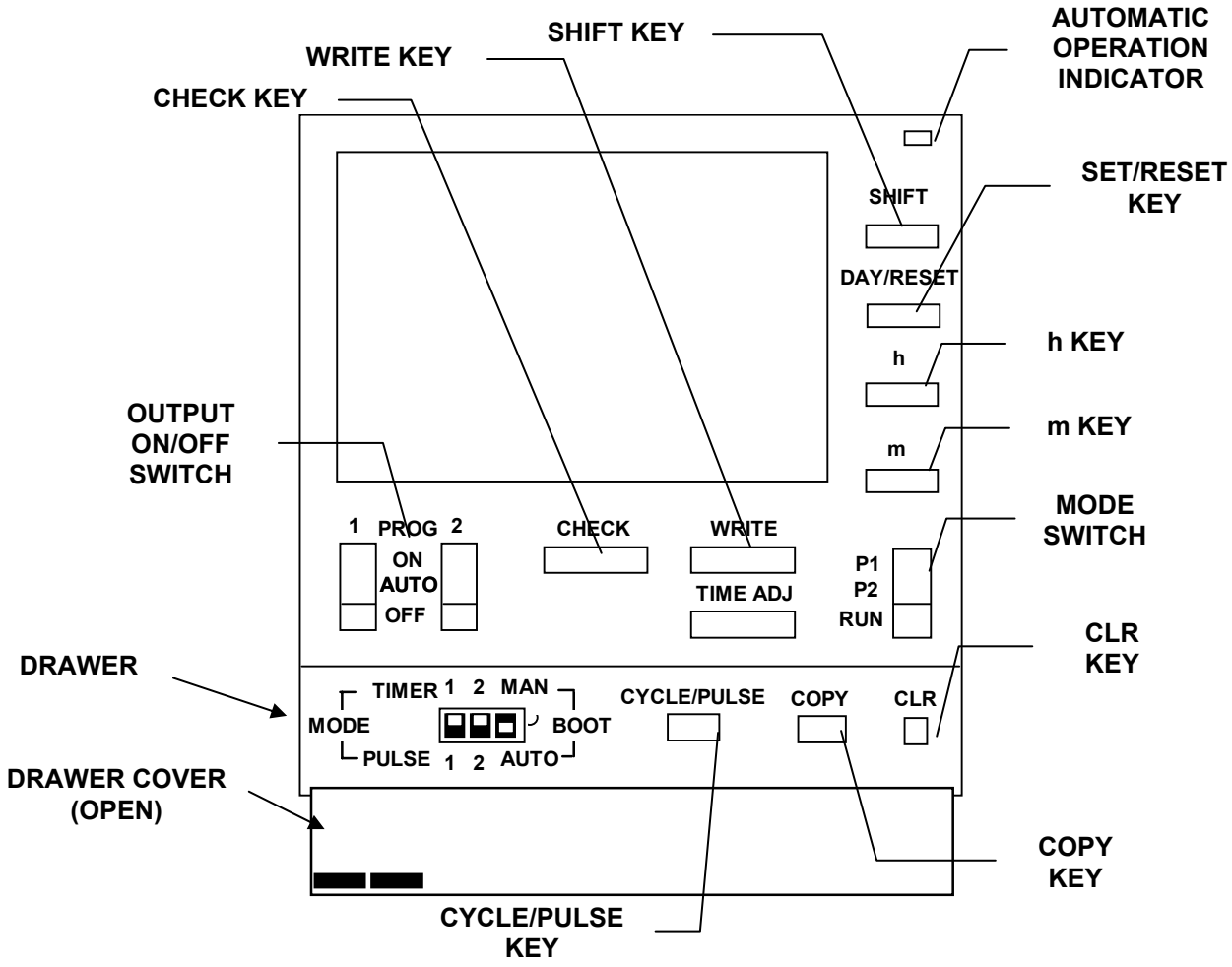
If your unit is so equipped, the electronic timer is used to set programmed times to control the operation of the shaker. **PROG1** enables the unit to alternate between primary (°C setting on the keypad) and secondary (* on the keypad) temperature setpoints at preset intervals (cycles) or at specific 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 7 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 7.3 for details.)

CAUTION!

Do not set the temperature above 75°C for 50 Hz units or 80°C for 60 Hz units.

Figure 5: Electronic Timer (Optional) Detail

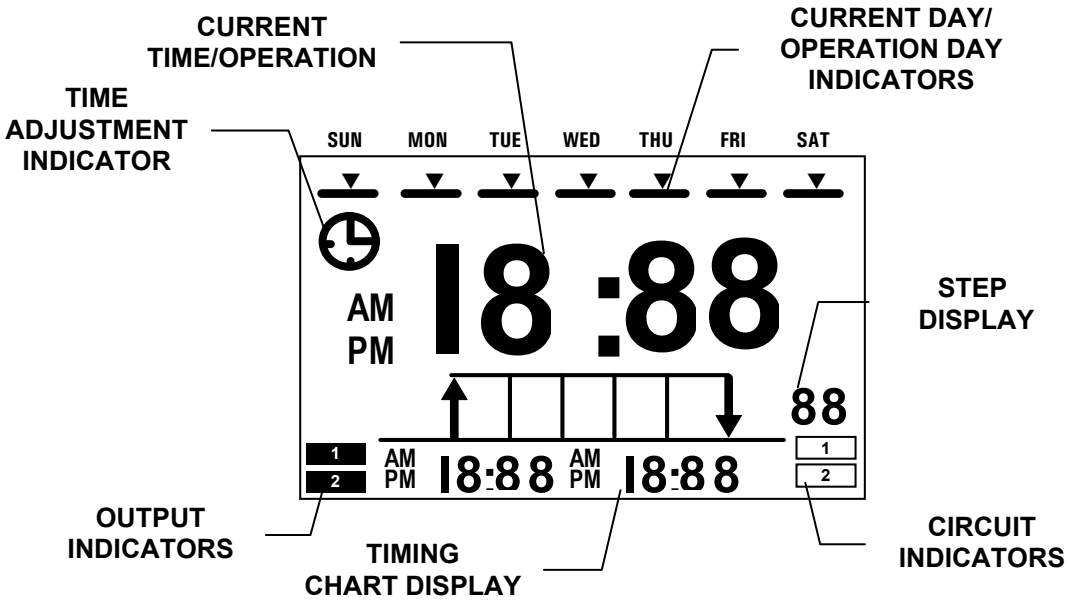


The following is a brief description of the optional electronic timer's features and functions:

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.

Component	*Function*
MODE SWITCH	Sets the operating mode of the timer **P1**: **PROG1 SET MODE**, allows the user to set timing operations in **PROG1**. **P2**: **PROG2 SET MODE**, allows the user to set timing operations in **PROG2**. **RUN**: **RUN MODE**, normal operating mode of the timer.
OUTPUT ON/OFF SWITCH	Allows the user to operate **PROG1** and **PROG2** separately: **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**. **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 to operate at the primary (°C) temperature. **AUTO**: Each program will operate at its specified timed settings. The **AUTOMATIC OPERATION INDICATOR** will illuminate when either switch is in this position.
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 6: Optional 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.

5 GETTING STARTED

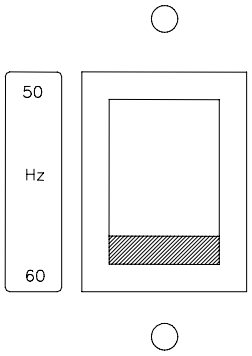
5.1 Setting Frequency

The Innova 4230 is set to the appropriate frequency prior to shipment. The **FREQUENCY SWITCH** (see drawing below) is on the back panel of the shaker. If you need to reset to the frequency prior to operation, perform the following steps:

CAUTION!
If the Innova 4230 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 shaker is disconnected from the power source.
2. Slide the small red switch up for 50 Hz.
3. Slide the small red switch down for 60Hz.

Figure 7: Frequency Selector Switch



5.2 Standard Platform Installation

NOTE:
There are two small plastic straps that hold the bearing housing in place for shipping. Be sure to remove the straps from the unit.

Before you operate the shaker, a platform *must* be attached. Platforms are purchased separately. To attach a platform:

1. Open the door of the shaker.

2. Remove the four **HEX SCREWS** from the subplatform of the bearing housing with the **HEX KEY** (supplied).

3. Place the platform on the upper bearing housing and align the holes in the platform over the holes in the upper bearing housing.

4. Place the **HEX SCREWS** in the four holes. Tighten with the **HEX KEY**. This secures the platform to the shaker.

5.3 Quick Change Accessory Platform Installation

1. Open the door of the shaker.

2. Place the **QUICK CHANGE PLATFORM** on the shaker.

3. Place the four platform **HEX SCREWS** in the four holes on the platform and tighten with the **HEX WRENCH** (provided).

4. Slide the **FLASK PLATFORM** in between the side guides on the inside of the **QUICK CHANGE PLATFORM.**

5. Push the platform all the way to the back of the shaker.

6. Press down on the front of the platform. The platform snaps into place.

7. Close the shaker door.

5.4 Installation Of Clamps

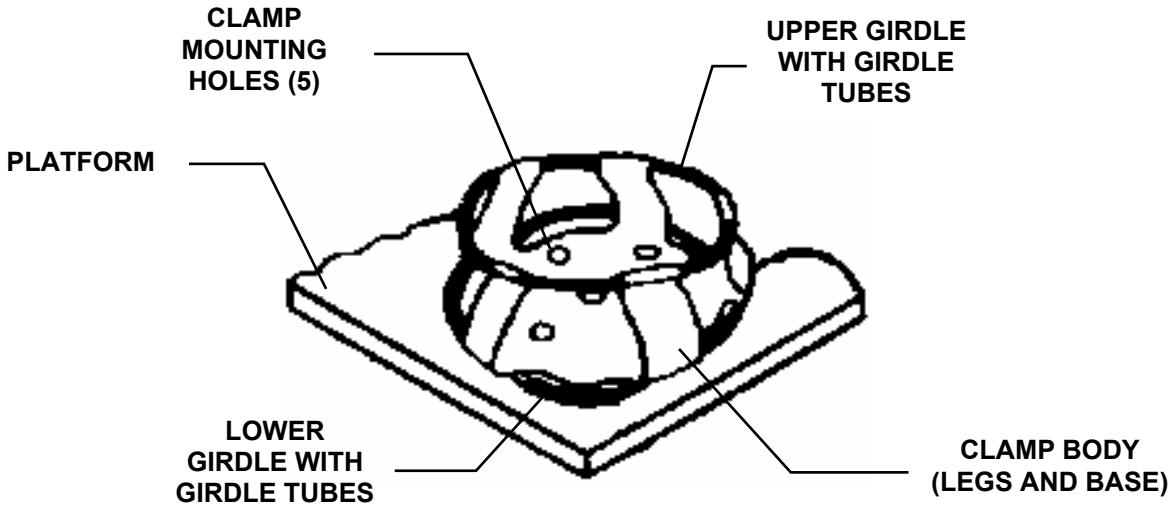
Flask clamps purchased for use with universal platforms require installation. Clamps are installed by securing the base of the clamp to the platform with the correct type and number of screws (refer to clamp hardware application charts). All clamps are shipped complete with hardware. Clamps for 2- to 6-liter flasks are shipped with an additional girdle to keep the flasks in place. To install 2- to 6-liter clamps:

1. Place clamp on platform, secure in place with correct type of screws (refer to clamp hardware application charts).

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 8: 2- to 6-Liter Flask Clamp Installation



NOTE:

The above includes 2800 ml Fernbach Flask Clamps.

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

Description	*Part Number*	*Qty.*	*Application*
10-24 x 5/8 (15.87 mm) flat Phillips (+) head screw	S2116-3101	1	¾ inch (19.05 mm) thick wood platform
10-24 x 5/16 (7.9 mm) flat Phillips (+) head screw	S2116-3051	1	5/16 inch (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	¾ inch (19.05 mm) thick wood platform
10-24 x 5/16 (7.9 mm) flat Phillips (+) head screw	S2116-3051	5	5/16 inch (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:

The above includes 2800 ml Fernbach Flask Clamps.

5.5 Electrical Connection

WARNING!

Before you make an electrical connection, verify the voltage, frequency and electrical specifications for your equipment.

WARNING!

The internal AC socket cover must always cover the socket when not in use. Verify the power is off before you attach or detach the cover.

To make the proper electrical connection to the Innova 4230:

1. Verify that the **FREQUENCY SWITCH** is set to the correct frequency for your shaker model.

2. Plug the socket end of the **POWER CORD** securely into the **POWER CONNECTOR** on the back panel of the Innova 4230.

3. Plug the pronged end of the **POWER CORD** into a ***grounded*** power strip or wall outlet.

4. Verify that the necessary platforms are properly installed and secured.

NOTE:

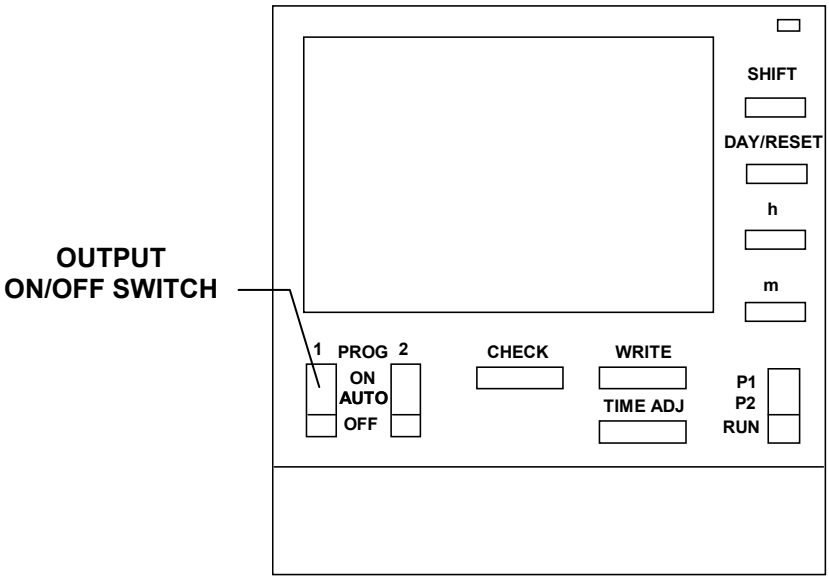
Recommended maximum speed: 400 rpm.

5.6 Initial Start-up

Before initially turning on the unit:

1. Verify that the door is in the closed position.
2. Set the **OUTPUT ON/OFF SWITCH** for **PROG1** to the **OFF** position and **PROG2** to the **ON** position (see drawing below).

Figure 9: Output On/Off Switches



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 the **RPM** is lit.

5. If the word **Off** appears in the display, the shaker is off.

6. If a numeric value appears in the display, press the **START/STOP KEY** to stop the shaker.

6 INNOVA 4230 OPERATION

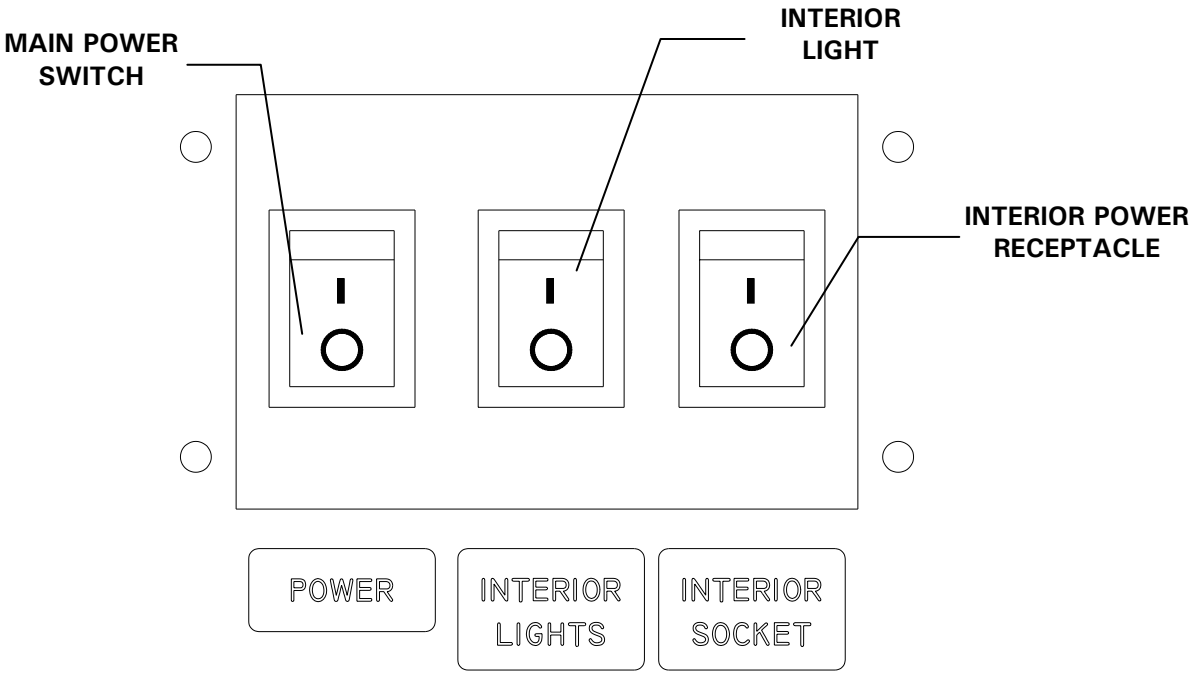
6.1 Continuous Run Operation

To start a standard continuous run:

1. Press the **ON/OFF MAIN POWER SWITCH** to **ON**. The switch is on the right side of the shaker.

2. If you want light inside the chamber, press the **ON/OFF LIGHT SWITCH** to **ON**. The **LED DISPLAY** will flash.

Figure 10: Switch Panel Detail



3. Press the **SELECT KEY** until the **RPM FUNCTION INDICATOR** illuminates. The word **Off** will appear in the **LED DISPLAY**.

CAUTION!

Holding down the Δ or ∇ keys for five or more seconds will cause speed, time or temperature setpoints to change.

4. Use the Δ (up) KEY or the ∇ (down) KEY to set the RPM value.

NOTE:

Maximum speed for the Innova 4230 is 400 rpm.
For stacked units, the maximum speed is 300 rpm.

5. When you use Δ (up) and ∇ (down) **KEYS**, the **SET** light on the left side of the **LED DISPLAY** illuminates, to advise you that you have entered the **SET MODE** of that particular function.

You can change the setpoint during a run without stopping the shaker:

1. Press the **START/STOP KEY**.

2. Press the **SELECT KEY** until the **RPM FUNCTION INDICATOR** illuminates.

3. Use the Δ (up) or ∇ (down) **KEY** to set the **RPM** value.

NOTE:

During the speed change, the alarm flashes until the speed returns to within 5 rpm of the setpoint.

6.2 Temperature

This control consists of an internal electrical interface and an **RTD** temperature probe.

1. Press the **SELECT KEY** until the **°C FUNCTION INDICATOR** illuminates.

2. Using the Δ (up) **KEY** or the ∇ (down) **KEY**, set the temperature value.

NOTE:

The temperature can be set from 20°C below ambient to 75.0°C (for 50 Hz units) or 80.0°C (for 60 Hz units), with a minimum setpoint of 4°C. Use the Δ (up) KEY or the ∇ (down) KEY, to increase or decrease the setpoint.

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

To deactivate the temperature control system:

1. Press and hold the ∇ (down) **KEY** until the setpoint is at 4.0°C.

2. Holding the ∇ (down) **KEY**, press the **START/STOP KEY**.

3. The temperature setpoint display shows **OFF** and both the heater and the refrigeration system are deactivated.

To reactivate the temperature controller:

1. Press the Δ (up) **KEY** until the desired temperature setpoint is displayed.

NOTE:

You can start or stop the shaker 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.

6.3 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 Δ (up) and ∇ (down) KEYS. The **SET** and **MAINT INDICATORS** will light.

6. While the **SET** and **MAINT INDICATORS** are illuminated, use the Δ (up) or ∇ (down) KEY to set the display to the calculated Temperature Correction Value.

NOTE:

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

To return to the factory calibration:

1. Press the **SELECT KEY** until the function **°C INDICATOR** illuminates.

2. Simultaneously press the Δ (up) and ∇ (down) KEYS. The **SET** and **MAINT INDICATORS** will light.

3. While the **SET** and **MAINT INDICATORS** are illuminated, press the START/STOP KEY.

6.4 Standard Timed Run Operation

Using the hour timer through the keypad, you can set the shaker to automatically stop after a pre-determined time period of 0.1 hr–99.9 hrs. A timed run can be created while the unit is either shaking or stopped, but there *must* be power to the unit.

To set the **HOUR TIMER** function:

1. Press the **SELECT KEY** until the **HRS FUNCTION INDICATOR** illuminates.

2. Use the Δ (up) **KEY** or the ∇ (down) **KEY**, and set the time value.

3. To start the timer operation, press either the Δ **KEY** or the ∇ **KEY**. The **SET FUNCTION INDICATOR** illuminates. While the **SET INDICATOR** is lit, press the **START/STOP KEY**. The **TIME INDICATOR** on the left remains lit for the duration of the timed run.

4. At the end of the run, the **LED DISPLAY** will read **Off**. The **TIME STATUS INDICATOR** will flash; the audible alarm will sound (if it is enabled); and the shaker will cease operation.

To *change the hour timer setpoint* during a timed run without stopping the shaker, perform the following steps:

1. Press the **SELECT KEY** until the **HRS FUNCTION INDICATOR** illuminates.

2. Using the Δ (up) **KEY** or the ∇ (down) **KEY**, reset the time value.

To *cancel the hour timer* without stopping the shaker:

1. Press the **SELECT KEY** until the **HRS FUNCTION INDICATOR** illuminates.

2. Use the Δ (up) **KEY** or the ∇ (down) **KEY** until the **SET STATUS INDICATOR** is lit.

3. While the **SET STATUS INDICATOR** is lit, press the **START/STOP KEY**. The **TIME STATUS INDICATOR** will go out and the **LED DISPLAY** will read **Off**.

6.5 Alarm Functions

Innova 4230 has an audible alarm that is set to activate at predetermined times. To deactivate the alarm:

1. Press the **SELECT KEY** until the **HRS FUNCTION INDICATOR** illuminates.

2. Simultaneously press the Δ (up) **KEY** and the ∇ (down) **KEY**. The **SET** and **MAINT STATUS INDICATORS** will flash.

3. While the **SET** and **MAINT STATUS INDICATORS** flash, press the **START/STOP KEY**. The **MUTE STATUS INDICATOR** will illuminate to advise that the audible alarm is *deactivated*.

4. To *reactivate* the alarm, press the **SELECT KEY** until the **HRS FUNCTION INDICATOR** illuminates.

5. Simultaneously press the Δ (up) **KEY** and the ∇ (down) **KEY**. The **SET** and **MAINT STATUS INDICATORS** will flash.

6. While the **SET** and **MAINT STATUS INDICATORS** flash, press the **START/STOP KEY**. The **MUTE STATUS INDICATOR** goes out when the alarm has been reactivated.

6.6 Total Running Time

The control module of the Innova 4230 totals the time the shaker has been **ON** to track hours of usage. To display the accumulated running time:

1. Press the **SELECT KEY** until the **HRS FUNCTION INDICATOR** illuminates.

2. Simultaneously press the Δ (up) **KEY** and the ∇ (down) **KEYS** and hold for a few seconds.

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

NOTE:

After 10,000 hours of operation, the MAINT STATUS INDICATOR illuminates. See Section 8.1 to respond to the maintenance indicator light.

6.7 Using the Innova 4230 as a Quiescent Incubator

The two stainless shelves can be used to incubate quiescent cultures. You should make sure that your cultures would not be susceptible to very slight vibrations that can occur when the refrigeration system is running. If this is a concern , the culture should be tested prior to use.

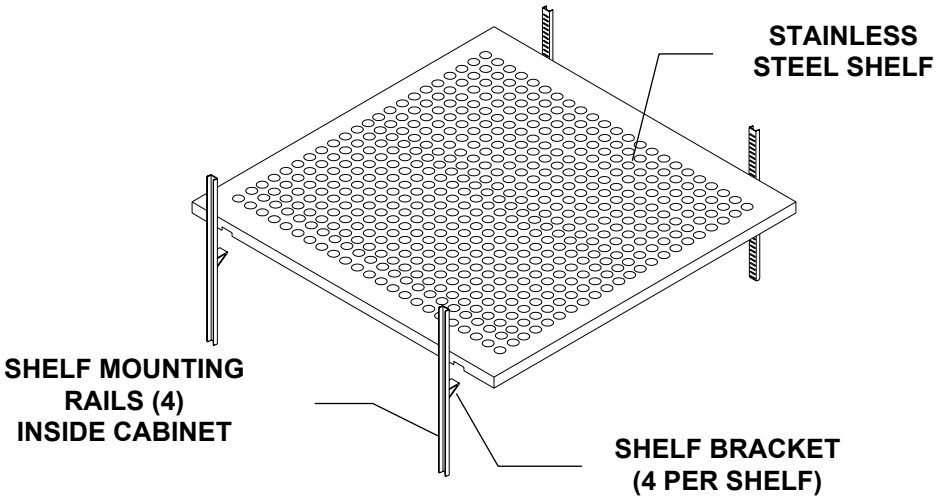
To install the shelves:

1. Verify that the **ON**/**OFF** main power switch is **OFF**.

2. Open the cabinet door. Remove any equipment or platforms from the cabinet interior that may interfere with or obstruct the mounting of a shelf.

3. There are four shelf mounting rails located on the side walls of the cabinet. Once the desired shelf height is selected, insert one shelf bracket into each of the shelf mounting rails, so that the flat side of the bracket is facing up. Ensure that each bracket is at the same level before installing the shelf.

Figure 11: Shelf Detail



1. Place the shelf on top of the brackets. Verify that the brackets are positioned inside the cutouts on each side of shelf , and that the shelf and brackets are securely in place, before mounting any equipment on the shelf.

2. Repeat these steps if you wish to add another shelf to the cabinet.

Because the 4230 is very efficient at keeping heat inside the unit, the refrigeration system is constantly on. The refrigeration operates at higher incubation temperatures to counteract the transient heat caused by internal illumination, produced by cultures as they grow, and even the small amounts of heat loss generated by ordinary inefficiencies in the shaker's electrical and mechanical systems.

One of the side effects of long-running refrigeration can be the removal of moisture from within the chamber. This can dehydrate cultures that are being incubated. Cultures grown on agar, or liquid cultures using very small volumes are most susceptible. This problem will become more serious if the ambient temperature and incubation temperature are close to each other.

6.8 Reducing Dehydration

Dehydration in the chamber can be limited in several ways:

- Install the air deflector provided to protect Petri dish cultures from direct exposure to air currents (see Section 6.9 below).
- Place a container of water inside the chamber to rehydrate the air.
- Seal the cultures if possible before they are placed in the chamber.
- Limit the incubation time.

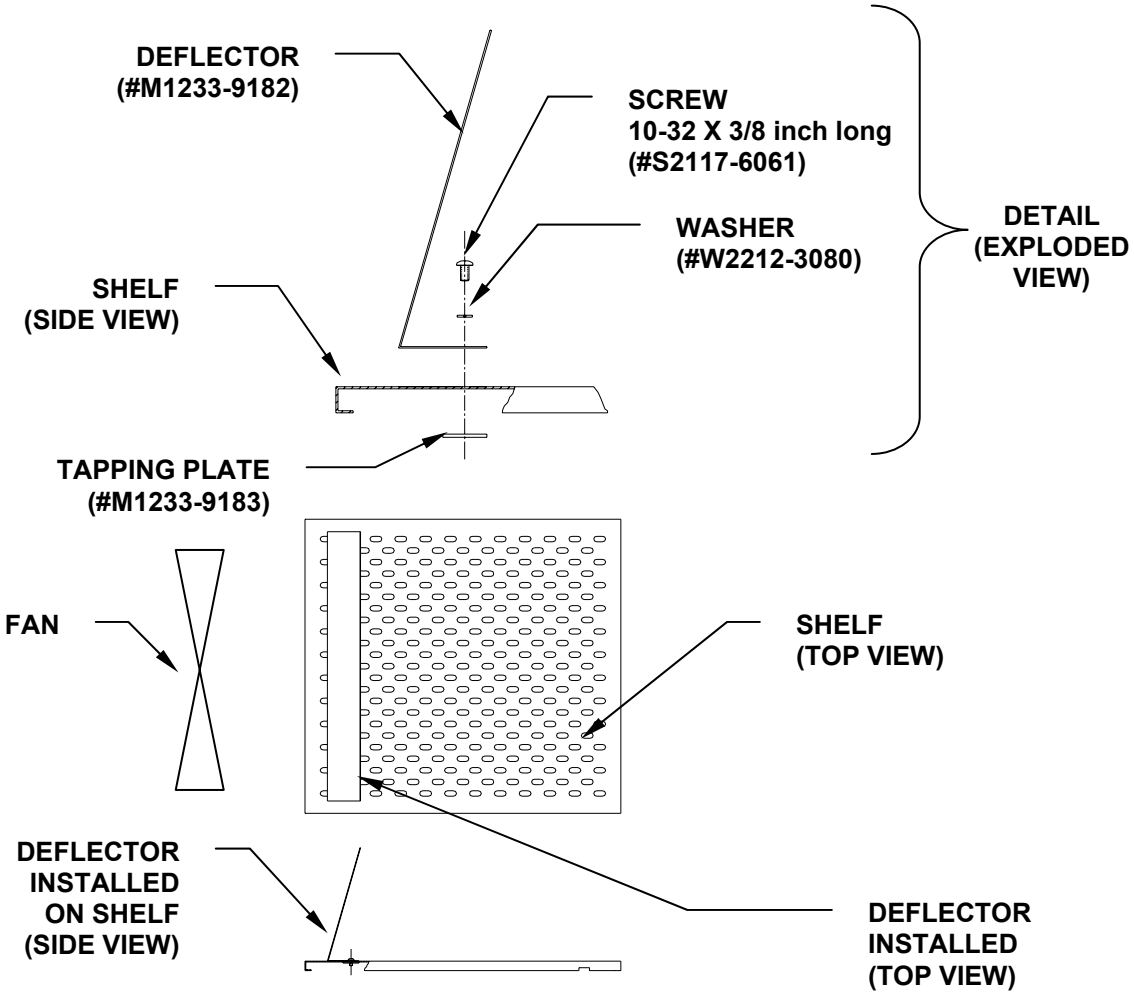
6.9 Air Deflector Installation

An air deflector kit (M1233-9994) is provided for installation on a shelf, particularly if you are using Petri dishes. The deflector acts as a barrier to the direct air currents generated by the fan, sending the air to the roof of the chamber. This keeps the Petri dishes, or other items placed on the shelves, from drying out.

To install the air deflector on the shelf:

1. With reference to Figure 12 below, stand the deflector on the fan side of the shelf.
2. Using the screws and washers provided, mount the deflector base to the shelf and the tapping plate underneath for support.

Figure 12: Air Deflector Installation



6.10 Gassing Cultures in the Innova 4230

There is an optional gassing manifold (M1233-0291) available for the 4230. The gassing manifold is installed in the gassing port on the right hand side of the unit. Instructions on how to install the gassing manifold are included with the manifold.

WARNING!

***Always* disconnect the power cord before performing *any* Service on the shaker.**

The following sections are ONLY for qualified electrical or service engineers.

6.11 Using Ancillary Equipment with Your Innova 4230

The Innova 4230 has a special internal AC socket that is used to power ancillary equipment such as magnetic stirrers, rockers, rollers and small shakers.

In most cases, the equipment used will be light duty rockers or rollers. However, if heavier equipment is desired, the operator should verify that the stainless steel shelves supplied can support the load.

In addition, verify that any equipment operating inside the Innova 4230 does not affect the stability of the unit. This is accomplished by operating the particular piece of equipment under the expected load and speed conditions. If the Innova 4230 vibrates, limit the load and/or the speed conditions under which the ancillary equipment operates.

If the Innova 4230 is intended to be used as a shaker at the same time, both the shaker and ancillary equipment should be run at expected load and speed conditions. If the unit vibrates, the speed of the 4230 and/or the load should be lowered, or the 4230 should not be used as a shaker at the same time that the ancillary device is in operation.

NOTE:

As a point of reference, it has been found that an Innova 2050 orbital shaker weighing 35 lb (15.9 kg) can be operated inside the Innova 4230 at 250 rpm, while the 4230 is shaking at 250 rpm.

The electrical outlet for ancillary equipment is located inside the shaker chamber on the upper right side. It is important to note that this AC supply is the same as the main supply of your 4230: i.e., if your unit operates off a 115 volt supply, then whatever you plug into the internal socket must also operate at 115 volts.

The AC socket, with cover and mating plug (supplied), is designed to be used in humid environments. To use the socket, you have to connect the special male plug (supplied K0380–0871 with the unit) to the equipment that you use in the Innova 4230. If your ancillary equipment has a detachable power cord, you may want to obtain a different power cord to be used solely with the Innova 4230 shaker.

WARNING!
The internal AC circuit supplied is fused at 200 Watts.
***DO NOT* connect other equipment that requires more power.**

WARNING!
The protective cover attached to the internal AC socket *MUST* always be in place when the socket is not being used. For safety, verify that the power is off before you install or remove the cover.

6.11.1 Electrical Moisture-Proof Plug

To assemble the moisture-proof plug:

1. Connect the **POWER CORD** to the electrical plug. Slide the **POWER CORD** through the **PLASTIC NUT**, **WASHER**, **RUBBER GROMMET** and the **MAIN BODY**.

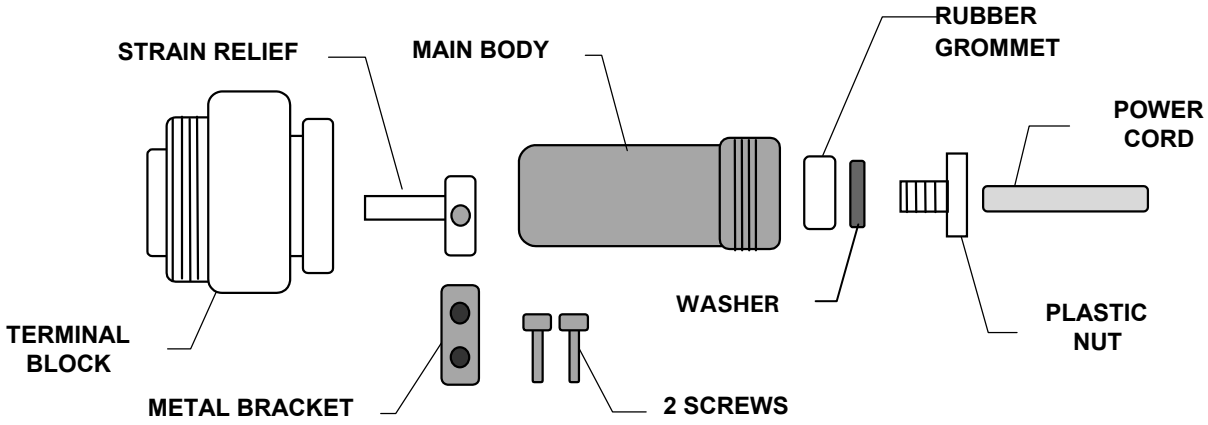
2. Connect the hot wire to *terminal 1*.

3. Connect the neutral wire to *terminal 3*.

4. Connect the ground wire to the *ground terminal* on the **TERMINAL BLOCK**.

5. Attach the **STRAIN RELIEF** to the **TERMINAL BLOCK**. Slide the two legs into the slots in the **TERMINAL BLOCK**.

Figure 13: Electrical Moisture-Proof Plug



6. Using the **METAL BRACKET**, capture the wires and secure them under the bracket with the **TWO SCREWS**.

7. Screw the **MAIN BODY** onto the **TERMINAL BLOCK**.

8. Push the **RUBBER GROMMET** into the end of the **MAIN BODY**.

9. Push the **WASHER** on.

10. Screw the **PLASTIC NUT** onto the **MAIN BODY** and tighten. Ensure a tight seal by hand tightening the **RUBBER GROMMET** to compress onto the **POWER CORD**. Securely tightening the **PLASTIC NUT** to the **MAIN BODY** also provides a watertight seal for the plug.

11. Connect the **POWER CORD** to the ancillary equipment, if applicable.

12. Turn off all the power switches.

13. Remove the cover to the internal socket. The socket is on the upper right side, inside the shaker chamber.

14. Plug the **ELECTRICAL PLUG** into the internal socket, then secure the plug in place by hand tightening the knurled knob to obtain a good seal.

NOTE:

The socket is keyed so that a plug will only mate if it is properly oriented.

Your ancillary equipment will operate whenever the main power switch and the internal AC switch are powered on.

NOTE:

As the use of ancillary equipment inside the Innova 4230 may generate additional internal heat, the Innova 4230 may not be able to achieve minimum operating temperature.

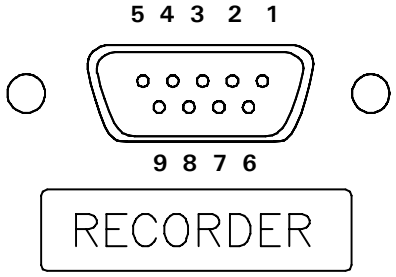
6.12 Accessory Recorder Connector

To record speed and temperature, an accessory recorder can be installed on the back panel of the shaker. The recorder should have the following capabilities:

- Two channels required for Speed and Temperature. Each channel should have signal conditioning which accepts 0-5 volt input.

- The pin out diagram and table below identify 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 14: Detail of Recorder Connector



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

7 OPTIONAL ELECTRONIC TIMER

If your Innova 4230 is equipped with an electronic timer, read this chapter to learn how to use it.

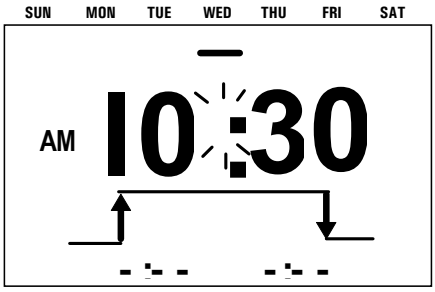
7.1 Setting the Electronic Timer

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**", "**HOUR**", and "**MINUTE**". If the day/time settings are correct, proceed to the next section to view the program settings.

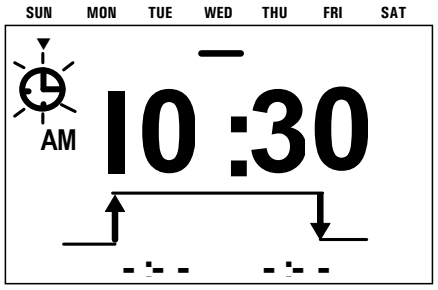
Once the timer is set, it does not have to be continually reset, only periodically checked to verify that the timer is functioning properly. The **ELECTRONIC TIMER** is equipped with a built-in battery that stores the day/time settings in memory when the Innova 4230 is turned **OFF**.

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

1. Verify that the Innova 4230 is in the "initial start-up" condition as described in the previous section.



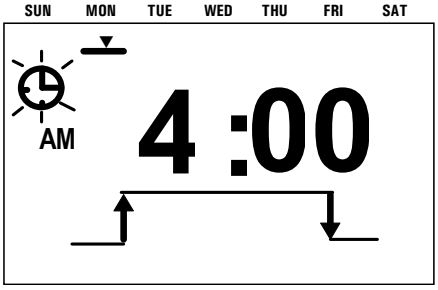
2. Hold down the **TIME ADJ KEY** for one second or more. An arrow and a flashing clock will appear under the word **SUN** in the display to signify that the timer is in **TIME ADJUST MODE**. The timer will stay in this mode for approximately one minute if no adjustments are made.



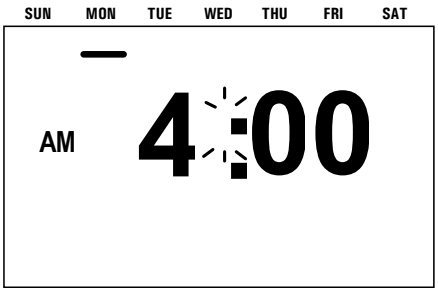
3. Select the current day of the week by pressing the **SHIFT** and **SET** keys. The **SHIFT KEY** allows you to move the cursor (▼) through the days of the week (from **SUN** to **SAT**). Holding down this key rapidly advances the cursor. The **SET** key selects the day of the week on by placing a 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.



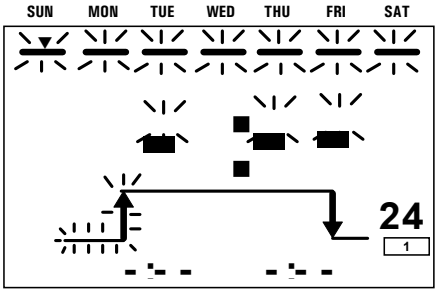
6. Verify that the settings entered are correct, and press the **WRITE KEY** to set the day and time. When the **WRITE KEY** is pressed, the arrow and flashing clock disappear from the display, and the timer is set to the displayed time at 0 seconds.



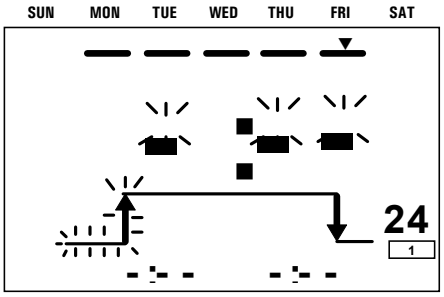
7.2 Ordinary Electronic Timer Operation

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:

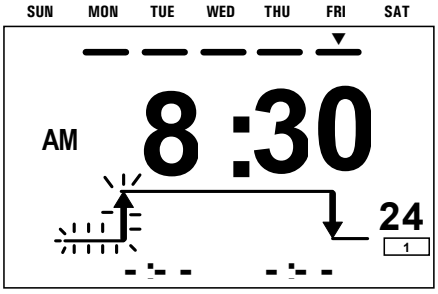
1. Enter the set **PROG1 SET MODE** by setting the **MODE SWITCH** in the **P1** position. The initial **PROG1** display will appear:



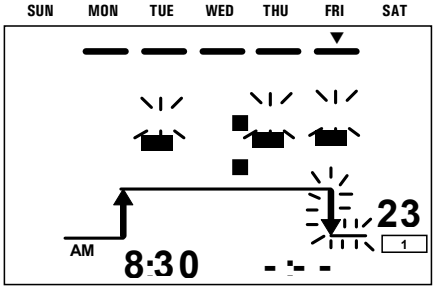
2. Using the **SHIFT** and **SET** keys, select Monday through Friday. All bars at the positions of Monday through Friday indicate that they are turned on:



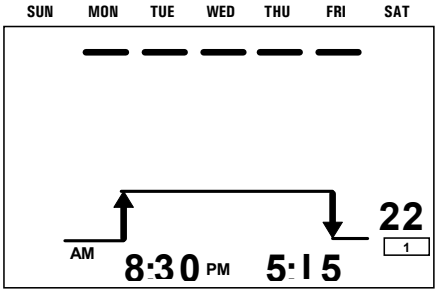
3. Using the **h** and **m KEYS**, set the time the program will begin to operate to 8:30 am.

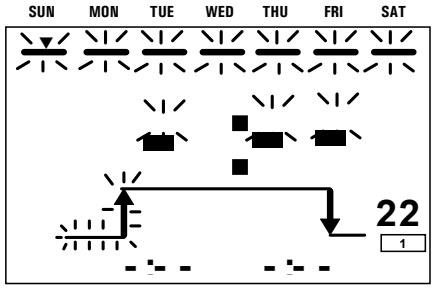


4. Press the **WRITE KEY** to enter this setting into memory. If the day, hour, and/or minute have not been set, the specified time and day will not be entered into memory when the **WRITE KEY** is pressed. Once the **WRITE KEY** is pressed, the timer will display the next available setting in **PROG1**. 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 available programmable operation steps remaining is displayed in the lower right hand corner.





NOTE:

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

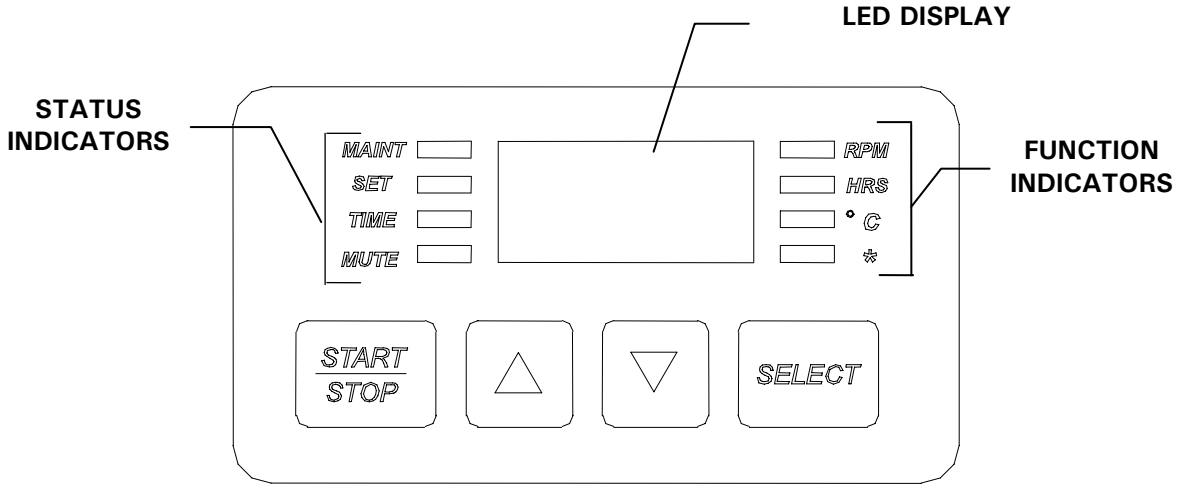
NOTE:

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 timer output is off.

7.3 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 7.4) will meet those needs.

In the following example, at 4:45 pm Friday, **PROG1** will automatically decrease the incubator temperature to the lower setpoint (4ºC) which you have pre-programmed. Then, at 7:45 Monday morning, **PROG1** will raise the temperature to your default setpoint (37ºC). 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.

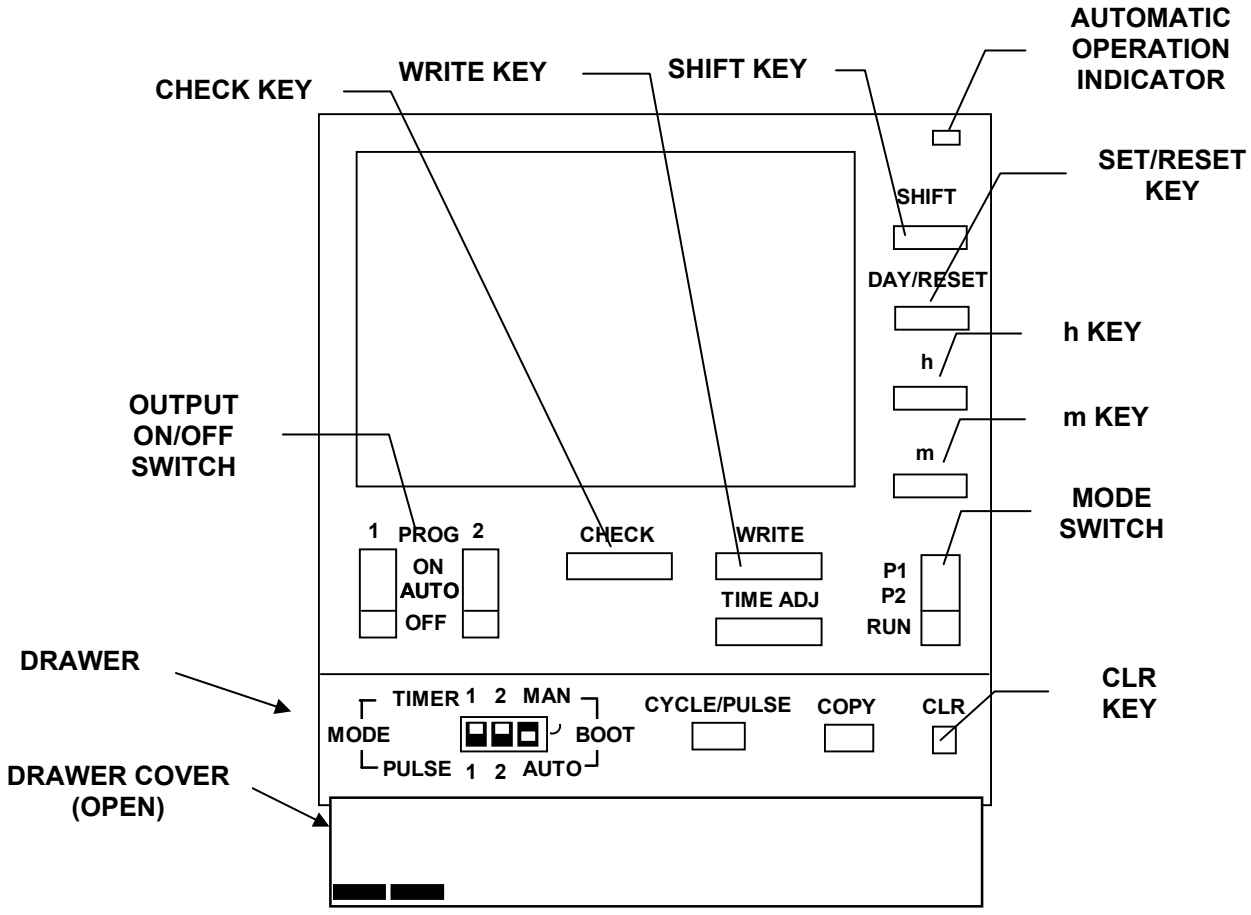


7.3.1 Check or Reset Alternate Temperature (*)

1. Press the **SELECT KEY** on the **CONTROL PANEL KEYPAD** until the * **FUNCTION INDICATOR** illuminates.
2. Press the Δ or the ∇ **KEY** once.
3. If it does not display 4, press the Δ or the ∇**KEY** until it reads 4.

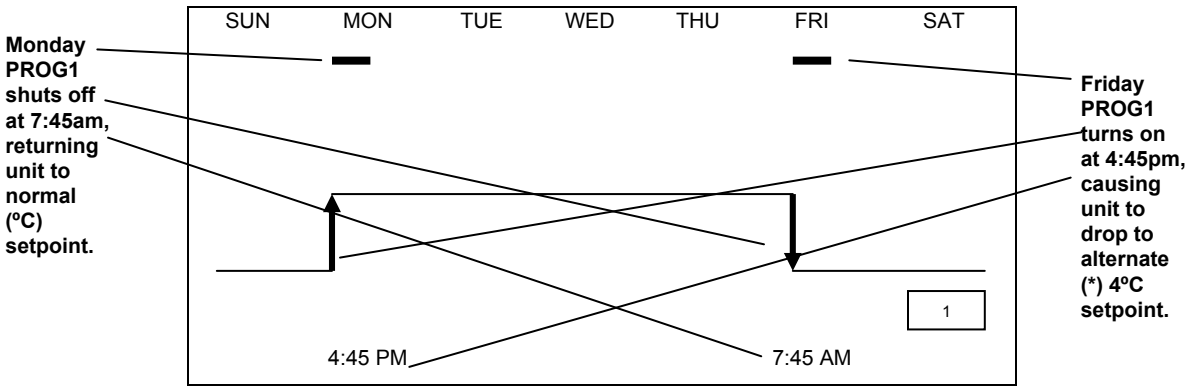
7.3.2 Check or Reset Default Temperature (ºC)

1. Press the **SELECT KEY** on the **CONTROL PANEL KEYPAD** until the **ºC FUNCTION INDICATOR** illuminates.
2. Press the Δ or the ∇ **KEY** once.
3. If it does not display 37, press the Δ or the ∇**KEY** until it reads 37.
4. Make sure that the **HOUR TIMER** is off.
5. Press the **SELECT KEY** on the **CONTROL PANEL KEYPAD** until the **HRS FUNCTION INDICATOR** illuminates.
6. Press either the Δ **KEY** or the ∇ **KEY** until the **SET STATUS INDICATOR** is lit.
7. Press the **START/STOP KEY**. The **TIME STATUS INDICATOR** will go out and the **LED DISPLAY** will read **OFF**.



7.3.3 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.



- Set the **PROG1 OUTPUT** to the **AUTO** position.

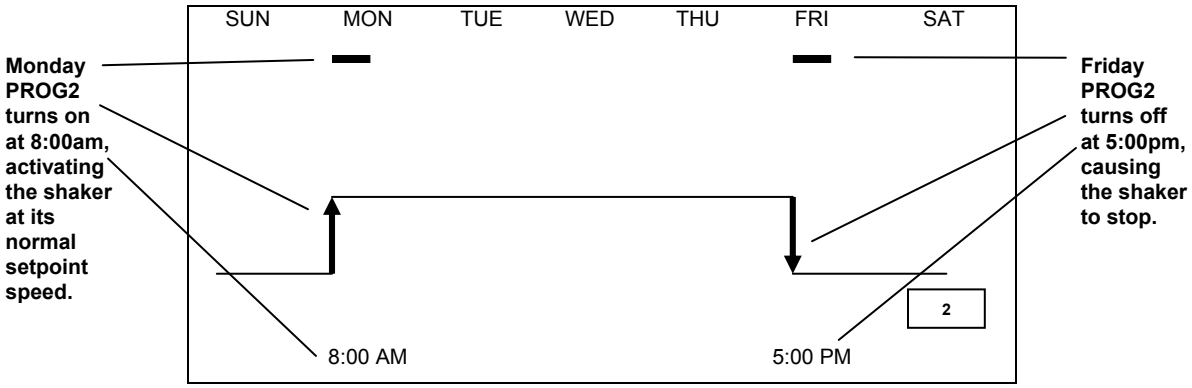
NOTE:

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 7.3, *Sample Program* and 7.6, *Viewing Programs*.

7.3.4 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.

7.3.5 Activate the programmed control

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

The 4230 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.

7.3.6 Troubleshooting the Program

- 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 6.5.

- 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.

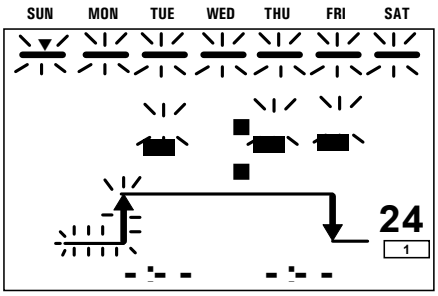
- If you wish to **view** your program settings in sequence with the possibility of making corrections or changes, see Section 7.6.

- 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 7.8)

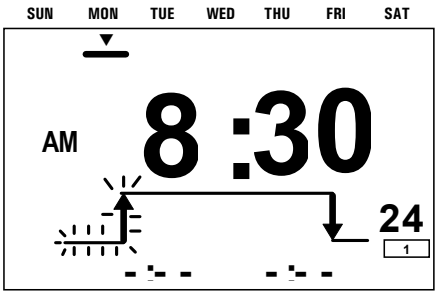
7.4 Multiday Operation

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

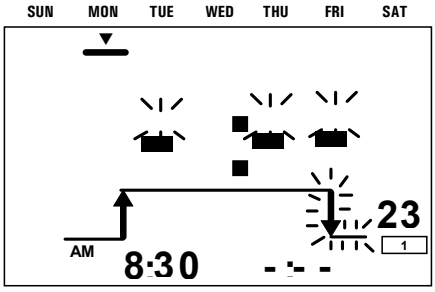
1. Enter the set **PROG1 SET MODE** by setting the **MODE SWITCH** in the **P1** position. The initial **PROG1** display will appear:



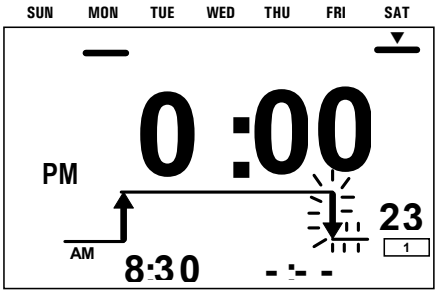
2. Using the **SHIFT** and **SET KEYS**, select Monday as the day of the week that this operation will start. A bar displayed in the Monday position signifies that the day of the week is turned on. Using the **h** and **m KEYS**, set the program start time to 8:30 am.



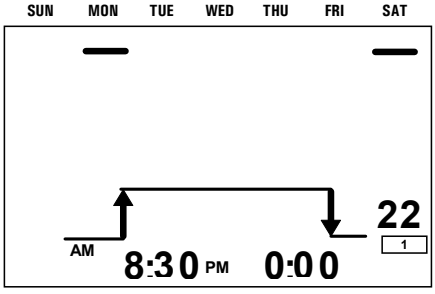
3. Press the **WRITE KEY** to enter this operation in memory. The timer will display the next operation to be programmed.

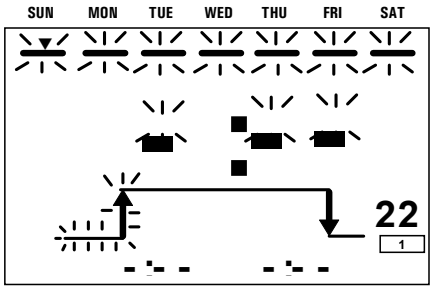


4. Press the **SET KEY** to release the cursor from Monday. Use the **SHIFT** and **SET KEYS** to select Saturday.



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:

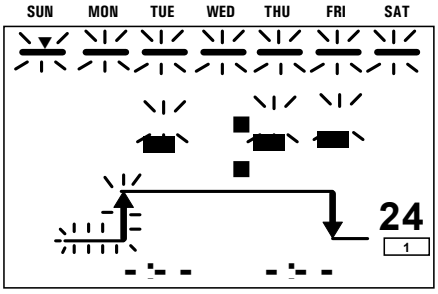
The procedure is identical for PROG2. To perform this procedure for PROG2, set the MODE SWITCH in the P2 position.

6. 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.

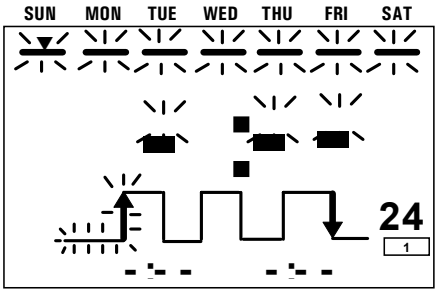
7.5 Cyclic Operation

The **ELECTRONIC TIMER** can 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:

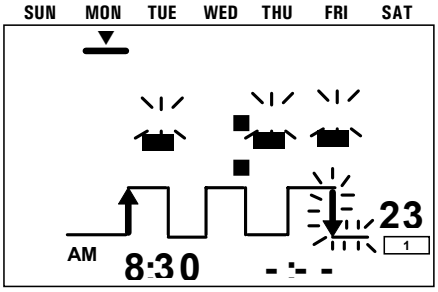
1. Enter the set **PROG1 SET MODE** by setting the **MODE SWITCH** in the **P1** position. The initial **PROG1** display will appear:



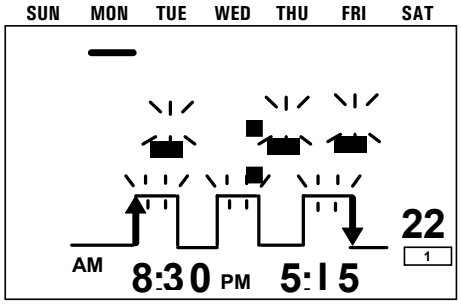
2. Open the lower drawer of the timer by pulling the cover down, and press the **CYCLE KEY**. The timer will enter the **CYCLE PROGRAM MODE**.



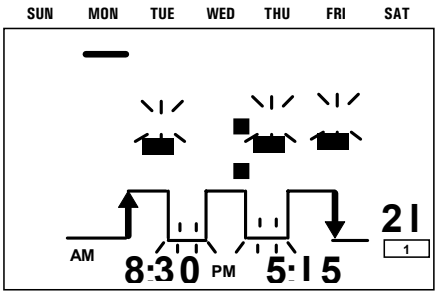
3. Using the **SHIFT** and **SET KEYS**, select the day of the week that the cycle operation is to start. In this example, the cycle is to be performed on Monday. Using the **h** and **m KEYS**, set the time the cycle operation will begin on Monday to 8:30 am. Press the **WRITE KEY** to enter this setting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



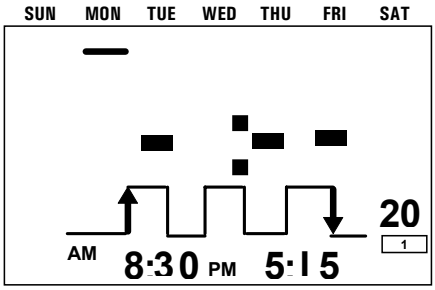
4. Using the **SHIFT**, **SET**, **h** and **m KEYS**, set the day and time the timer will stop the cycle operation. In this example, the timer will cease to cycle on Monday at 5:15 pm. Press the **WRITE KEY** to enter these settings into memory. The timer will then prompt you to input the cycle-on time.



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 cycle-off 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**. The number of available programmable operation steps remaining is 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.

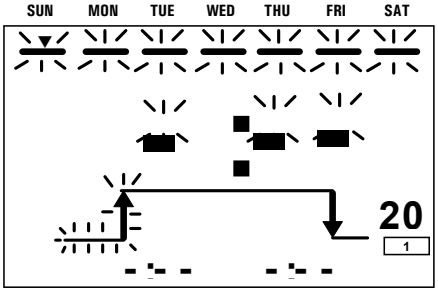
8. When you have completed your programming, set the **OUTPUT SWITCH** to the **AUTO** position to run the unit with programmed control.

7.6 Viewing Programs

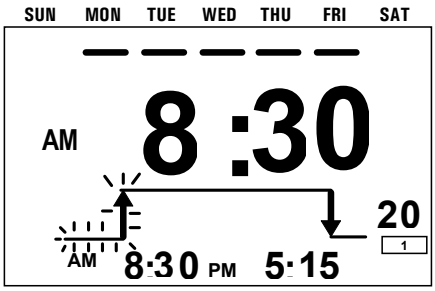
The timed operations for **PROG1** or **PROG2** can be viewed in the **PROG1** or **PROG2 SET MODE**, or in the **RUN MODE.** To view previously set programs in the **ELECTRONIC TIMER**:

7.6.1 In PROG1 or PROG2 set mode

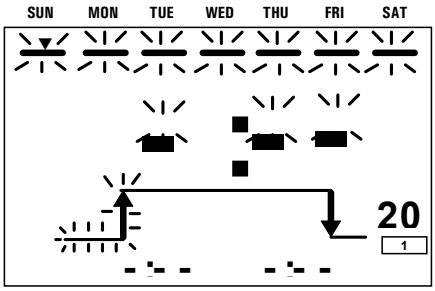
1. Enter the set **PROG1 SET MODE** by setting the **MODE SWITCH** in the **P1** position. The initial **PROG1** display will appear:



2. Press the **WRITE KEY**. If it is necessary to change the setting, do so with the appropriate 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.

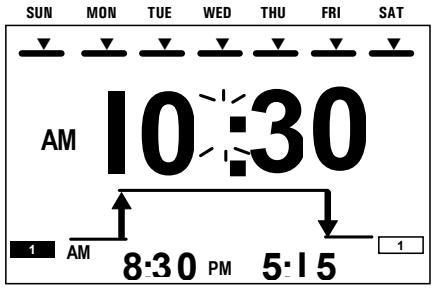


NOTE:

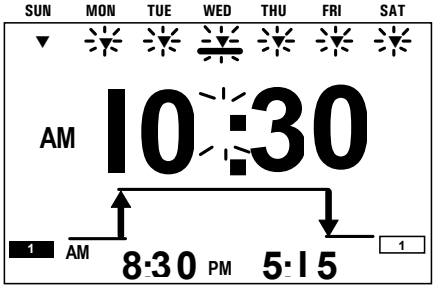
This procedure is identical for PROG2. To perform this procedure for PROG2, set the MODE SWITCH in the P2 position.

7.6.2 In RUN mode

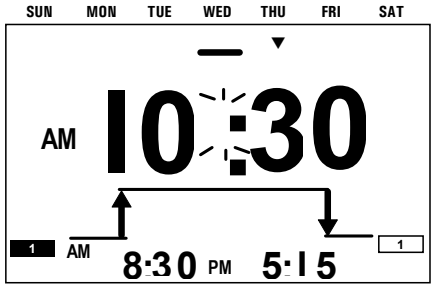
In **RUN MODE**, the operations for both **PROG1** and **PROG2** can be viewed by the day. In the following example, the current day of the week is Wednesday; we will check the timer operations to be performed on Thursday.



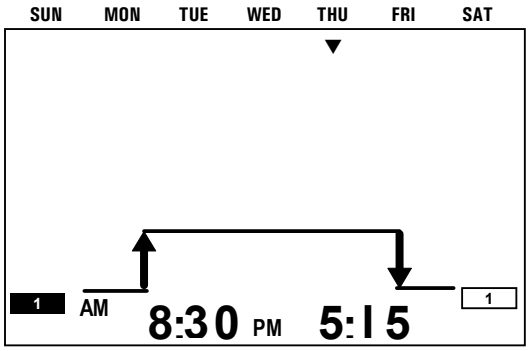
1. Press the **SHIFT KEY**. The cursor (denoted by a solid ▼) will initially appear in the Sunday position. In all other days of the week the ▼ will be blinking.



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



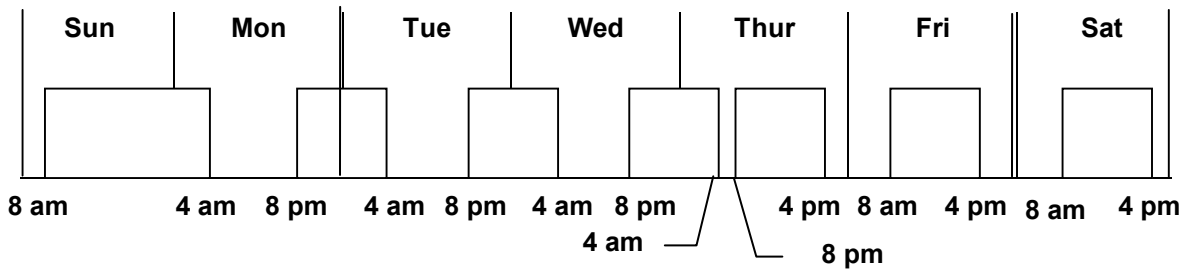
3. Open the lower drawer of the timer and press the **CHECK KEY**. Each time this key is pressed, the operation schedule is displayed in the sequence the operations are to be executed. The **ON** and **OFF** times for **PROG1** are displayed, starting with the earliest **ON** time. Then the times set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



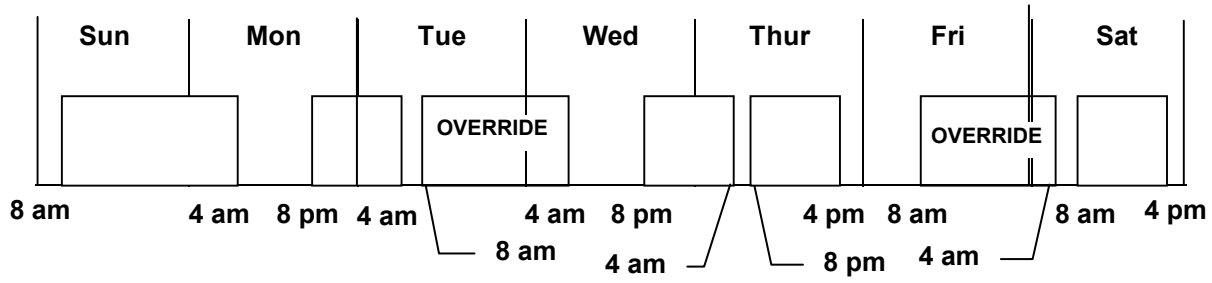
7.7 Day Override

Circumstances may require that the timer operations for a given day be executed on a different day. 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 using the day override function, the operation that is transposed on 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:



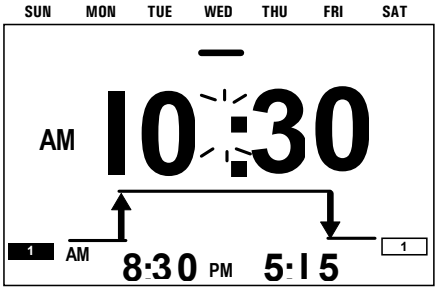
In this case, the programmed operation of Sunday-Monday is transposed upon Tuesday and Friday. On Tuesday, the switch output of the timer is turned on at 8:00 am (Sunday's time) instead of the original programmed time of 8:00 pm. The switch output of the timer is then turned off the following day, Wednesday,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

7.7.1 Setting an Override

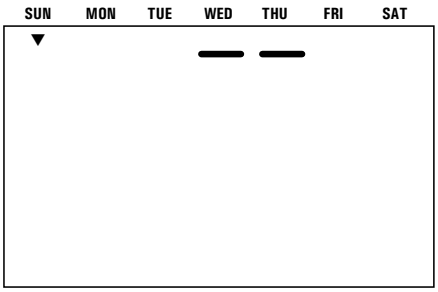
In the following example, the timer operations for Wednesday and Thursday will be overridden with Sunday's. To transpose Sunday's operations onto Wednesday and Thursday:

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

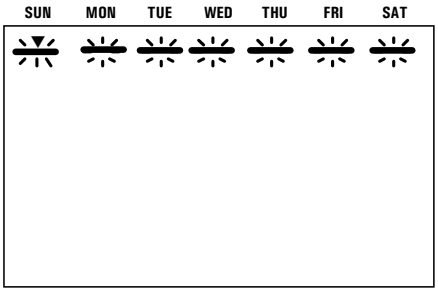


2. Open the lower drawer of the timer and hold down the **COPY KEY** for one second or more.

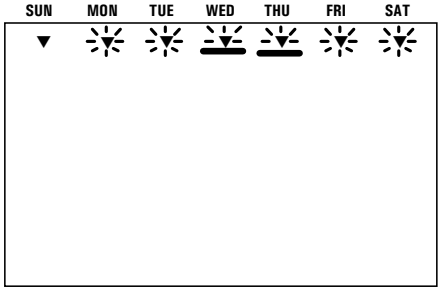
3. If an override has been previously set, the following display will appear. To change the setting of that day, cancel it once and specify the new setting using the **SHIFT** and **SET KEYS**.



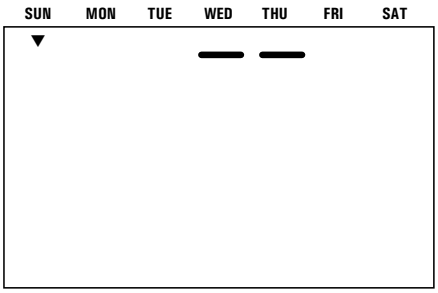
4. If no override was previously set, the following display will appear:



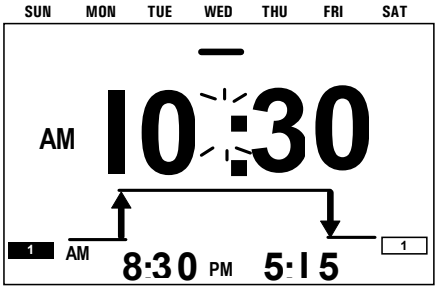
5. Using the **SHIFT** and **SET KEYS**, select both Wednesday and Thursday as the days to be overridden.



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



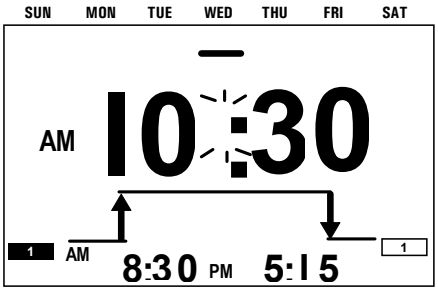
7. Press the **WRITE KEY** to enter this override into memory. The override will stay in the timer's memory for one week and a day (until the following Monday), after which the timer will operate in its previously set programming scheme.



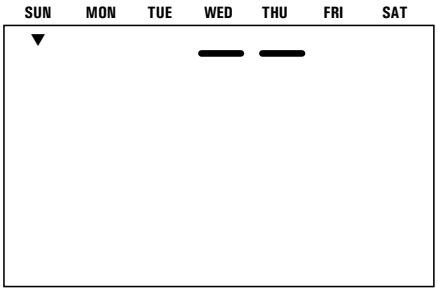
7.7.2 Canceling an Override

To cancel a day override:

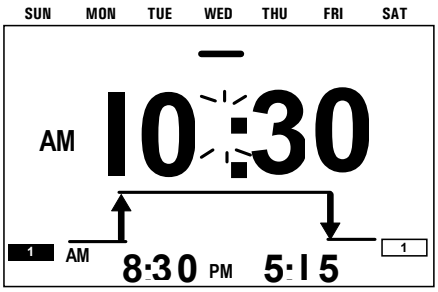
1. Verify that the timer is in **RUN MODE**. If it is not, place the **MODE SWITCH** in the **RUN** position.



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



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

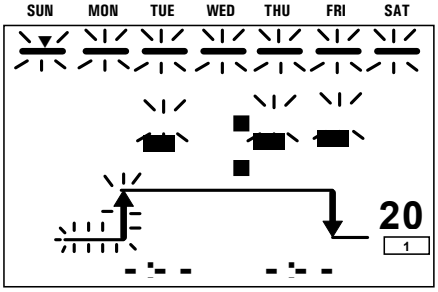


7.8 Clearing/Canceling Programs

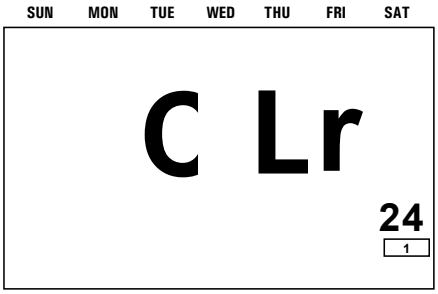
To clear previously set programs in the **ELECTRONIC TIMER** memory:

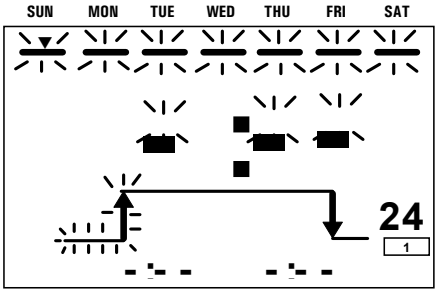
7.8.1 In PROG1 or PROG2 SET MODE

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:

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

8 PREVENTIVE MAINTENANCE

Although the Innova shaker requires no routine mechanical maintenance, the user should provide some routine preventive maintenance. After the shaker has operated for more than 10,000 hours, the ***MAINT INDICATOR*** *on the control panel will illuminate. This means that the shaker requires a routine maintenance check.*

Preventive maintenance keeps your equipment in proper working condition. When periodically performed, maintenance results in longer life for your equipment and reduces time lost due to equipment failure. We suggest that you perform the maintenance procedures outlined in the following pages.

8.1 Acknowledging the MAINT Light

When the **MAINT STATUS INDICATOR** light comes on, the following steps will turn the light off:

1. Press the **SELECT KEY** until the **HRS FUNCTION INDICATOR** illuminates.

2. Simultaneously press the Δ (up) **KEY** and the ∇ (down) **KEYS** and hold for a few seconds. The **MAINT STATUS INDICATOR** flashes.

3. Press the ∇ (down) **KEY** and the **MAINT** light will turn off.

8.2 Cleaning Procedures

WARNING!

***Always* disconnect the power cord before performing *any* maintenance on the shaker.**
***Do not* immerse the shaker in water or any liquids.**
***Do not* use a cleaning fluid that is corrosive or flammable on or around the shaker.**

Clean the outside surfaces of the Innova 4230 with a damp cloth or any standard laboratory cleaner. Do not use scouring compounds, gritty cloths, leaded or ethylene gasolines or solvents such as alcohol, acetone, or carbon tetrachloride. These types of cleansers can damage the shaker; using them will void the warranty.
The following techniques are recommended to clean the Innova 4230:

1. Set the **ON/OFF POWER** Switch to **OFF**.

2. Disconnect the **POWER CORD** from the electrical outlet.

3. Use a cloth dampened with mild detergent and water to wipe the exterior and interior of the shaker.

4. Rinse the cloth in clean water, and wipe the exterior and interior of the shaker.

5. Clean the viewing window with standard laboratory glass cleaner.

6. Reconnect the **POWER CORD** to the electrical outlet.

8.3 Condenser Fan Filter Cleaning

Every 3 to 6 months, you should remove accumulated dust from the **CONDENSER FAN FILTER**. The **CONDENSER FAN FILTER** is behind the front panel on the left side. If the shaker is located in a dusty environment, perform these cleaning procedures more often:

1. Set the **ON/OFF POWER** Switch to **OFF**.

2. Disconnect the **POWER CORD** from the electrical outlet.

3. Before you can gain access to the front panel, open the door of the shaker. The door *must* be open all the way.

4. Using a Phillips head (+) screwdriver, remove the three screws that attach the hinged front panel to the housing. Gently lay down the front panel. Put the screws aside for reuse.

5. As you look into the shaker, the **CONDENSER FAN FILTER** is on the left side. Remove the two screws that hold the **FAN FILTER** to the grate; put them aside for reuse.

6. Wash the filter in warm soapy water, then rinse it thoroughly in cool water.

7. Allow the filter to dry completely before you put it back.

8. Using the two screws previously set aside, secure the **FILTER** to the grate.

9. Reinstall the hinged front panel using the three screws previously set aside. Tighten the screws with the Phillips head (+) screwdriver.

10. Close the door of the shaker.

11. Reconnect the **POWER CORD** to the electrical outlet.

9 SERVICE PROCEDURES

The following sections describe basic service procedures and troubleshooting for the Innova 4230. A qualified Service Engineer must perform the following procedures.

CAUTION!
The following procedures be must performed *only* by a qualified Electrical or Service Engineer.

9.1 Motor Belt Replacement

WARNING!
Always keep fingers clear of the motor belt and pulley.

The **MOTOR BELT** for the Innova 4230 is behind the front panel of the shaker. To replace the **MOTOR BELT**, the qualified Service Engineer will:

1. Set the **ON/OFF POWER** Switch to **OFF**.

2. Disconnect the **POWER CORD** from the electrical outlet.

3. Open the door of the shaker to gain access to the front panel. The door *must* be open all the way.

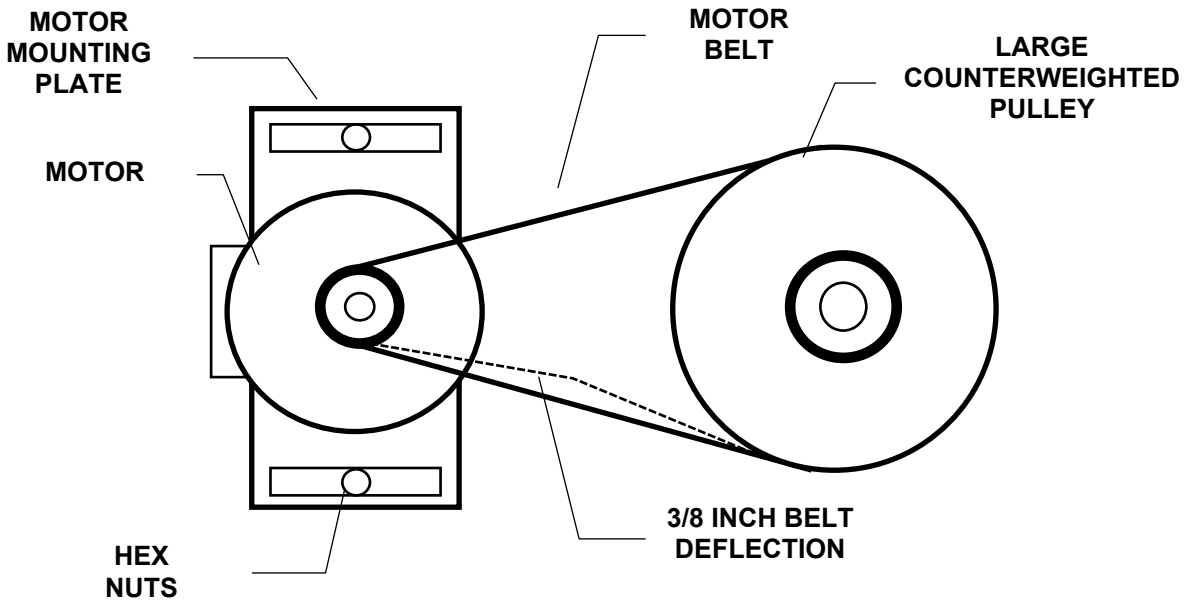
4. Use a Phillips head (+) screwdriver to unscrew the three screws that attach the hinged front panel to the housing. Gently lay down the front panel and set aside the screws for reuse. Looking into the shaker, the **MOTOR ASSEMBLY** is on the left side.

5. Use the **HEX WRENCH** to loosen the two **HEX NUTS** on the **MOTOR MOUNTING PLATE**.

6. Gently slide the **MOTOR MOUNTING PLATE** toward the back of the shaker. This loosens the **MOTOR BELT** from the **MOTOR PULLEY** and the **LARGE COUNTER-WEIGHTED PULLEY**. Moving the **MOTOR MOUNTING PLATE** back will cause the **MOTOR BELT** to fall from both belt tracks.

7. Remove the old belt.

Figure 15: Motor Belt Replacement



8. With one hand, place the new **MOTOR BELT** around the **MOTOR PULLEY** and with the other hand guide the **MOTOR BELT** around the **LARGE COUNTERWEIGHTED PULLEY**.

9. Move the **MOTOR MOUNTING PLATE** forward, until there is a slight resistance.

10. Verify that the **MOTOR BELT** has a slight pressure near the center. The recommended deflection is 3/8″(9.5 mm).

11. Use the **HEX WRENCH** to tighten the two **HEX NUTS** on the **MOTOR MOUNTING PLATE**.

12. Reinstall the hinged front panel with the three screws previously set aside. Use a Phillips (+) head screwdriver to tighten the screws.

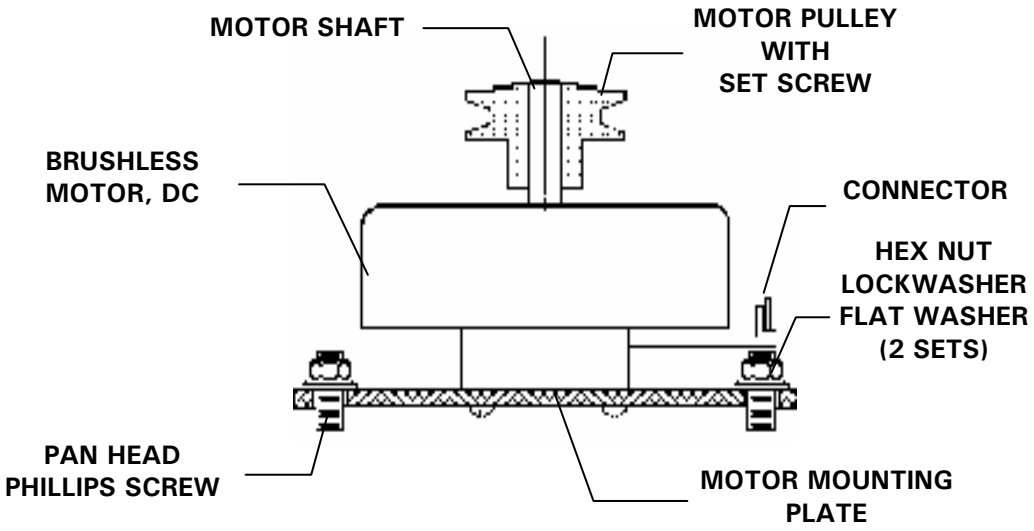
13. Close the door of the shaker and reconnect the **POWER CORD** to the electrical outlet.

9.2 Full Motor Assembly Replacement

To replace the full **MOTOR ASSEMBLY**, the qualified Service Engineer will:

1. Set the **ON/OFF POWER** Switch to **OFF**.
2. Disconnect the **POWER CORD** from the electrical outlet.
3. Open the door of the shaker to gain access to the front panel. The door *must* be open all the way.
4. Use a Phillips head (+) screwdriver to unscrew the three screws that attach the hinged front panel to the housing. Gently lay down the front panel and set aside the three screws for reuse. Looking into the shaker, the **MOTOR ASSEMBLY** is on the left side.
5. Lift up the **WHITE CONNECTOR** from the **MOTOR BASE** and disconnect it.
6. Unscrew the **NUT** from the **SMALL SCREW STUD** to the right of the **MOTOR MOUNTING PLATE**.
7. Remove the one **GREEN** and the **TWO GREEN/YELLOW GROUND WIRES**.
8. Use a **HEX WRENCH** to loosen the two **HEX NUTS** on the **MOTOR MOUNTING PLATE**.

Figure 16: Motor Replacement



9. Gently slide the **MOTOR MOUNTING PLATE** toward the back of the shaker, to loosen the **MOTOR BELT** from the **MOTOR PULLEY** and the **LARGE COUNTERWEIGHTED PULLEY**. Moving the **MOTOR MOUNTING PLATE** back will cause the **MOTOR BELT** to fall from both belt tracks.

10. Remove **MOTOR BELT** and set it aside.

11. Continue to loosen and remove the two **HEX NUTS** and **WASHERS** from the **MOTOR MOUNTING PLATE**.

12. Tilt the **MOUNTING PLATE** backwards. Unscrew the **NUT** on the right, and remove the **GREEN/YELLOW GROUND WIRE** from underneath the **PLATE**.

13. Remove the old **MOTOR** and the **MOTOR MOUNTING PLATE**.

14. Tilt the new **MOTOR** upside down and place the **GREEN/YELLOW WIRE** over the **SMALL SCREW STUD**.

15. Tighten the **NUT**.

16. Align the **MOTOR PLATE** over the holes on the **SHAKER BASE** and verify that the **MOTOR PLATE** sits smoothly over the holes.

17. Replace and slightly tighten the two **HEX NUTS** and **WASHERS** on the **MOTOR MOUNTING PLATE**.

18. With pne hand, place the **MOTOR BELT** around the **MOTOR PULLEY** and with the other hand guide the **MOTOR BELT** around the **LARGE COUNTERWEIGHTED PULLEY**.

19. Adjust the **MOTOR PULLEY** height so that the belt is level relative to the **DRIVE PULLEY**.

20. Move the **MOTOR MOUNTING PLATE** forward, until there is a slight resistance.

21. Verify that the **MOTOR BELT** has a slight pressure near the center. The recommended deflection is 3/8 inch (9.5 mm).

22. Tighten the two **HEX NUTS** on the **MOTOR MOUNTING PLATE**.

23. Reinstall the two **GREEN/YELLOW GROUND WIRES** over the **SMALL SCREW STUD** to the right of the **MOTOR MOUNTING PLATE**, then reinstall the **GREEN GROUND WIRE**.

24. Tighten the **NUT** to the **SMALL SCREW STUD**.

25. Reconnect the **WHITE CONNECTOR** on the **MOTOR BASE** and verify that the pins are properly positioned.

26. Reinstall the hinged front panel using the three screws previously set aside. Use a Phillips head (+) screwdriver to tighten the screws.

27. Close the door of the shaker and reconnect the **POWER CORD** to the electrical outlet.

9.3 Partial Motor Assembly Replacement

The qualified Service Engineer will:

1. Unscrew the three Phillips head (+) screws, setting them aside for reuse, and separate the **MOTOR** from the **PLATE**.

2. Loosen the **PULLEY SET SCREW** and remove the **PULLEY** from the **SHAFT**. Save the **PULLEY**.

3. Mount the new **MOTOR** to the **MOTOR PLATE** with the three Phillips head (+) screws previously set aside.

4. Reinstall the pulley, screwing the set screw to the shaft flat, without tightening.

5. Position this assembly back onto the shaker. Replace the two **HEX NUTS & WASHERS** with new hardware, without tightening.

6. Replace the belt. Adjust the **MOTOR PULLEY** height so that the belt is level relative to the drive pulley. Tighten the set screw.

7. Adjust the belt tension by tightening the two **HEX NUTS**.

9.4 Compressor Fan Replacement

The qualified Service Engineer will:

1. Disconnect **POWER CORD** from the electrical outlet.

2. Unscrew the three Phillips head (+) screws from the lower rear panel, then remove the lower rear panel.

3. Use the 3 mm Allen key to remove the two screws that secure the fan to the bracket.

4. Carefully remove the fan, disconnecting the two plug-in connectors.

5. Remove the two screws with the 3 mm Allen key and remove the fan from the assembly.

6. Carefully put the new fan into place, tightening the two screws with the 3 mm Allen key.

7. Reconnect the two plug-in connectors.

8. Reinstall and tighten the two screws that secure the fan to the bracket.

9. Reinstall the lower rear panel, using the three Phillips head (+) screws previously set aside. Tighten with a Phillips head (+) screwdriver.

10. Reconnect the **POWER CORD** to the electrical outlet.

9.5 Removing the Recirculating Fan

The qualified Service Engineer will:

1. Disconnect the **POWER CORD** from the electrical outlet.

2. Open the door of the shaker and remove all shelving.

3. Remove the three screws that secure the fan mounting plate assembly, setting them aside for reuse.

4. Remove the wires from the fan.

WARNING!

Fan blades are extremely sharp and can cause serious injury.
Handle with *EXTREME CARE!*

5. Remove the fan mounting plate assembly.

9.6 Bearing Housing Replacement

The qualified Service Engineer will:

1. Set the **ON/OFF POWER** Switch to **OFF** and disconnect the **POWER CORD** from the electrical outlet.

2. Open the door of the shaker to gain access to the front panel. The door *must* be open all the way.

3. Use a Phillips head (+) screwdriver to unscrew the three screws that attach the hinged front panel to the housing. Gently lay down the front panel and set aside the screws for reuse.

4. Unscrew the eight Phillips head (+) screws from the small panel on the left side of the shaker.

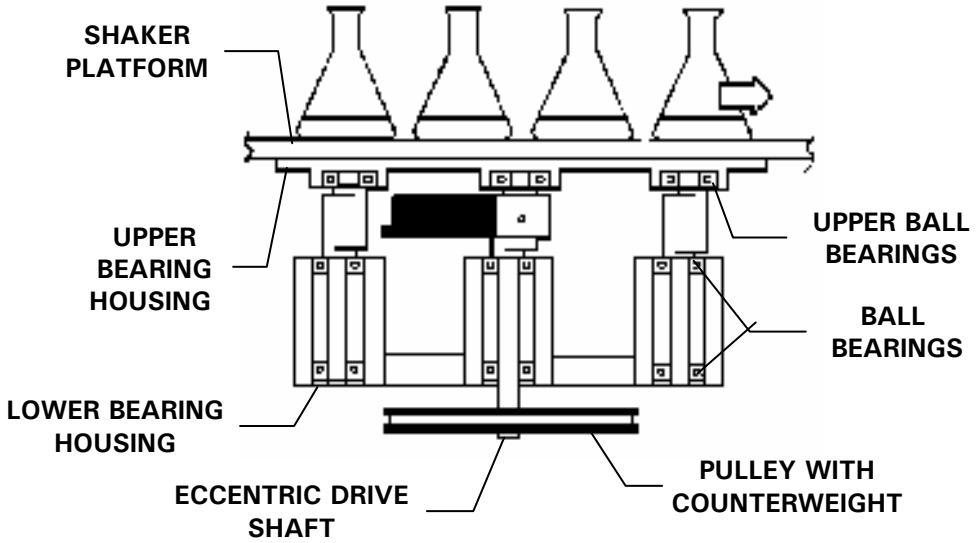
5. Remove all shelving from the inside of the shaker.

6. Use the **HEX KEY** to remove the four **HEX SCREWS** from the center of the shaker platform. Set the platform aside.

7. Remove the four **NUTS** from the **STUD SCREWS** that secure the **BEARING HOUSING**.

8. Use a **HEX WRENCH** to loosen the two **HEX NUTS** on the **MOTOR MOUNTING PLATE**.

Figure 17: Bearing Housing Replacement



9. Gently slide the **MOTOR MOUNTING PLATE** toward the back of the shaker to loosen the **MOTOR BELT** from the **MOTOR PULLEY** and the **LARGE COUNTERWEIGHTED PULLEY**. Moving the **MOTOR MOUNTING PLATE** back causes the **MOTOR BELT** to fall from both belt tracks.

10. Remove **MOTOR BELT** and set it aside.

11. Use an **ALLEN KEY** to remove the **ALLEN SCREW** from the **LARGE BEARING HOUSING PULLEY**.

12. Remove the **LARGE BEARING HOUSING PULLEY** from the **BEARING HOUSING SHAFT**.

13. Remove the **BEARING HOUSING**.

14. Place the new **BEARING HOUSING** inside the shaker.

15. Reinstall and tighten the four **NUTS** on the **STUD SCREWS**.

16. Reinstall the **LARGE BEARING HOUSING PULLEY** on the **BEARING HOUSING SHAFT**. Reinsert the **ALLEN SCREW** and tighten with the **ALLEN KEY**.

17. Put the set screw in place on the shaft flat without tightening it.

18. Place the **MOTOR BELT** around the **MOTOR PULLEY**. Guide the **MOTOR BELT** around the **LARGE BEARING HOUSING PULLEY**. Move the **MOTOR MOUNTING PLATE** forward, until there is a slight resistance.

19. Adjust the belt so that the belt is level relative to the **MOTOR PULLEY**.

20. Verify that the **MOTOR BELT** has a slight pressure near the center. The recommended deflection is 3/8″ (9.5 mm).

21. Tighten the two **HEX NUTS** on the **MOTOR MOUNTING PLATE**.

22. Reinstall and tighten the four **NUTS** on the **STUD SCREWS** to secure the **BEARING HOUSING**.

23. Reinstall the shaker platform. Reinstall the four **HEX SCREWS** in the center of the platform, tightening them with the **HEX KEY**.

24. Reinstall all shelving.

25. Reinstall the small panel on the left side of the shaker. Secure it with the eight Phillips head (+) screws previously set asidse. Tighten with a Phillips head (+) screwdriver.

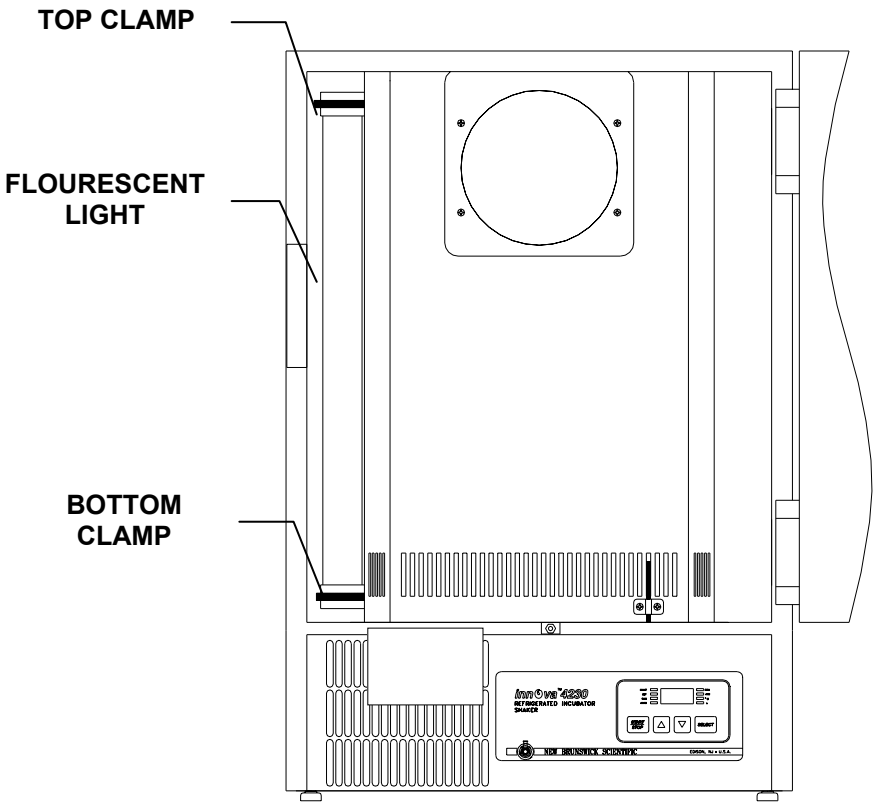
26. Reinstall the hinged front panel using the three screws previously set aside. Use a Phillips head (+) screwdriver to tighten the screws.

27. Close the door of the shaker.

9.7 Light Replacement

The fluorescent light for the shaker is on the back left wall inside the chamber. Two clips hold the light in place. One clip is on the top and one is on the bottom. Four wires connect the light to the **TERMINAL BLOCK**.

Figure 18: Light Replacement



To replace the light in the Innova 4230, the qualified Electrical or Service Engineer will:

1. Set the **ON/OFF POWER SWITCH** to **OFF**.

2. Disconnect the **POWER CORD** from the electrical outlet.

3. Open the door of the shaker.

4. Remove all the shelving from inside the chamber.

5. Use a Phillips head (+) screwdriver to remove the three screws that secure the hinged front panel to the housing. Gently lay down the front panel, setting aside the screws for reuse.

NOTE:

The qualified Electrical or Service Engineer should make a note of the wiring locations and wire color before disconnecting wires from the terminal block, to use as reference when reconnecting the wires to the terminal block.

6. Remove the top four wires that connect the **LIGHT WIRES** to the **TERMINAL BLOCK** (which is on the left side wall of the shaker).

7. With one hand on the light and the other near the **TOP CLAMP**, carefully, but with some force, push the light to the left. The light will unclamp from the **TOP CLAMP**. Do the same for the **BOTTOM CLAMP**.

8. Carefully pull the light forward and guide the unconnected wires out through the **RUBBER GROMMET** on the bottom of the shaker.

9. Carefully push and clamp the new light to the **TOP** and **BOTTOM CLAMPS**.

10. Feed the unconnected wires back through the **RUBBER GROMMET** on the bottom of the shaker.

11. Connect the top four wires to the **TERMINAL BLOCK** using the note as reference to match the initial connections.

12. Reinstall the hinged front panel using the three screws previously set aside. Use a Phillips head (+) screwdriver to tighten the screws.

13. Replace and secure all shelving.

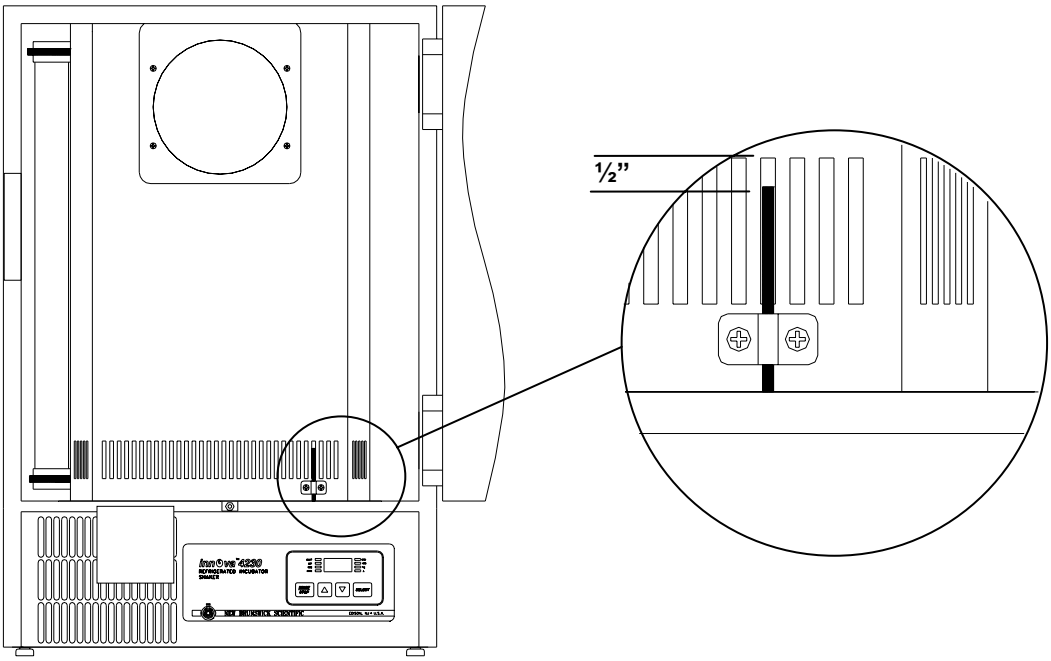
14. Close the door of the shaker.

15. Reconnect the **POWER CORD** to the electrical outlet.

9.8 Temperature Sensor Adjustment

The temperature sensor is located in the bottom right of the center panel on the chamber's back wall. It is held in place by a bracket and can be adjusted vertically. The sensor should be adjusted so that there is a ½ inch gap between the tip of the sensor and the top of the slot that it rests in front of (see drawing below).

Figure 19: Temperature Sensor Adjustment



1. Set the **ON /OFF POWER SWITCH** to **OFF**.

2. Disconnect the **POWER CORD** from the electrical outlet.

3. Remove all the shelving from inside the chamber.

4. If the sensor and bracket have been removed, set the sensor, sensor bracket and mounting screws in place, but do not secure. If the sensor is still in place, loosen the sensor bracket screws to allow the sensor to move. Adjust the sensor so that the gap between the tip of the sensor and the top of the slot is ½ inch. Secure the sensor bracket screws in place.

9.9 Replacing the Temperature Control Board

WARNING!

***Do not* attempt to change boards or electronic components unless you are a qualified Service Engineer.**

Integrated circuits are extremely sensitive and susceptible to damage from electrostatic discharge. Read and follow the ESD Precautions before attempting to replace boards.

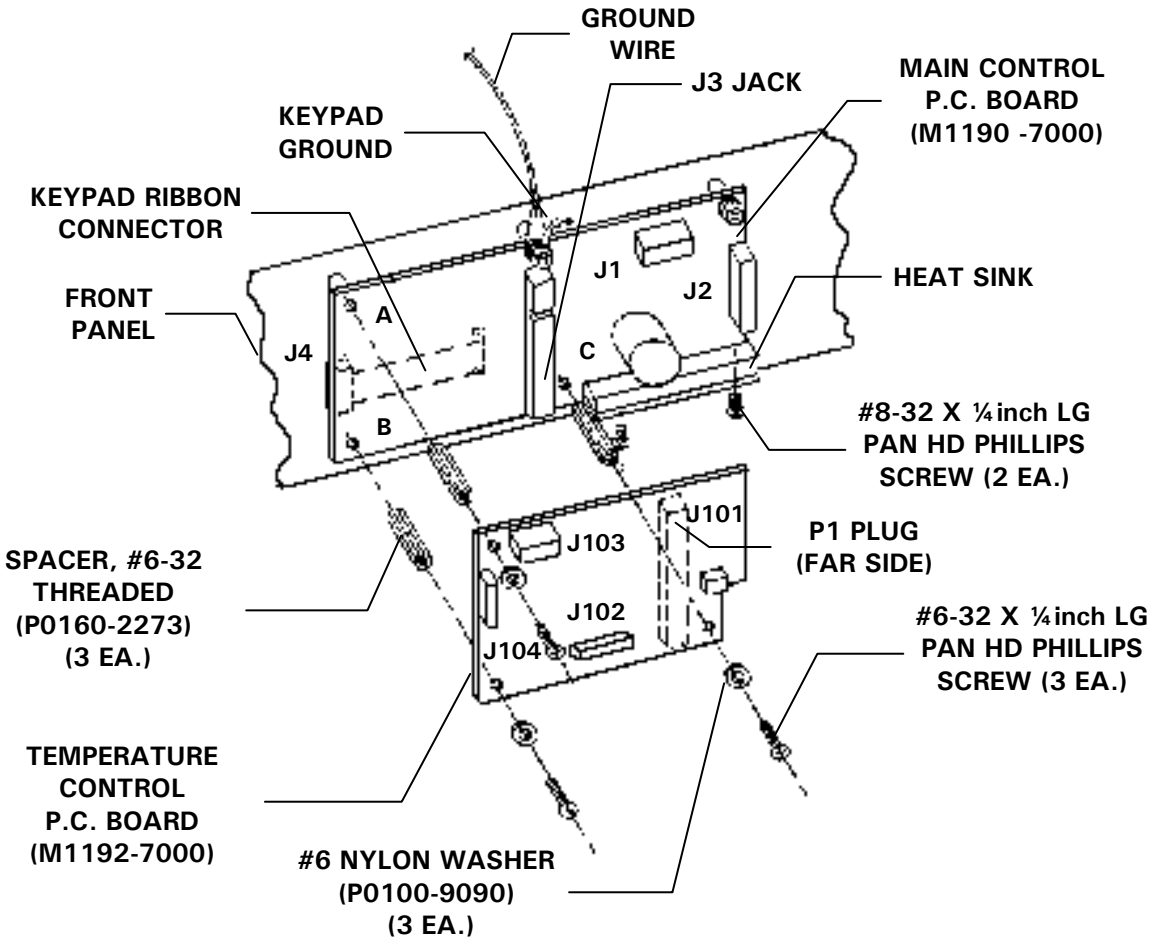
9.9.1 ESD Precautions

- Do not remove components from their antistatic packaging until you are ready to insert into sockets or install boards.
- Before handling components or boards, touch an unpainted portion of the system unit chassis for a few seconds.
- Wear a grounding wrist strap while working on components. The wrist strap *must* be connected to a grounded work station. Wrist straps are available at most electronic component stores.

To replace the **TEMPERATURE CONTROL BOARD**, the qualified Electrical or Service Engineer will:

1. Set the **ON/OFF POWER** Switch to **OFF**.
2. Disconnect the **POWER CORD** from the electrical outlet.
3. Open the door of the shaker to gain access to the front panel. The door *must* be open all the way.
4. Use a Phillips head (+) screwdriver to remove the three screws that secure the hinged front panel to the housing. Gently lay down the front panel, setting aside the three screws for reuse.

Figure 20: Temperature Board Replacement



Looking down at the inside of the panel, the **TEMPERATURE CONTROL BOARD** is on the right side of the panel. The **TEMPERATURE CONTROL BOARD** lays on top of the **MAIN CONTROL BOARD**.

1. Disconnect the harness wires from connectors **J101**, **J102**, **J103** and **J104**.

NOTE:

Make a note of how the wires are positioned before or while disconnecting.

2. Use a Phillips head (+) screwdriver to remove the three screws. Remove nylon washers.

3. Using caution, disconnect the **TEMPERATURE CONTROL BOARD** from the **MAIN CONTROL BOARD**. Apply force perpendicular to the plane of the board; *do not* lift from one end.

4. Ensure that the board to board connectors are properly positioned. Snap the new **TEMPERATURE CONTROL BOARD** onto the **MAIN CONTROL BOARD**. Verify that no pins are visible and the board is secure.

5. Replace the three nylon washers. Reinstall the three ¼″ screws. Use a Phillips head (+) screwdriver to tighten the screws.

6. On the **TEMPERATURE CONTROL BOARD**, reconnect the harness wires to connectors **J101**, **J102**, **J103** and **J104**. Ensure that all connectors are properly positioned and secure. Verify that no pins are visible.

7. Reinstall the hinged front panel, securing it with the three screws previously set aside. Use a Phillips head (+) screwdriver to tighten the screws.

8. Close the door of the shaker, then reconnect the **POWER CORD** to the electrical outlet.

9.10 Replacing the Main Control Board

WARNING!

***Do not* attempt to change boards or electronic components unless you are a qualified Service Engineer.**

Integrated circuits are extremely sensitive and susceptible to damage from electrostatic discharge. Read and follow the ESD Precautions (see Section 9.9.1) before attempting to replace boards.

To replace the **MAIN CONTROL BOARD**, the qualified Electrical or Service Engineer will:

1. Set the **ON/OFF POWER** Switch to **OFF**.

2. Disconnect the **POWER CORD** from the electrical outlet.

3. Open the door of the shaker to gain access to the front panel. The door *must* be open all the way.

4. Use a Phillips (+) head screwdriver and unscrew the three screws that attach the hinged front panel to the housing. Gently lay down the front panel.

Looking down, the **MAIN CONTROL BOARD** of the Innova 4230 is on the right side of the panel. The **TEMPERATURE CONTROL BOARD** lies on top of the **MAIN CONTROL BOARD**. One must remove the **TEMPERATURE CONTROL BOARD** to access the **MAIN CONTROL BOARD**.

5. Disconnect the harness wires from **CONNECTORS J101**, **J102**, **J103** and **J104** on the **TEMPERATURE CONTROL BOARD**.

6. Use a Phillips head (+) screwdriver to remove the three screws. Remove the nylon washers.

7. Using caution, disconnect the **TEMPERATURE CONTROL BOARD** from the **MAIN CONTROL BOARD**. Apply force perpendicular to the plane of the board; *do not* lift from one end. Set the **TEMPERATURE CONTROL BOARD** aside.

8. On the **MAIN CONTROL BOARD**, disconnect the harness wires from **CONNECTORS J1** and **J2**.

9. Remove the five **HEX SPACERS** and the five 5/16 inch **HEX NUTS**.

10. Remove the **GREEN GROUND WIRE**.

11. Remove the **KEY PAD GROUND LEAD**.

12. Remove two screws that fasten the **HEAT SINK** to the front panel.

13. Lift the board slightly and disconnect the **KEY PAD RIBBON CONNECTOR** from **J4**.

14. Apply heat sink compound to the **HEAT SINK BRACKET**.

15. Position the gray insulator on the solder side of the new **MAIN CONTROL BOARD** and reconnect the **KEY PAD RIBBON CONNECTOR** to the **J4 CONNECTOR**.

16. Verify that the five ¼″ **SPACERS** are lined up with the **MOUNTING STUDS**. Set the new **MAIN CONTROL BOARD** in place.

17. Tighten the two screws to the **HEAT SINK BRACKET**.

18. Reconnect the **KEY PAD GROUND LEAD**.

19. Reconnect the **GROUND WIRE**.

20. Reconnect the harness wires to **CONNECTORS J1** and **J2**. Ensure that all connectors are properly positioned and secure. Verify that no pins are visible.

21. Ensure that the board to board connectors are properly positioned. Snap the **TEMPERATURE CONTROL BOARD** onto the **MAIN CONTROL BOARD**. Verify that no pins are visible and the board is secure.

22. Replace the nylon washers. Reinstall the three ¼″ screws. Use a Phillips head (+) screwdriver to tighten the screws.

23. On the **TEMPERATURE CONTROL BOARD**, reconnect the harness wires to connectors **J101**, **J102**, **J103** and **J104**. Ensure that all connectors are properly positioned and secure. Verify that no pins are visible.

24. Reinstall the hinged front panel and secure in place with the three screws previously set aside. Use a Phillips head (+) screwdriver to tighten the screws.

25. Close the door of the shaker and reconnect the **POWER CORD** to the electrical outlet.

10 TROUBLESHOOTING

If any problems occur with your Innova 4230, do not attempt to perform any service on the shaker yourself. Unauthorized servicing may void the warranty. Please contact your local NBS Service Department or local NBS distributor.

In any correspondence with NBS, please refer to the Model Number, Manufacturing Part Number and Serial Number of your shaker. This information is on the **ELECTRICAL SPECIFICATION PLATE** on the side of the Innova 4230 (see Figure 3).

10.1 Troubleshooting Guide

Symptom	*Possible Cause*	*Solution*
LED Display does not illuminate	**Power cord not connected**	**Verify power cord is plugged into power source**
	No power supplied to power source	**Verify power source is active**
	Fuse may need replacement	**Verify fuse voltage/Verify fuse is good**
	Motor may need replacement	**Call local NBS Service Department or contact your local NBS distributor**
LED reads ACC	**Motor not operating properly**	**Call local NBS Service Department or contact your local NBS distributor**
LED reads ERR	**Temperature Probe not making proper contact**	**Call local NBS Service Department or contact your local NBS distributor**
Shaker does not move	**Fuse may need replacement**	**Verify fuse voltage/Verify fuse is good**
	Motor may need replacement	**Call local NBS Service Department or contact your local NBS distributor**

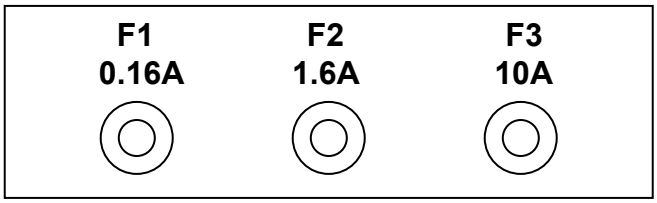
10.2 Fuse Replacement

CAUTION!
The following procedure must be performed only by a qualified Electrical or Service Engineer.

There are three fuses for the Innova 4230, housed behind the front panel. To replace a fuse, the qualified Electrical or Service Engineer will:

1. Set the **ON/OFF POWER** Switch to **OFF.**
2. Disconnect the **POWER CORD** from the electrical outlet.
3. Open the door of the shaker to gain access to the front panel. The door *must* be open all the way.
4. Use a Phillips head (+) screwdriver to remove the three screws that secure the hinged front panel to the housing. Gently lay down the front panel, setting aside the screws for reuse.

Figure 21: Fuse Replacement



5. Gently twist the black cap of the fuse. The fuse pops out.
6. Remove the bad fuse and replace it with a new one.
7. Replace the black cap and twist until tight.
8. Reinstall the front panel, securing it with the three screws previously set aside. Use a Phillips head (+) screwdriver to tighten the screws.
9. Close the door of the shaker, then reconnect the **POWER CORD** to the electrical outlet.

11 REPLACEMENT PARTS & ACCESSORY INFORMATION

When ordering replacement or accessory parts, or requesting service information, please provide the Model Number, Manufacturing Part Number and Serial Number of the Innova 4230. This information is on the **ELECTRICAL SPECIFICATION PLATE** on the side of the Innova 4230 (see Figure 3).

11.1 Replacement Parts Descriptions & Part Numbers

Spare Part Description	*Quantity*	*NBS Part Number*
Air Deflector Kit	1	M1233-9994
Bearing Housing Assembly 1″ stroke	1	M1233–6330
Bearing Housing Assembly 3/4″ stroke	1	M1233–6331
Belt	1	P0700–5242
Bridge Rectifier	1	P0460–4091
Compressor	1	P0620-0813
Condenser	1	K0620–1320
Condenser Fan	1	P0620-2591
Door Gasket	1	M1233–9500
Evaporator	1	M1233-1360
Fan Internal	1	P0620–2591
Filter	1	M1233–9501
Filter Drier	1	P0200-1210
Fluorescent Lamp	1	K0300-0160
Ballast Tray	1	K0420–0170
Fuse 10 AMP SloBlo–Compressor/F3	1	P0380–3162
Fuse 1.6 AMP SloBlo–Electronics/F2	1	P0380-3532
Fuse 0.16 AMP FastBlo–Electronics/F1	1	P0380-3710
Heater	1	P0620–1380
Motor	1	M1195–4001
Moisture Proof Plug	1	K0380–0871
PCB Assy. Main Control	1	M1190–7050
PCB Assy. Temperature Control	1	M1192–7050
RTD Assembly	1	M1195–8001
Solid State Relay	1	P0400–3151
Solid State Relay	1	P0400–3011
Switch Actuator	1	P0400-1538
Starter Fluorescent Light	1	P0400-1430

11.2 Accessory Descriptions & Part Numbers

11.2.1 Quick Change Platform Kit

The Quick Change Platform Kit allows you to snap in the platform without using tools or hardware. The kit includes a sub-platform with spring clips, an extra counterweight and hardware.

Accessory Description	*NBS Part Number*
Quick Change Platform Kit	M1192–9901

11.2.2 Accessory Platforms

The following table lists *accessory platforms* for the Innova 4230:

Accessory Description	*Clamps*	*NBS Part Number*
Universal Platform *	–	M1250-9902
Utility Carrier	–	M1194–9909
Utility Tray	–	M1194–9910
50 ml Erlenmeyer Flask	64	M1194–9903
125 ml Erlenmeyer Flask	34	M1194–9904
250 ml Erlenmeyer Flask	25	M1194–9905
500 ml Erlenmeyer Flask	16	M1194–9906
1 Liter Erlenmeyer Flask	9	M1194–9907
2 Liter Erlenmeyer Flask	5	M1194–9908
4 Liter Erlenmeyer	4	M1233–9930
6 Liter Erlenmeyer Flask	2	M1233–9931
2800 ml Fernbach Flask	4	M1233–9932

*Flask clamps must be ordered separately

11.2.3 Accessory Clamps

The following table lists *accessory clamps* for the Innova 4230:

Accessory Description	*NBS Part Number*
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 L Erlenmeyer Clamp	ACE–1000S
2 L Erlenmeyer Clamp	ACE–2000S
4 L Erlenmeyer Clamp	ACE–4000S
6 L Erlenmeyer Clamp	ACE–6000S

Accessory Description	NBS Part Number
2800 ml Fernbach Flask Clamp	ACFE–2800S
500 ml Media Bottle Clamp	ACSB–500S
1 L Media Bottle Clamp	ACSB–1000S

11.2.4 Accessory Test Tube Racks

The following table lists *accessory test tube racks*† for the Innova 4230:

Accessory Description	Tube Capacity	NBS Part Number
Test Tube Rack–13 mm	48	TTR–111
Test Tube Rack–20 mm	33	TTR–121
Test Tube Rack–25 mm	21	TTR–122
Adjustable Angle Slant Rack	15	TTR–199
Test Tube Rack 30 mm for 50 ml Centrifuge Tubes	15	TTR–208
Angle Test Tube Rack Holder for 4–5″ W (12.7 cm) –15″ L (38 cm)		TTR–210

† Test Tube Rack requires Universal Platform.

NOTE:

The adjustable angle slant rack can hold test tubes 30 mm and smaller. Clips can be adjusted for different test tube sizes by tightening or loosening the screw in the middle of the clip.

11.2.5 Optional Accessories

The following table lists *optional accessories* for the Innova 4230:

Accessory Description	Voltage of Unit	NBS Part Number
Photosynthetic Light Bank	120V 60 Hz	M1233–9940
Photosynthetic Light Bank	100V 60 Hz	M1233–9941
Photosynthetic Light Bank	220/230V 60 Hz	M1233–9942
Photosynthetic Light Bank	100V 50 Hz	M1233–9944
Photosynthetic Light Bank	220/230V 50 Hz	M1233–9945
Photosynthetic Light Bank	240V 50 Hz	M1233–9946
Gassing Manifold	All	M1233–0291
Stacking Kit	All	M1233–9992
Spare Parts Kit	All	M1233–6002

11.2.6 Clamp 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 following tables identify the proper screw(s) for your shaker application by reference to the head style:

Hardware for 10 ml to 500 ml Clamps:

Description	Part Number	Qty.	Application
10-24 x 5/8 (15.87 mm) flat Phillips (+) head screw	S2116-3101	1	¾ inch (19.05 mm) thick wood platform
10-24 x 5/16 (7.9 mm) flat Phillips (+) head screw	S2116-3051	1	5/16 inch (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

Hardware for 1-Liter to 6-Liter Clamps:

Description	Part Number	Qty.	Application
10-24 x 5/8 (15.87 mm) flat Phillips (+) head screw	S2116-3101	5	¾ inch (19.05 mm) thick wood platform
10-24 x 5/16 (7.9 mm) flat Phillips (+) head screw	S2116-3051	5	5/16 inch (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

(Chart includes 2800 ml Fernbach Flasks)

12 DRAWINGS

12.1 Schematics

Figure 22: Electrical Schematic <u>without</u> optional electronic timer

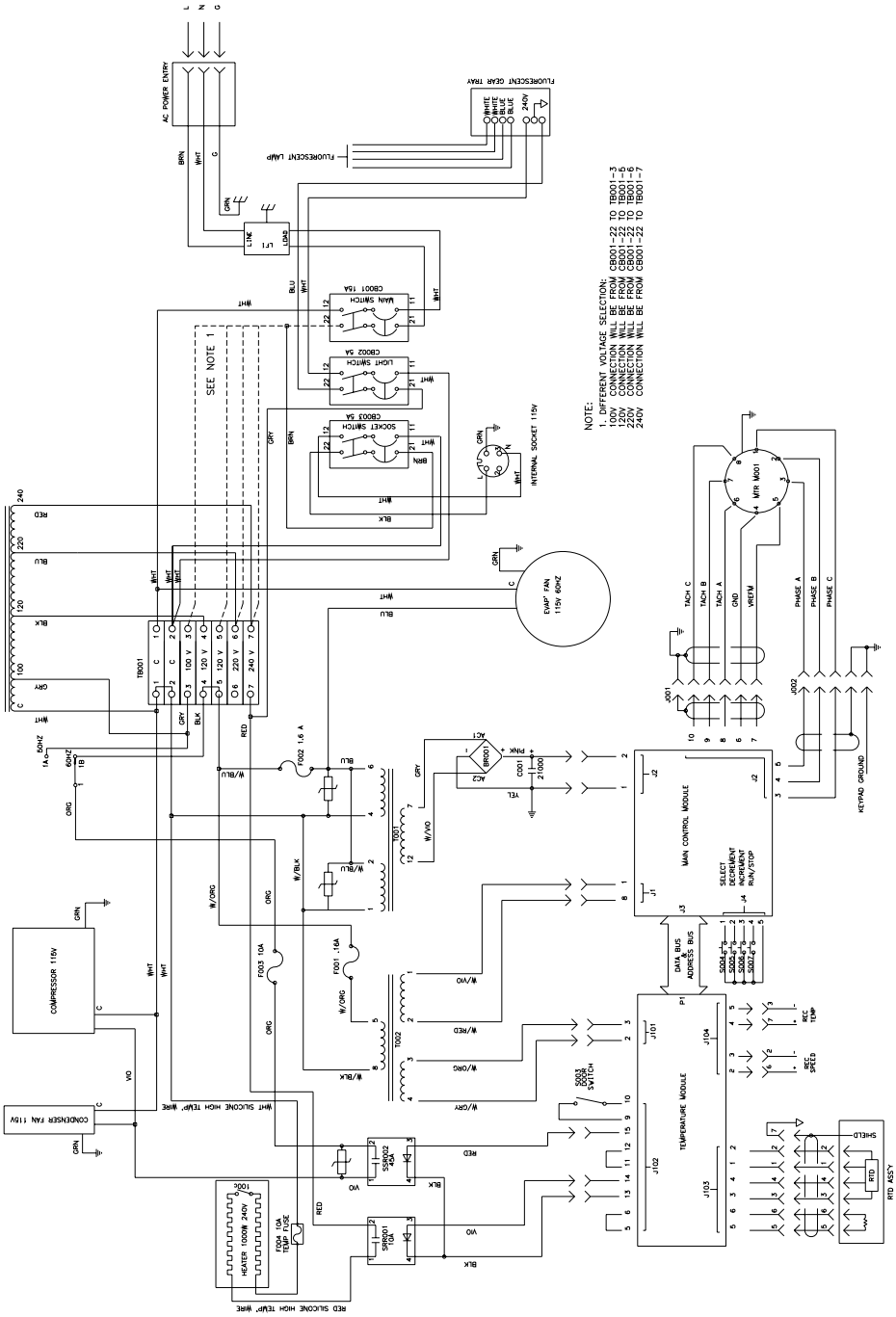


Figure 23: Electrical Schematic <u>with</u> optional electronic timer

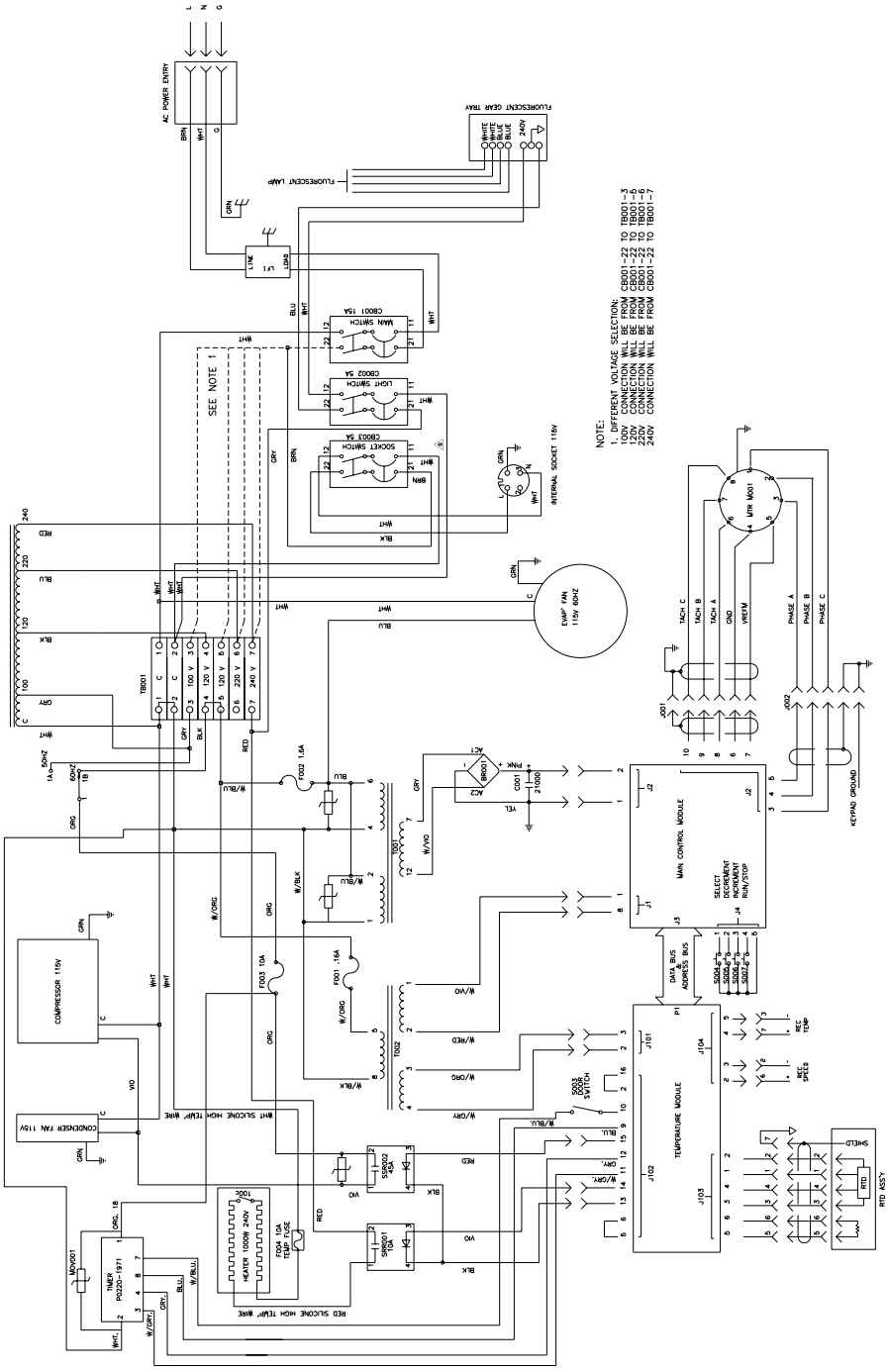


Figure 24: Schematic for Optional Photosynthetic Light Bank

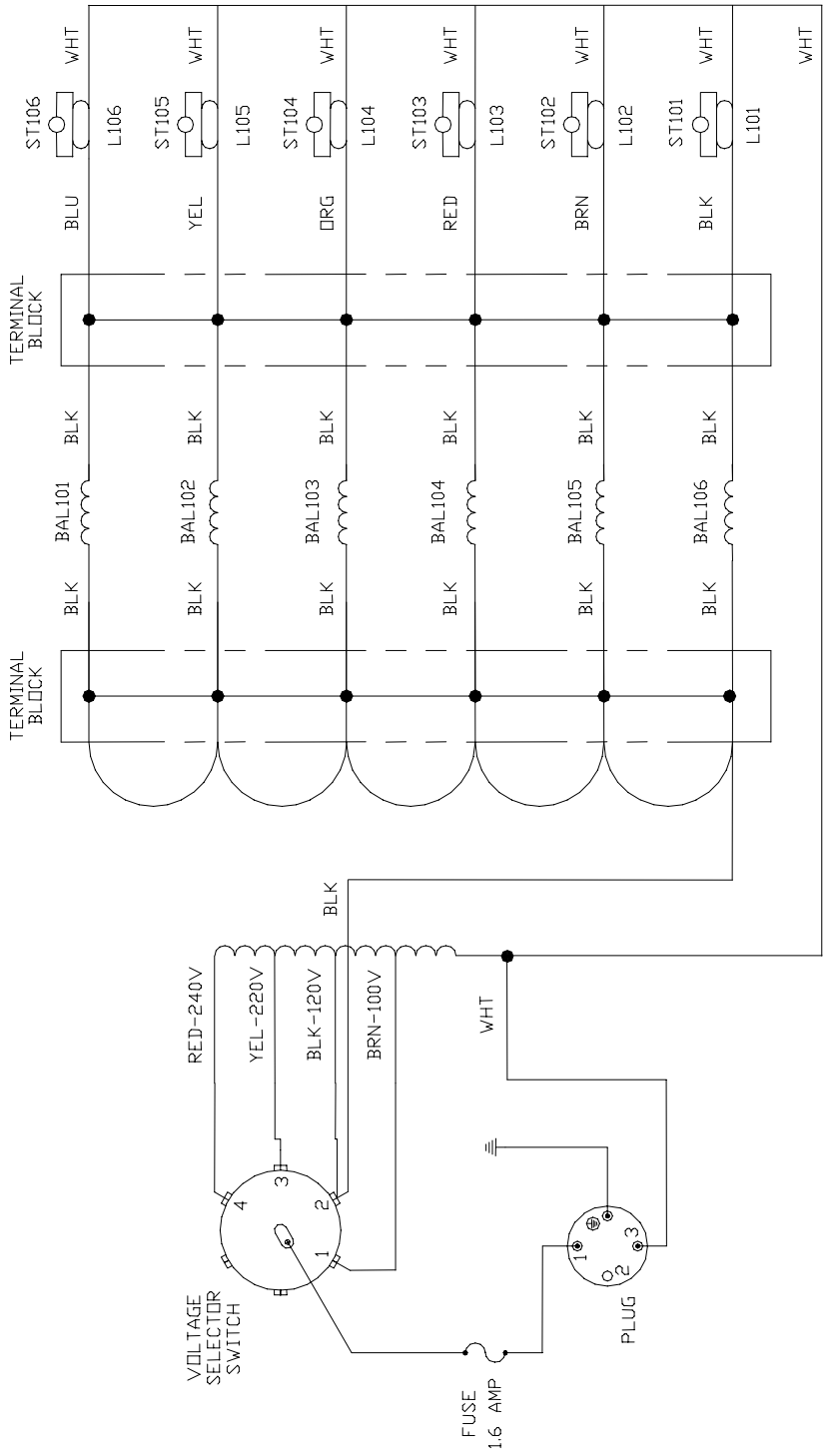
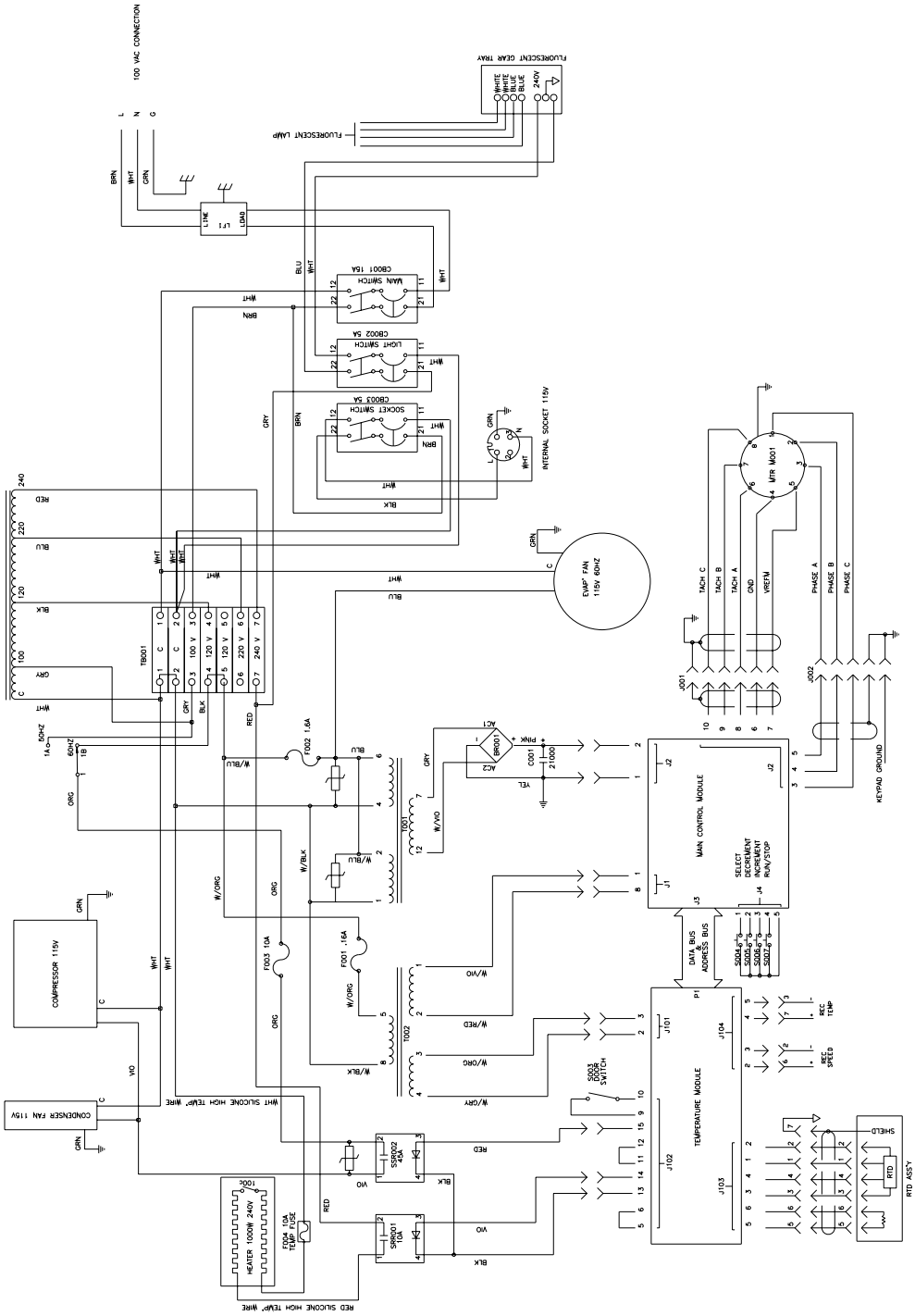


Figure 25: 100V Power Schematic, overview



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