Biological Shakers

New Brunswick
an eppendorf company

New Brunswick Biological Shakers Innova® 44/44R

Operating Manual
M1282-0050
Revision M

eppendorf

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November 16, 2011
Revision M
M1282-0050

CAUTION! ***Risk of damage to personnel and/or equipment!***

- **This equipment *must* be operated as described in this manual.**
- **Please read the entire Operating Manual before attempting to use this equipment. If operational guidelines are not followed, equipment damage and personal injury *can* occur.**
- **Do not use this equipment in a hazardous atmosphere or with hazardous materials for which the equipment was not designed.**
- **New Brunswick Scientific Co., Inc. is not responsible for any damage to this equipment that may result from the use of an accessory not manufactured by New Brunswick.**

WARRANTY

New Brunswick Scientific equipment is protected by a comprehensive warranty. The warranty covers faulty components and assembly, and our obligation under this warranty is limited to repairing or replacing the instrument or part thereof, which shall prove to be defective after our examination.

The warranty does not cover loss of time or materials, such as the loss of biological or biochemical by-products caused by any work interruption resulting from equipment failure; it does not extend to equipment that has been subject to misuse, neglect, accident or improper installation or application; nor does it cover any machine that has been repaired or altered by anyone other than an authorized New Brunswick Scientific factory-trained service representative, without prior written approval from your local New Brunswick sales office or distributor.

Expendable items such as bearings and seals, lamps, probes, sensors including incubator sensors, glass, filters, single-use vessels, etc., are not covered.

The warranty begins on the date the equipment ships from New Brunswick Scientific or an authorized distributor and extends through the period indicated in the chart below:

Instrument		Parts Warranty	Labor Warranty
Shakers	Innova	3 years	2 years
	I Series	2 years	2 years
	Excella & C-76	2 years	2 years
	Accessories[1]	1 year	1 year
CO_2 Incubators	Incubators	2 years	2 years
	Accessories[2]	1 year	1 year
Freezers	ULT Freezers	5 years; Vacuum insulation panels: 12 years	2 years
	Accessories[3]	1 year	1 year
Fermentors, Bioreactors & all other New Brunswick equipment		1 year	1 year

1 Photosynthetic light banks, etc.
2 Stacking stand, casters, shelves, etc.
3 Chart recorders, CO_2/LN_2 back-up systems, etc.

Warranty Registration

To register your warranty, complete the online form at www.nbsc.com /warranty..

Extended Warranty Option

A variety of service plans are offered to help minimize downtime from unexpected malfunctions in equipment operation. Speak to your New Brunswick sales representative for more information.

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1 OVERVIEW

The Innova® 44/44R Stackable Incubator Shakers are large-capacity orbital shakers that utilize an eccentric counter-balanced drive mechanism. They provide horizontal plane rotary motion in either a 2.54 cm (1-inch) or a 5 cm (2-inch) diameter circular orbit, depending on the model. A Proportional/Integral (PI) microprocessor controller with instantaneous digital feedback controls the speed over the entire speed range.

The Innova 44R provides temperature control from 20º below ambient (as low as 4ºC) to 80°C, and the Innova 44 from 5º above ambient to 80ºC. Naturally, both these ranges depend on relative humidity and other ambient factors, as well as the options installed in the unit. Ambient temperature is measured at one meter from the exterior of the unit.

Erlenmeyer flasks (up to 5 liters in size) as well as a wide variety of tubes and plates can be accommodated using the New Brunswick Scientific shaker accessories described in Section 9.12. These are easily accessed on slide-out platforms.

The Innova 44/44R may be operated in the following ways:

- **Continuously:** at a set speed and temperature, until user intervention.
- **In a timed mode:** run at a set speed, time and temperature for a period of up to 99.9 hours, after which the shaker automatically shuts off.
- **Via the shaker's programmable controller:** run through multiple temperature and speed changes for an extended period of time.
- **Via computer through an RS-232 interface.**

See Section 7 for more details on these various modes of operation.

For safe operation, the Innova 44/44R shakers are designed with a safety switch that automatically stops the shaker mechanism when the door is opened.

The Innova 44/44R is equipped with visual and/or audible alarms that alert the user to the following conditions:

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

To accommodate customer needs, a wide variety of platforms can be used with the Innova 44/44R:

- Universal platforms are the most flexible, providing hole patterns for flask clamps, test tube racks and other accessories.
- Dedicated platforms are supplied with flask clamps attached; they are designed solely and expressly for this purpose.
- Test tube racks, microplate holders, and test tube rack holders are also available (a universal platform is needed for all test tube racks and holders).

For further information on these accessories, see Section 9.12.

2 INSPECTION & UNPACKING OF EQUIPMENT

2.1 Inspection of Boxes

After you receive 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 New Brunswick Customer Service Department.

2.2 Packing List Verification

Verify against your New Brunswick packing list that you have received all of the correct materials.

2.3 Unpacking of Equipment

CRUSH WARNING!
Do not attempt to lift the Innova 44/44R by hand.
Always use a lifter or other suitable equipment when raising or handling the unit.

To unpack your Innova 44/44R, you will need the following tools:

- Claw hammer
- Forklift or other lifting equipment to lift more than 259 kg (570 lb)
- Shears to cut 19 mm (¾-inch) wide steel strapping
- Tool to remove 7.6 cm (3-inch) metal staples

Save all packing materials and this operating manual.

2.4 Out of Box Concerns

If any part of your order was damaged during shipping, is missing pieces, or fails to operate properly, please contact your New Brunswick sales representative.

2.5 Warranty Registration

Please register electronically at our Website: www.nbsc.com

3 PREPARING THE LOCATION

3.1 Physical Location

It is essential that the instrument be situated in an area where there is sufficient space for the shaker and platform to clear walls and potential obstructions during operation. The surface on which the unit is placed must be smooth, level, and able to support the shaker under full load operating conditions.

CRUSH WARNING!
REMINDER: Do not attempt to lift the Innova 44/44R by hand. Always use a lifter or other suitable equipment when raising or handling the unit.

3.2 Environment

The shaker is designed to operate optimally in the following ambient conditions:

- 10º to 35°C
- 20 to 80% Relative Humidity (non-condensing)

3.3 Electrical Requirements

The Innova 44/44R can be equipped to run on:

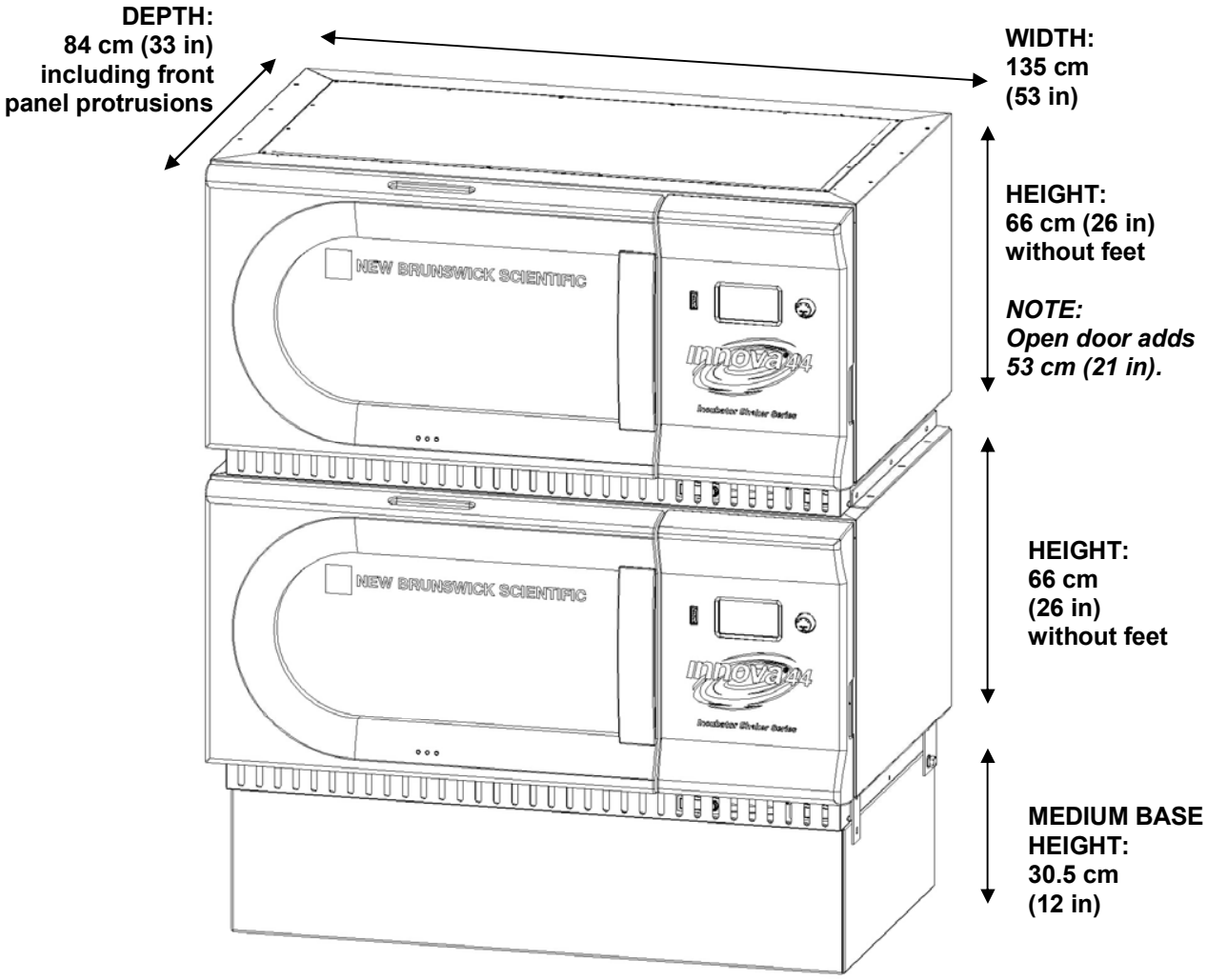
- 100 Volts, 50 or 60 Hz, 1500 VA maximum
- 120 Volts, 60 Hz, 1500 VA maximum
- 230 Volts, 50 Hz, 1500 VA maximum

Check your shaker's Electrical Specification Plate (located on the back of the unit) to be sure the electrical requirements of your unit match the output of your electric supply. If they do not match, contact your New Brunswick representative.

3.4 Space Requirements

Allow at least 10 cm (4 in) around the shaker for proper ventilation and for access to Power Switch and RS-232 port accessibility on the right side. Be sure to keep the power plug and power outlet easily accessible to facilitate unplugging the unit, as needed.

Figure 1: Innova 44/44R Front View
Two Shakers Stacked on 12-Inch Base



NOTE:

Be sure to allow at least 10.5 cm (4 in) around shaker for ventilation, access to power cord (rear panel), and access to power switch and RS-232 port (right side).

NOTE:

If you are stacking three shakers, use a 10.5 cm (4 in) base.

4 INSTALLATION

CRUSH WARNING!
REMINDER: Do not attempt to lift the Innova 44/44R by hand. Always use a lifter or other suitable equipment when raising or handling the unit.

NOTE:
Feet are used on the shaker ONLY when a single unit is operated without a base. At all other times (with two or three shakers stacked, or when a base is added), all feet must be removed.

4.1 Tools Required for Installation

To install the Innova 44/44R on an optional base and/or to stack Innova 44/44R units, the following tools will be needed:

- Number 2 Phillips head screwdriver
- Blade screwdriver
- 3mm (1/8-in) Allen key
- 3/8-inch Allen key (provided)
- Level, ≥ 25.4 cm (10 in)
- Two adjustable wrenches or 7/16-inch socket wrench
- Forklift or other lifting equipment able to lift more than 259 kg (570 lb)
- Metal leveling shims (provided in stacking kit)
- Optional: set of screw-in lifting handles, for small lifts of short duration (adding leveling shims, for example) or for minor location adjustments (*see Section 9.12.11*)
- Optional: stacking kit(s).

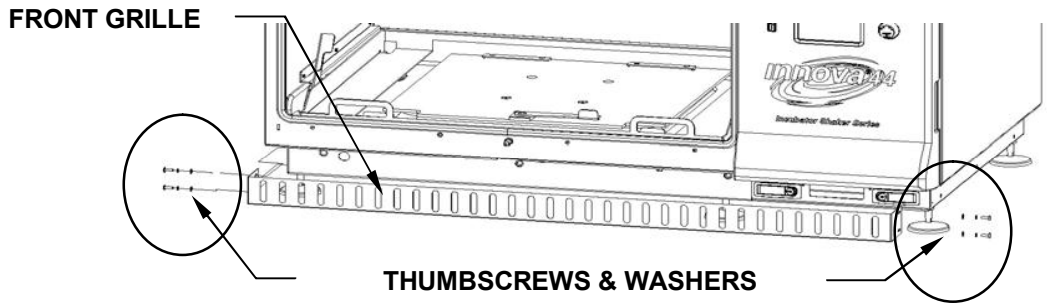
4.2 Installing the Front Grille

1. Remove and discard the plastic retaining clip that holds the drain hose in place for shipping.

2. Temporarily remove the thumbscrews (with their washers) installed at the bottom of each side panel, in the corner closest to the front of the shaker.

3. Hold the front grille in place (*see Figure 2 on the following page*) and reinstall the thumbscrews (and washers).

Figure 2: Installing the Front Grille



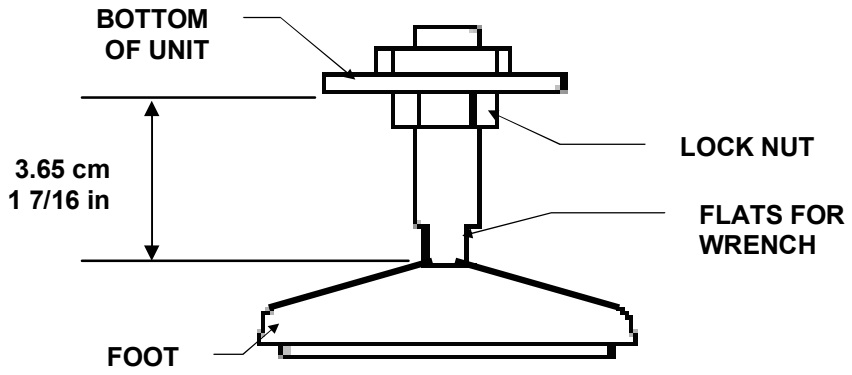
4.3 Leveling a Single Shaker

These instructions are for a single shaker without an added base.

Make sure that the shaker is placed on a level surface and that all four feet are solidly on the surface. If the shaker is not level, adjust the feet as needed to achieve leveling:

1. Immobilize the top lock nut against the unit with one wrench **whenever you adjust the foot**, to keep the threaded stud from falling out *(see Figure 2a)*.

Figure 2a: Adjustable Foot (as shipped)



2. With a second wrench against the flats of the threaded stud, just above the foot. Rotate clockwise to lower the foot or counter-clockwise to raise the foot.

3. Place a level on the top of the unit. If necessary, make further adjustments by repeating all steps until the unit is level.

4. After installing a platform (*see Section 6*), fully load the shaker and do a test run at normal speed (*see Section 7*). Make additional leveling adjustments if necessary.

NOTE:

The maximum shaker lowering adjustment is 12.7 mm (½ in). The shaker cannot be raised above the height at which it was shipped. If more adjustment is required, you will need to add metal shims.

4.4 Leveling the Optional Base

Place the base on a sturdy (capable of bearing the weight of the combined base shakers and shaker contents), level surface, making sure that all four corners are solidly on the surface. If the base is not level, place metal shims as needed under the base until it is level.

4.5 Mounting Innova 44/44R on Optional Base

1. Using a forklift or lifter, raise the Innova 44/44R so that its back end is tilted toward the rear of the base.

2. Remove all four feet from the bottom of the shaker. They will not be needed for stacking, but you may want to keep them for future use.

3. With two assistants, guiding the shaker from opposite sides, lower the unit onto the base, back end first. Slowly and gently remove the forklift or lifter, lowering the front of the unit onto the base by hand.

4. Remove the set screws from the bottom sides of the shaker that correspond to the mounting holes for the rear corner braces (*see Figure 3 on the following page*).

5. Using the ½ - 13 x 1¼-inch screws, lock washers and washers provided, mount the rear braces on the base. Do not fully tighten the screws yet.

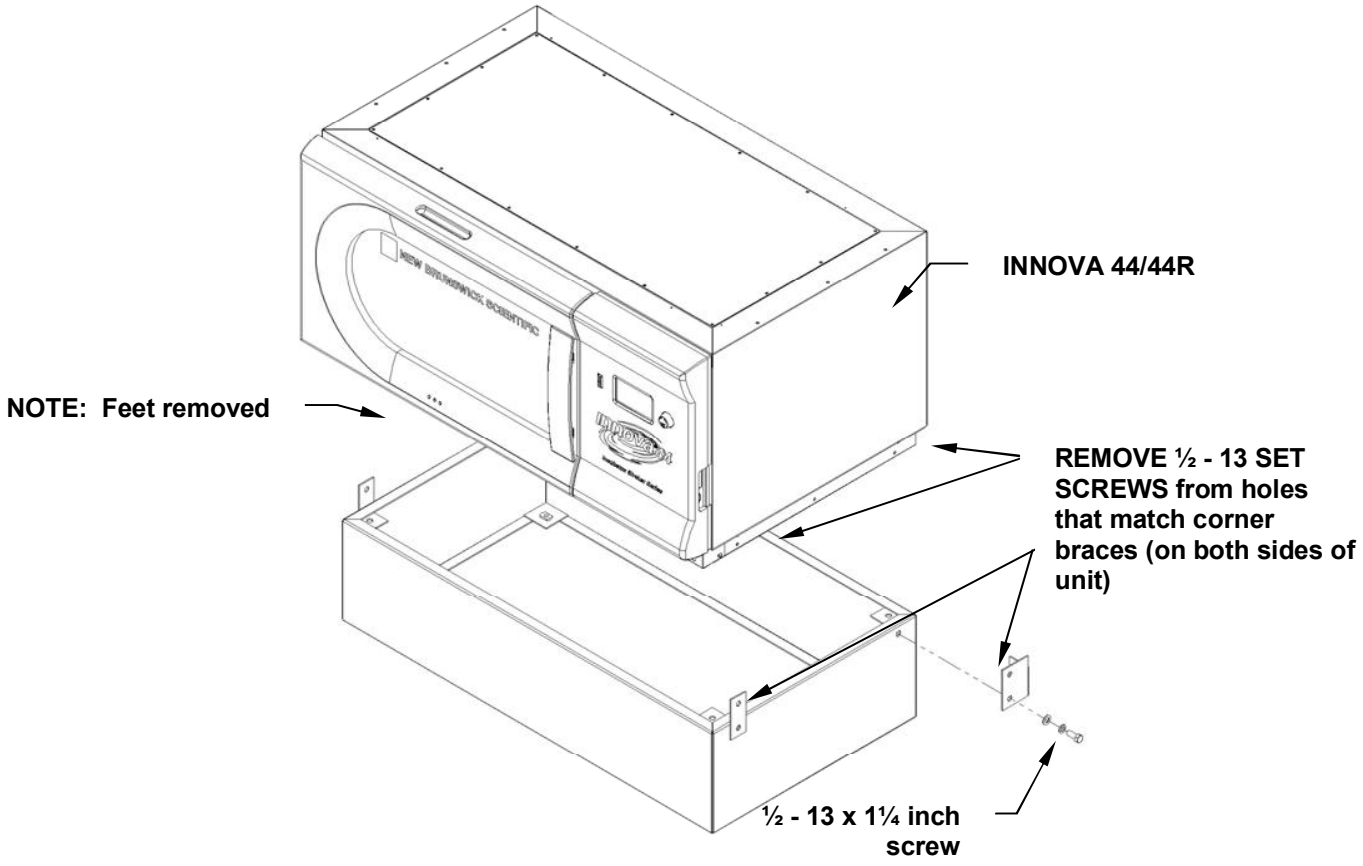
6. Mount the rear of the Innova 44/44R to the corner braces on the base, using the ½ - 13 x 1¼-inch screws, lock washers and washers provided. Do not fully tighten the screws yet.

7. Mount the front corner braces to the base using two sets of the ½ - 13 x 1¼-inch screws, lock washers and washers provided. Do not fully tighten the screws yet.

8. With the remaining ½ x 13 x 1¼-inch screws, lock washers and washers, attach the front corner braces to the unit.

9. Tighten all screws equally.

Figure 3: Mounting Shaker on Base



With the corner braces securely in place, the shaker mounted on its base will look as shown in Figure 4:

Figure 4: Shaker Installed on Base

10. Make sure the shaker is level; add metal shims under the base as needed to level the unit. Shims are provided with the stacking kit.

11. After installing a platform (*see Section 6*), fully load the shaker and do a test run at normal speed (*see Section 7*). Make additional leveling adjustments if necessary.

4.6 Installing the Stacking Kit

To stack two Innova 44/44R shakers, see Section 4.6.1. To stack an Innova 4400/4300 on an Innova 44/44R, skip to Section 4.6.2.

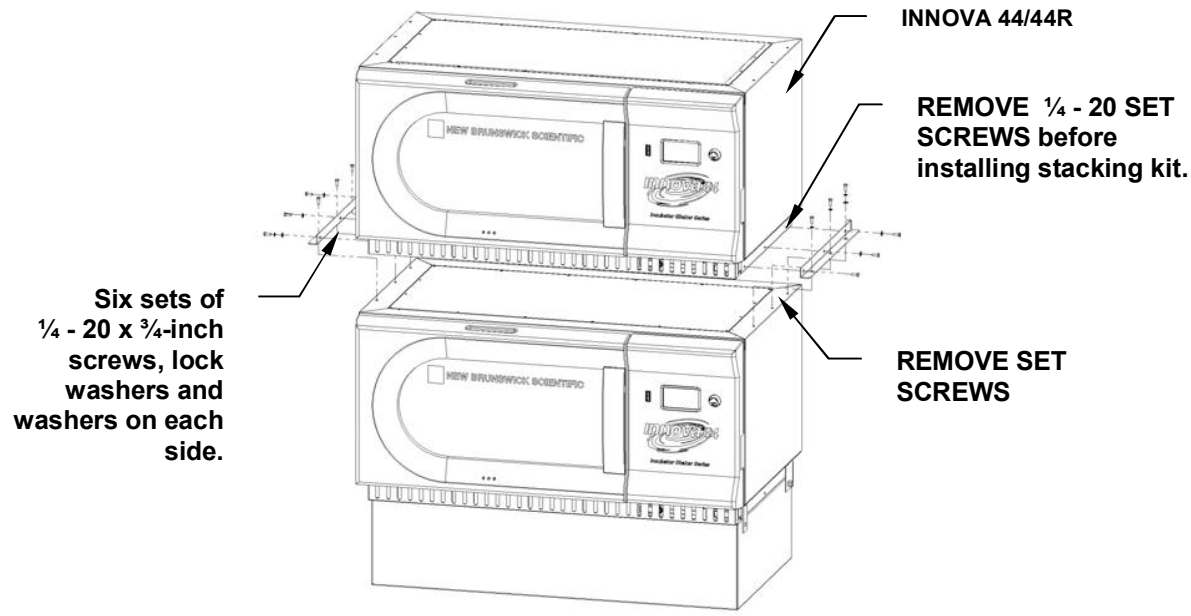
4.6.1 For Two 44/44R Shakers

1. Remove all feet from the units (putting them aside for possible future use).

2. If you do not plan to use an optional base, skip to Step 3. If you are using one, level the base according to Section 4.4, then mount the bottom unit on the base as explained in Section 4.5 above. **If you are stacking three units, use a 4-inch base.**

3. *With reference to Figure 5a below*, remove the set screws from the top of the bottom unit, on the two side edges, and remove the set screws (from the sides of the unit to be stacked) that correspond to the mounting brackets.

Figure 5a: Installing Innova 44/44R Stacking Kit



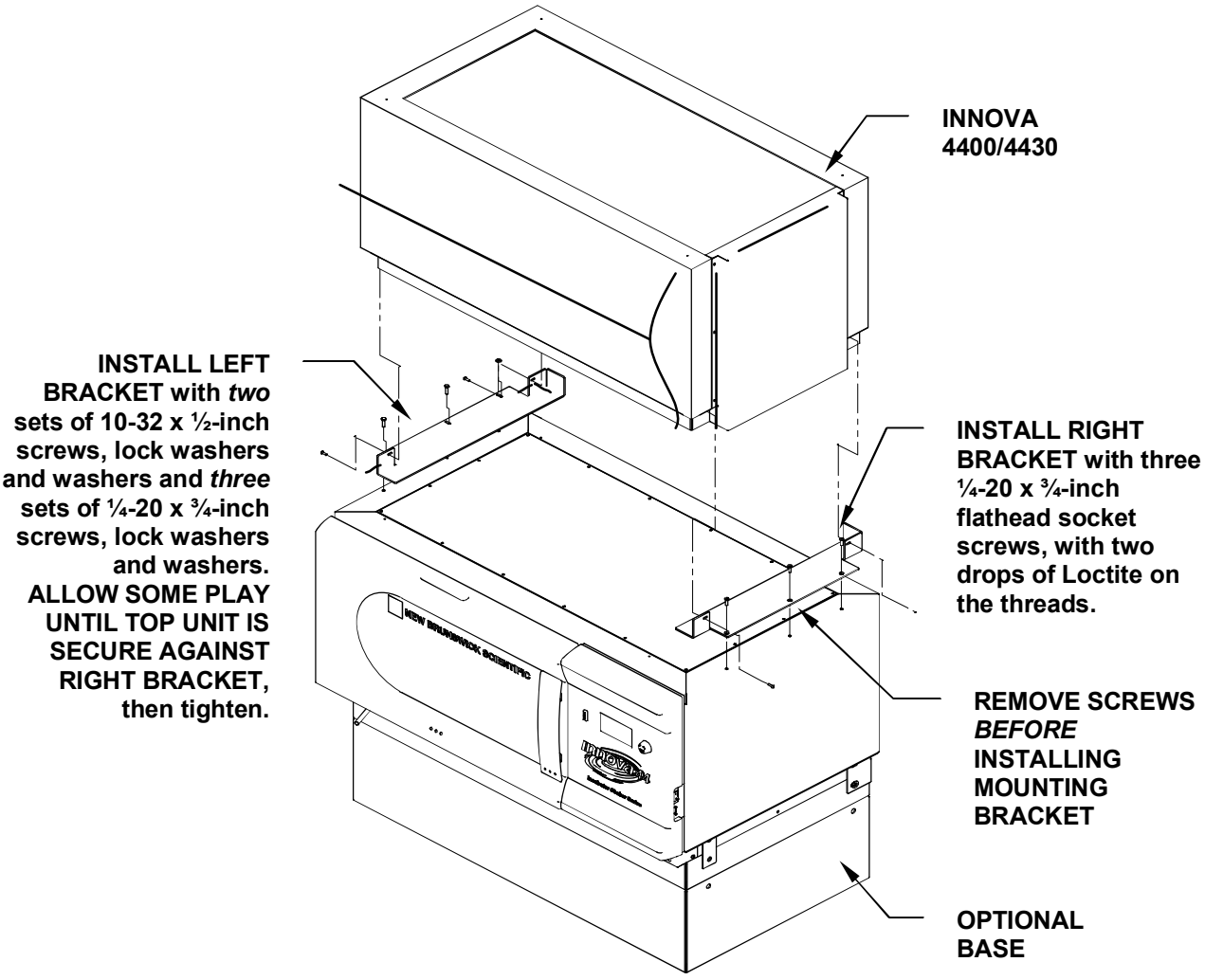
4. Using the screws and washers provided, attach the stacking kit mounting brackets to the top of the bottom unit. Secure the brackets in place as shown in Figure 5a above.

4.6.2 For an Innova 4400/4430 on an Innova 44/44R

1. Remove all feet from the units (putting them aside for possible future use).

2. If you do not plan to use an optional base, skip to Step 3. If you are using one, level the base according to Section 4.4, then mount the bottom unit on the base as explained in Section 4.5 above. **If you are stacking three units, use a 4-inch base.**

Figure 5b: Installing 4400/4430 to 44/44R Stacking Kit



3. *With reference to Figure 5b above*, remove the screws installed at the top of the bottom unit, on the two side edges.

4. Use the countersunk flathead screws provided, with two drops of Loctite on their threads, to attach the righthand (facing the door) mounting bracket to the top of the unit installed on the base. Secure the bracket in place.

5. Use the other screws and washers provided to attach the lefthand mounting bracket to the top of the unit installed on the base. Loosely tighten these screws, to allow some play.

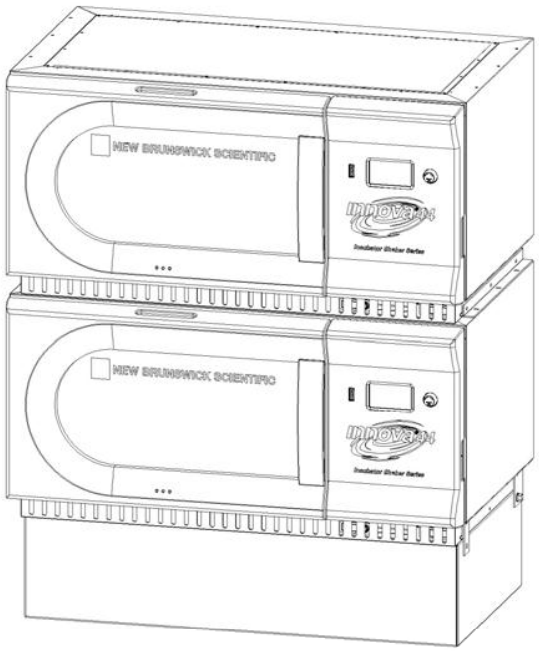
4.7 Stacking Two Innova 44/44R Shakers

1. Using a forklift or lifter, raise the Innova 44/44R to be stacked so that its back end is tilted toward the rear of the mounting brackets.

2. Remove the feet from the unit. They will not be needed for stacking, but you may want to keep them for future use.

3. With two assistants, guiding the unit from opposite sides, lower the shaker onto the mounting brackets, back end first. Slowly and gently remove the forklift or lifter, lowering the front of the unit onto the mounting brackets by hand.

Figure 6: Stacked Shakers



4. As indicated in Figure 6, secure the bottom of the upper shaker to the mounting brackets (already fastened to the shaker below) with the screws, lock washers and washers provided.

5. Make sure the shakers are level; add metal shims under the bottom unit (or base) if needed.

6. After installing a platform (*see Section 6*), fully load the shaker and do a test run at normal speed (*see Section 7*). Make additional leveling adjustments if necessary.

If you are stacking a third shaker, skip to Section 4.9.

4.8 Stacking a 4400/4430 on a 44/44R

1. Using a forklift or lifter, raise the Innova 4400/4430 to be stacked so that its back end is tilted toward the rear of the mounting brackets.

2. Remove the feet from the unit. They will not be needed for stacking, but you may want to keep them for future use.

3. With two assistants, guiding the unit from opposite sides, lower the shaker onto the mounting brackets, back end first. Slowly and gently remove the forklift or lifter, lowering the front of the unit onto the mounting brackets by hand, and making sure it is tight against the righthand mounting bracket.

4. *As indicated in Figure 5b*, secure the bottom of the upper shaker to the mounting brackets with the screws, lock washers and washers provided. Be sure to tighten the right side first, then secure the left side.

5. Make sure the shakers are level; add metal shims under the base if needed.

4.9 Stacking a Third Shaker

CAUTION!
When stacking three shakers, do not use a base taller than 10.5 cm (4 in).

CAUTION!
When stacking three shakers, all shaker loads must be balanced. These shakers operate best at maximum speed with a load of 15.5 (± 1.4) kg or 34 (±3) lb, which includes all platforms, clamps, and filled glassware.

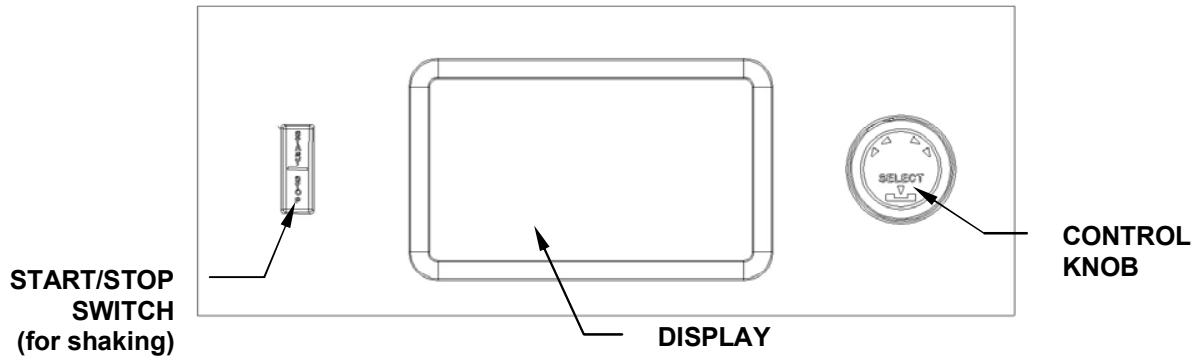
CAUTION!
For three stacked 2-inch stroke shakers, maximum operating speed must be limited to 250 rpm.

To stack a third shaker, repeat the appropriate procedures provided above to install the stacking kit, to stack the shaker, and to level the entire assembly.

5 FEATURES

5.1 Controls

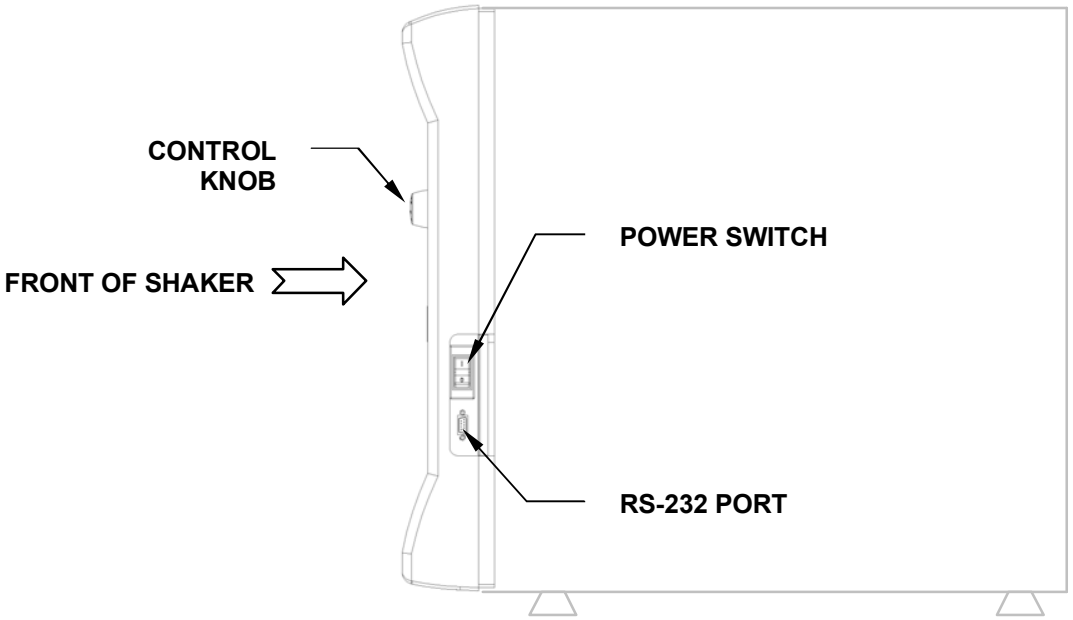
Figure 7: Front Panel (detail)



- **START/STOP SWITCH** This switch is used to start or stop the shaker. It will also activate the timer when a timed run is desired. If the unit is stopped and restarted, the timer automatically returns to the beginning of a run.

- **CONTROL KNOB** This knob is multifunctional. It is used to change screens, and to select and change operating conditions.

Figure 8: Control Panel (Right Side)



- **RS-232 PORT** — See Section 5.8 for details.
- **POWER SWITCH** — This rocker switch is a circuit breaker that turns power on and off to the entire Innova 44/44R.

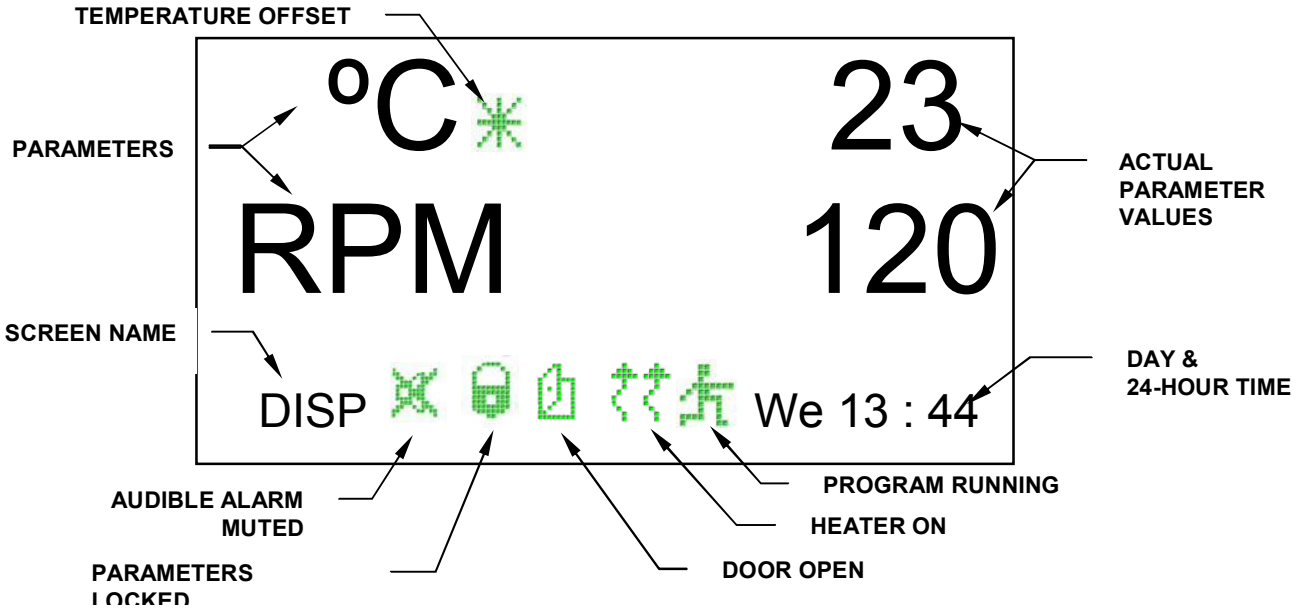
NOTE:

In addition to the Power Switch, the Power Cord is also used to conduct power or to break the power circuit to the shaker. Whenever power to the shaker may be a hazard (during cleaning, maintenance or service work), be sure to disconnect the power cord from the electrical outlet.

5.2 LCD Display

When the unit is powered up, using the Power Switch located on the lower right side of the machine (*see Figure 8*), the initial display screen will remain for a short time while the system boots up. Then the main screen, called **DISP** for Display, appears (*see Figure 9*). This screen will indicate the same parameters that were in effect when the power was turned off.

Figure 9: Display Screen



- For an explanation of the icons on the display screen, see Section 5.4.
- Turning the Control Knob will highlight functions and/or values that can be changed.
- Whenever you turn the Control Knob, the chamber light will go on (for details, see Section 5.9).

For more information on working in the Display Screen, see Section 7.4.1.

5.3 Changing Screens

You can change screens displayed by highlighting the screen name field in the lower left corner, pressing the Control Knob in until it clicks, rotating the Knob left or right (which also makes clicking sounds) to the desired screen and clicking the Control Knob in again. Table 1 describes the various screens:

Table 1: Screens

Screen Name	*Meaning*	*Features/Modes*
DISP	Display	Shows two user-selectable parameters* and actual values.
SUMM	Summary	Shows all parameters*, setpoints and actual values.
SET	Set-Up	Set day of week, set time, enable or mute alarm, lock or unlock operating parameters
LAMP	Lamps	**Internal chamber light:** ON (always on); OFF (always off); AUTO (default mode), light goes on and stays on when door is open, shuts off 15 seconds after door is closed, and goes on for 15 seconds when Control Knob is moved. ¤**Photosynthetic lights (GRO)**: ON, OFF, [1]NONE ¤**UV Light (UV)**: ON, OFF, [1]NONE
COMM	Communication (RS-232)	SET: set baud rate OFF disables RS-232 MONITOR: PC commands shaker to read setpoints and actual values on a schedule determined by PC software. Parameters are unlocked and can be changed by program or manually. SLAVE: PC controls shaker and logs data. TALK: Shaker sends setpoint and actual data to PC at one-minute intervals.
CAL	Calibration	Allows user to enter a temperature offset. Allows user to calibrate speed.
PROG	Program	Allows user to set up 1- 4 programs, each with 1-15 steps.

* see Table 2, Display Screen Parameters ¤ Optional [1]Not installed

Table 2: Display Screen Parameters

Parameter Name	*Meaning*
RPM	Shaking speed, in revolutions/minute
ºC	Chamber temperature, in degrees Celsius
HRS	Programmed time remaining, in hours
¤ %RH	Relative Humidity, in percent.
¤ UV	Status of Ultraviolet germicidal lamp
¤ GRO	Status of Photosynthetic growth lamps

¤ Optional

5.4 Display Icons

There are six icons that help identify operating conditions. Five of these icons are located at the bottom of the display, and they are visible, when applicable, in any screen you are viewing, except the Program subscreens. The sixth appears, when applicable, next to ºC whenever the temperature is onscreen.

Table 3: Display Icons

Icon	Explanation
	This icon appears when audible alarms are muted.
	This icon appears when the possibility to make manual or programmed parameter changes is disabled (locked). This is controlled by settings on the SET screen. See Section 7.4.3
	This icon appears when the shaker door is open.
	This icon appears when the Heater is on. See Section 5.10.
	This icon appears when a user-defined Program is running. See Section 7.5.
	This icon appears to the right of ºC if the Temperature Offset feature is being used. See Section 7.7.

5.5 Alarms

If an alarm condition exists, the field in the lower right corner will alternate the Day and Time with characters indicating the nature of the alarm condition, accompanied by an audible alarm (unless muted):

Table 4: Alarms

Indication	*Description*
TEMP	The temperature deviates more than 61ºC from setpoint after achieving control temperature range. After door is opened, alarm will be disabled for 5 minutes while chamber recovers to setpoint.
RPM	The speed deviates more than 65 RPM from setpoint after achieving operating speed setpoint. After door is opened, alarm will be disabled for 5 minutes while chamber recovers to setpoint.
POWER	Indicates unit is powering up (both at normal power-up and after power interruption); will flash until the Control Knob is moved.
HRS	Indicates when timed run is completed.
TILT	Indicates an unbalanced shaking condition. After load is evenly distributed and/or shaker is leveled, restart by pressing START/STOP.

5.6 Glide-Up Door

The Innova 44/44R is equipped with a space-saving glide-up door. To release the door from the latch mechanism, firmly press the bottom of the large, curved push bar (located on the right side of the door), then manually move the door up to the open position.

When the door opens, the following will happen:

- Heater turns off
- Shaker stops
- Interior light goes on and, when it is in **AUTO** mode, will remain on for 15 seconds after the door is closed
- UV germicidal lamp (if so equipped) turns off

5.7 Spill Pan/Water Reservoir

The Innova 44/44R is equipped with a spill pan to protect the drive mechanism in the case of accidental spills and/or broken glassware. This pan can also be used as a water reservoir to humidify the chamber and to reduce evaporation. An optional factory-installed humidity monitor is also available.

5.8 Software Interfaces

The RS-232 port is located below the Power Switch on the right side of the control panel (*see Figure 8*). It can be used to interface a computer to the shaker for control of operating conditions or data logging applications (*see Section 12*).

The customer is responsible for securing the proper driver to interface with the RS-232.

5.9 Interior Light(s)

When the **LAMP** screen is in its default **AUTO** mode, the interior ("chamber") light is activated for 15 seconds whenever you turn the Control Knob. It will automatically shut off after 15 seconds of Control Knob inactivity.

The chamber light will also go on when the door is open.

In addition, you can set the chamber light to be continuously **ON** or **OFF** by selecting either mode in the **LAMP** screen.

There are two additional light options: interior photosynthetic growth lamps (*see Section 6.7*) and, for refrigerated units only, a UV germicidal lamp located outside the chamber but in the airflow path *(see Section 6.6*).

5.10 Heater

The chamber temperature is sensed by a 1000 ohm platinum RTD. The heater is controlled using pulse width modulation on a 2.5-second duty cycle. This cycle time is fast enough to prevent noticeable changes in air temperature due to the cycling.

Whenever the heater is on, the Heater On icon  will appear in the display. The heater automatically stops running when the door is opened.

5.11 Refrigeration (44R Only)

The refrigeration system in the Innova 44R is a fixed-capacity system carefully designed to maintain the setpoint, to balance pressure within the system, and to prevent freezing on the evaporator surface.

When the shaker is powered up, there is a four-minute time delay prior to compressor start-up.

5.12 Service Accessibility

In the unlikely event that your Innova 44/44R should need service, all electronic boards, refrigeration, heating components are mounted on a pull-out drawer mechanism which is easily accessed, **by an authorized service technician**, from the front of the shaker.

6 GETTING STARTED

6.1 Platform Assemblies

The Innova 44/44R can be used with a variety of New Brunswick platforms that will accept a wide range of clamps for flasks, test tubes, etc. A platform, which is required for operation, is a separate item, not included with the shaker assembly. Refer to Section 9.12 for details on available platforms and platform accessories.

6.2 Installation of Platform

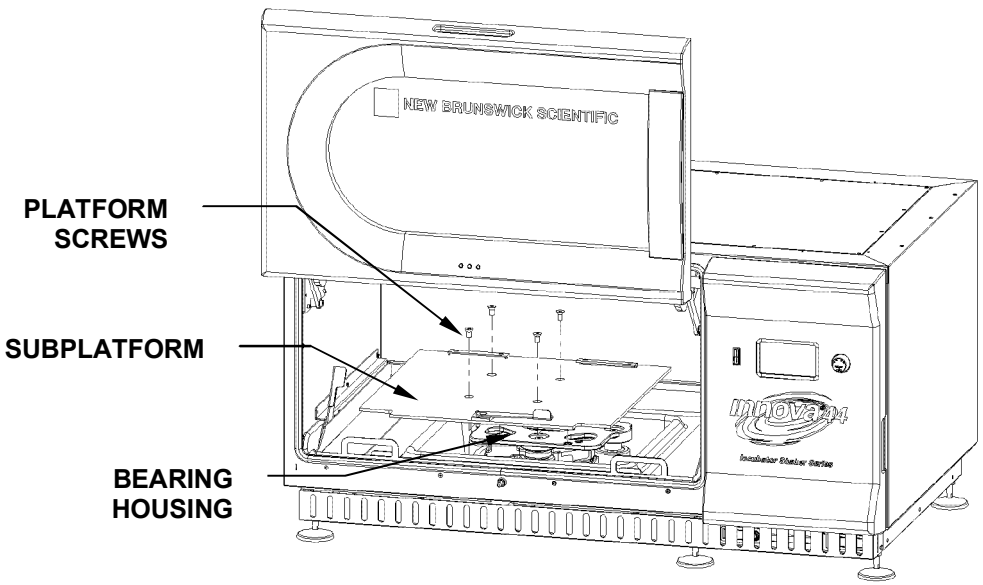
NOTE:

In transit, there are two small plastic straps on the side of the bearing housing to secure the slide-out mechanism, and two small plastic straps that immobilize the bearing housing; all straps must be removed.

When you cut the bearing housing straps, be particularly careful not to cut the wiring that is in close proximity to the straps.

Prior to use, a subplatform and platform must be installed on the unit. The shaker is shipped with four Allen head platform screws installed in the bearing housing (*see Figure 10a below, which also shows the subplatform that you must install*).

Figure 10a: Installing Subplatform



Using Figure 10a as your guide, install the subplatform:

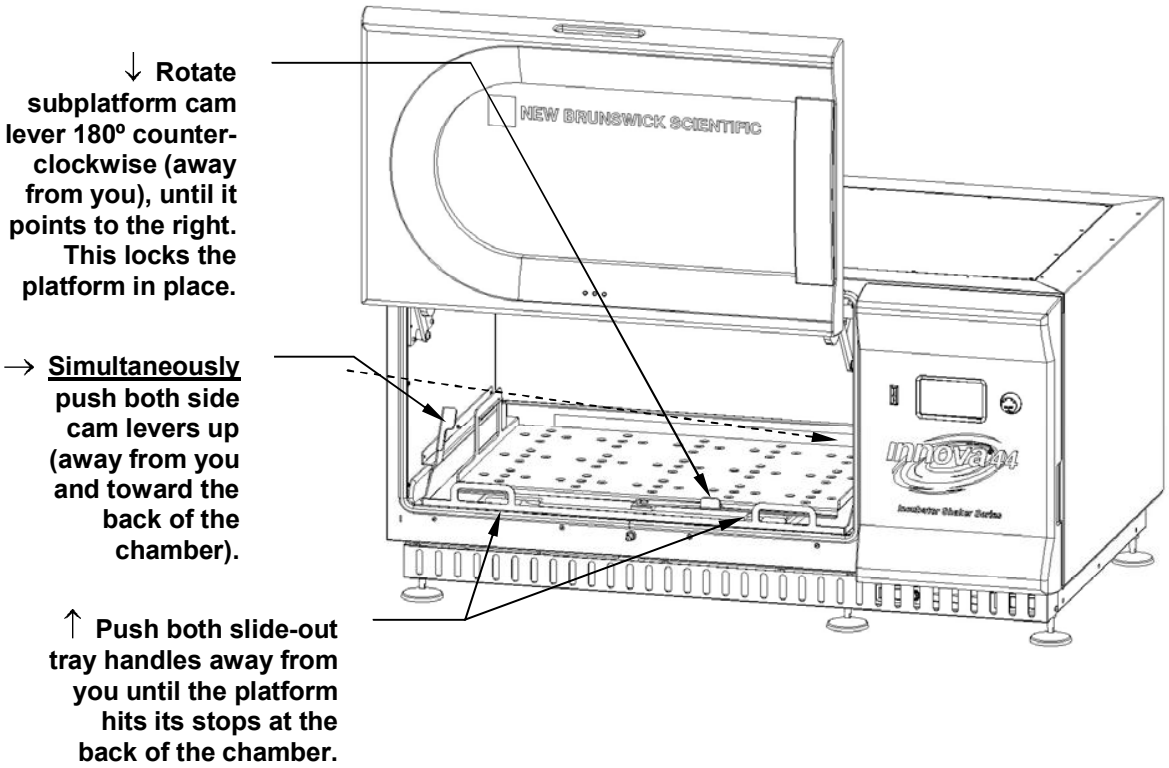
1. Remove the Allen head platform screws, setting them aside.
2. Place the subplatform onto the bearing housing, taking care to orient it as shown in Figure 10a, with the notches and the lever toward the front of the shaker, lever facing up.
3. Align the subplatform holes with the tapped holes in the bearing housing, then secure the subplatform with the Allen head platform screws you previously removed.

To install the slide-out platform you have purchased:

1. With reference to Figure 10b below, place the platform on the subplatform, making sure the two slots in the back of the platform are inserted under the subplatform's blocks in the back, and the slide-out tray handles are at the front edge, facing up.

Steps 2-4 are called out in Figure 10b:

Figure 10b: Installing Slide-Out Platform



6.3 Installing Flask Clamps

Flask clamps purchased for use with universal platforms (*see Section 9.12.2*) require installation. Clamps are installed by securing the base of the clamp to the platform with the correct type and number of screws. All clamps are shipped complete with hardware.

Clamps for 2-, 2.8- and 4-liter flasks are shipped with an additional girdle to keep the flasks in place. The girdle is an assembly of springs and sections of rubber tubing. One girdle is already in place on the clamp, the other is packed separately. To install these double girdle clamps:

1. Place the clamp on the platform, aligning its mounting holes with holes on the platform. Secure the clamp in place using the flat Phillips head screws provided (#S2116-3051, 10-24 x 5/16-inch). *Use Figure 11b to help you identify the proper screws, as three different types of screws are shipped with the clamps*.
2. With the first girdle in place, as delivered, on the upper part of the clamp body (*see Figure 11a*), insert an empty flask into the clamp.
3. After making sure the sections of tubing are located between the clamp legs, roll the first girdle down the legs of the clamp as far as it can go. The tubing sections will rest against the platform, and the springs will be under the clamp base.
4. Place the second girdle around the upper portion of clamp body (just as the first girdle was initially). Make sure that its spring sections rest against the clamp legs, while its rubber tubing sections sit against the flask, in between the clamp legs.

Figure 11a: Double Girdle Clamp Installation

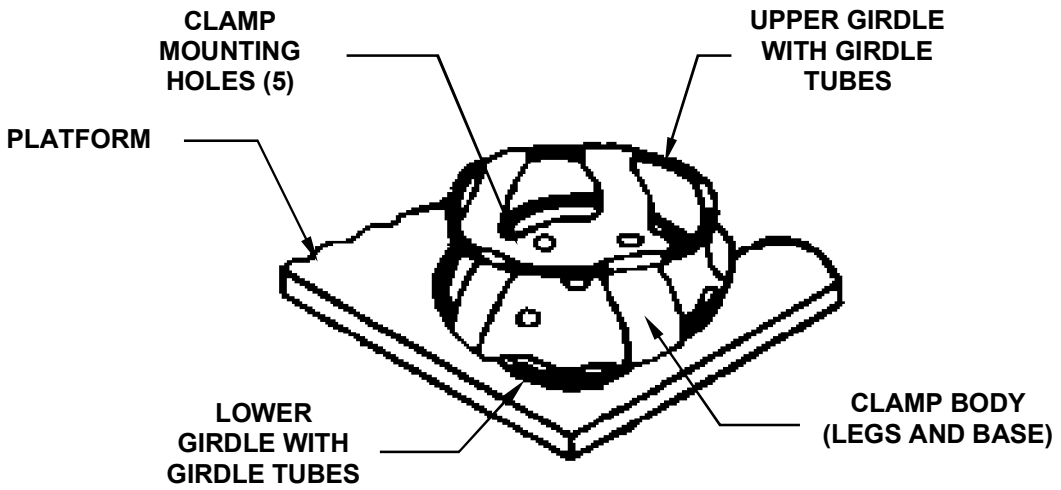


Figure 11b: Clamp Fastener

NOTE:

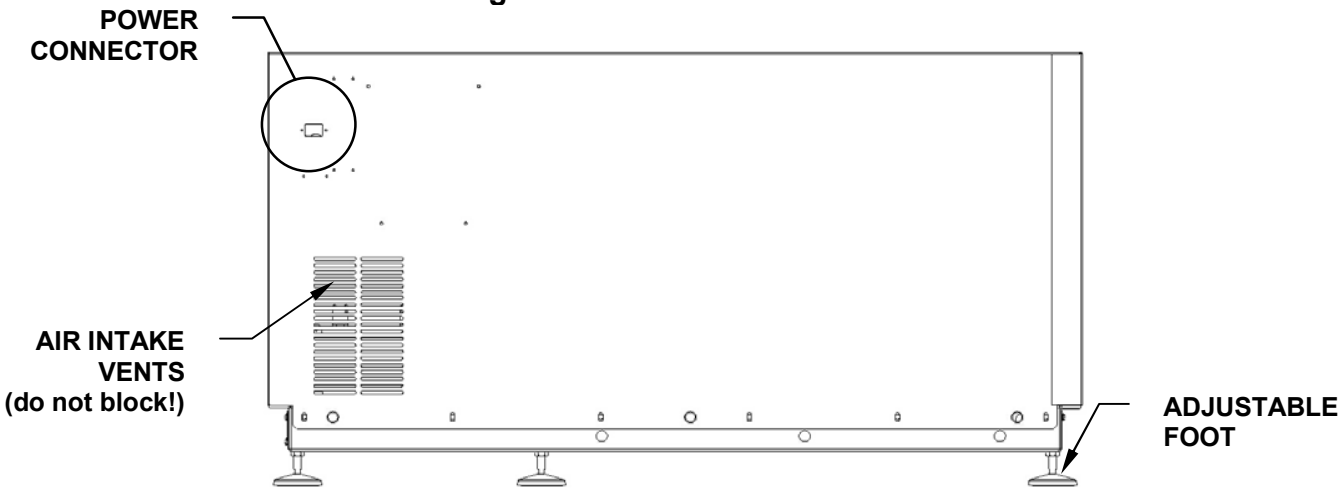
The upper girdle secures the flask within the clamp, and the bottom girdle keeps the flask from spinning.

6.4 Electrical Connections

Before making electrical connections, verify that the power source voltage matches the voltage on the electrical specification plate and that the **ON/OFF** switch is in the **OFF** position. The electrical specification plate is located on the rear panel of the unit near the power connector.

Connect the power cord to the power connector, then connect the other end to a suitable, grounded receptacle. Make sure there is enough clearance to disconnect the plug whenever necessary.

Figure 12: Rear Panel



6.5 Optional Gassing Port Kit

This option is factory-installed. The manifold delivers gas into the chamber via six ports. You may elect to use splitters after the manifold to increase the number of ports for your application.

6.6 Optional UV Germicidal Lamp

> ***WARNING!***
> **Never try to operate the UV Germicidal Lamp while the shaker door is open.**

This option, a germicidal ultraviolet lamp, is placed inside the Service Drawer, outside the chamber to help reduce the risk of contamination. The lamp is identified on the display screen as **UV**.

The UV germicidal lamp is factory-installed and available on refrigerated units only. Operation instructions are provided with this option (see Section 9.12.9).

6.7 Optional Photosynthetic Lamps

This factory-installed option provides nine photosynthetic growth lamps inside the chamber. They can be turned on and off manually, by the easily set programmatble timer, or by computer. These lamps are identified on the display screen as **GRO**. The replacement bulb part number is P0300-0221.

The recommended operating temperature when using this option is 15 - 37ºC.
The maximum operating temperature when using photosynthetic lamps is 70ºC.

6.8 Optional Humidity Monitor

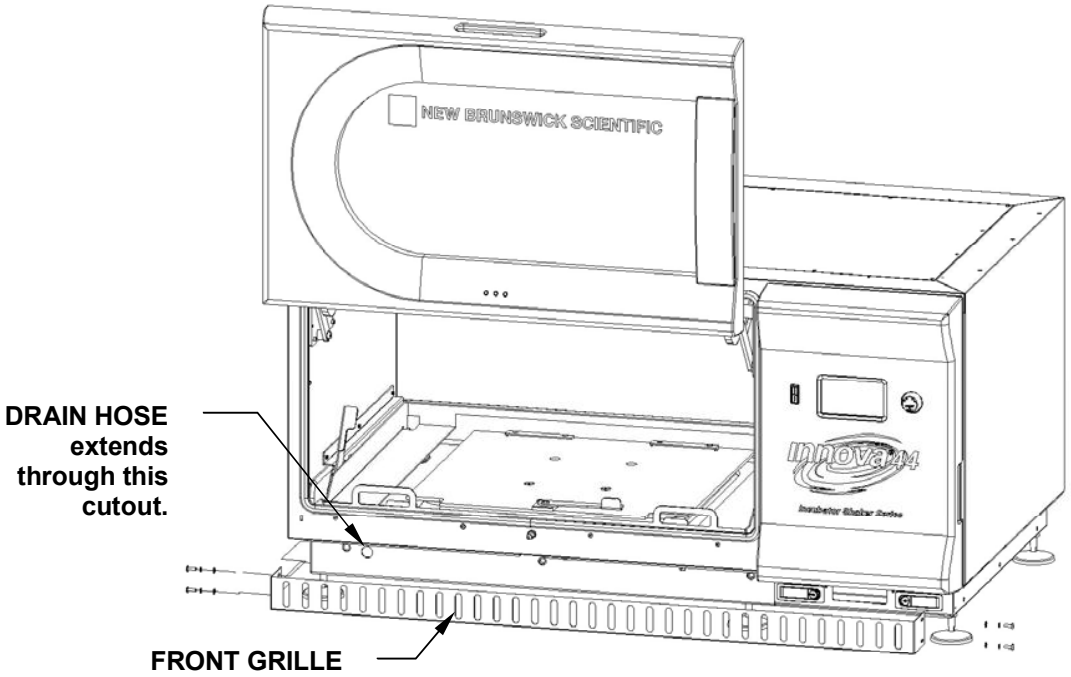
This optional factory-installed accessory allows you to monitor actual humidity levels in the chamber throughout your run.

6.9 Filling the Water Reservoir

If you choose to use the spill pan as a water reservoir to reduce evaporation:

1. Temporarily remove the four thumbscrews (with their washers) that secure the front grille in place (*see Figure 13 on the following page*).

Figure 13: Front Grille



2. Check the drain hose to be sure it is clamped tightly.
3. Replace the grille and secure it with the four thumbscrews and the washers that you previously removed.

NOTE:

Never pour water directly under the subplatform. Pour water *very slowly* into the shallow area beyond the edge of the adapter plate, to protect the bearing housing.

4. Accessing the pan/reservoir from the left, the right or in front of the subplatform, **slowly** fill the reservoir with no more than 3 liters of distilled water.

6.10 Draining the Water Reservoir

To drain water from the water reservoir/spill pan:

1. Temporarily remove the four thumbscrews that secure the front grille (*see Figure 13*).
2. Disengage the drain hose, direct it to a container or drain, then unclamp it, allowing the water to gravity drain.
3. Reclamp the hose, tuck it back in place, and replace the grille, securing it with the thumbscrews you previously removed.

The spill pan/water reservoir drain is located in the front, on the left, under the slide-out tray.

NOTE:

The drain hose should be tightly clamped when it is not being used for draining the reservoir. Keep it clamped even if there is no water in the pan.

7 OPERATION

7.1 Safety Precautions

Before operating the shaker, verify that anyone involved with its operation has been instructed in both general safety practices for laboratories and specific safety practices for this apparatus.

The user is also responsible for following local guidelines for handling hazardous waste and biohazardous materials that may be generated from the use of this equipment.

If service should be required on a unit that is going to be returned to a New Brunswick facility, it must be completely decontaminated and cleaned prior to its return, and a Returned Material Safety Sheet must be filled out to certify that you have complied. See Section 13, *Product Returns*.

It is the responsibility of the user to carry out appropriate decontamination procedures if hazardous material is spilled on or inside the equipment. Before using any cleaning or decontamination method other than those suggested by the manufacturer, users should check with New Brunswick Scientific that the proposed method would not damage the equipment.

This equipment is **not** "explosion-proof" and should never be used with flammable substances or used to grow organisms that produce flammable by-products.

> ⚠ ***CAUTION!***
> **To prevent damage to the shaker and its contents, never run the shaker without a platform.**

7.2 Opening the Door

Open the door by firmly pressing the bottom of the large curved push bar (located on the right side of the door) to release the latching mechanism. You can now manually move the door up to the open position, or down to the closed position (make sure it latches closed).

7.3 Starting the Shaker

To initially start the shaker, close the door and turn the power switch (located on the righthand side of the control panel) to the **ON** position. The display will come on (first showing only **New Brunswick Scientific**, then briefly displaying the model number, **44** or 44R, and the stroke, **1 inch** or **2 inch**, and then quickly moving into the Display screen), and the audible alarm will sound. To mute it, see Section 7.6.

When the shaker begins to operate, the LCD display will track the speed as it accelerates to the last entered setpoint. The shaking action may be started or stopped by pressing the Start/Stop button on the front panel.

NOTE:

The shaker will not operate if the door is open. This is indicated by the "door open" symbol appearing in the bottom line of the display (see Figure 9 or Table 3).

7.4 Using the LCD Screens

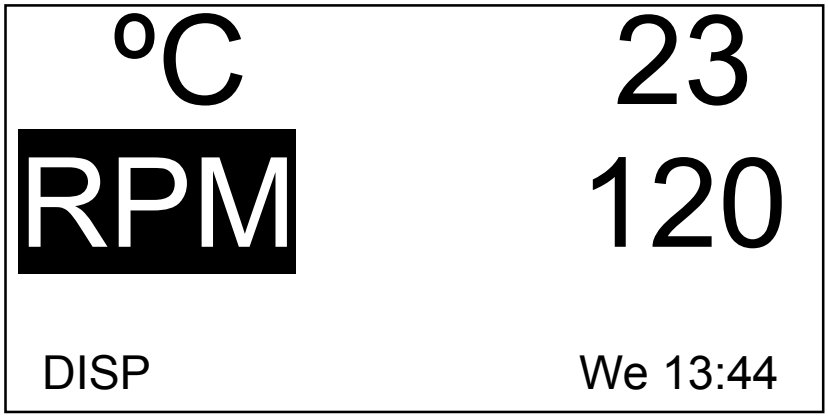
7.4.1 Display Screen

When you turn the power on, this is the first screen to appear after the company title screen. The default display parameters are temperature (**ºC**) and shaking speed (**RPM**).

You can change the displayed parameters. **To replace a parameter**:

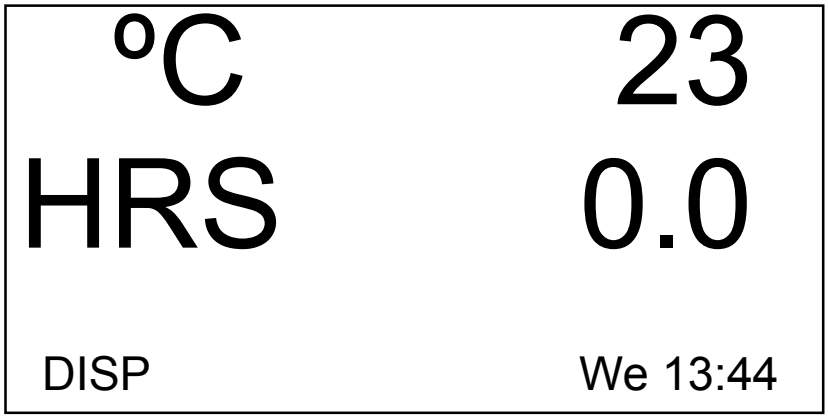
1. Using the Control Knob, highlight the parameter that you wish to replace. For this example, we will replace **RPM** (*see Figure 14*).

Figure 14: Changing Display Parameter



2. Click the Control Knob in. **RPM** will flash.
3. Turn the Knob until the desired parameter appears in the highlighted field. For this example, we will select **HRS**.
4. Click the Knob in, to set and save the parameter (*see Figure 15*).

Figure 15: Changed Display Parameter



NOTE:

If you highlight an item, change it, but do not save your selection, after a few seconds the screen will revert to its previous setting.

NOTE:

"UV" (UV Germicidal lamp) and "GRO" (photosynthetic growth lamps) will appear in this screen with the word "NONE" if your shaker is not equipped with these optional features.

You can also use this screen to verify a setpoint, even though the values displayed here are actual (current) values. **To view a setpoint**:

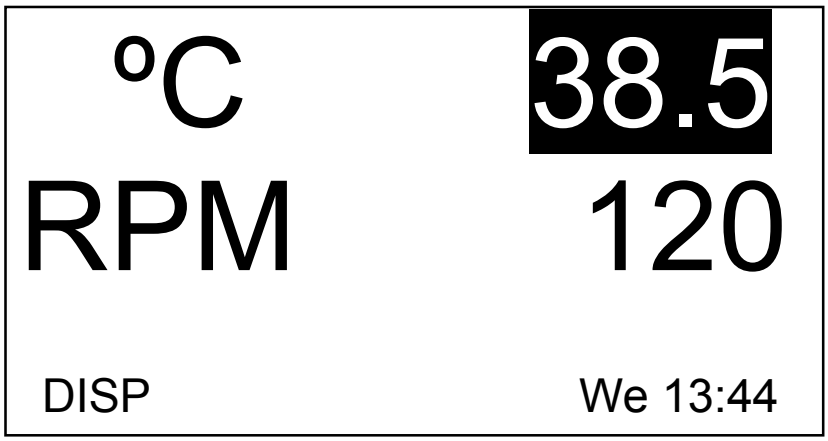
1. Use the Control Knob to highlight the value (in this example, we will view the temperature setpoint, so we will highlight the current **ºC**, which is **23**).
2. Click the Knob in to display the current setpoint, which will flash.

At this point you can modify the setpoint or click the Knob in again to return to the normal display, which will be the actual temperature.

To modify a setpoint in this screen:

1. Use the Control Knob to highlight the current value (we will continue to use the temperature as our example, so we will select **23**).
2. Click the Knob in to display the current setpoint (in this example, **38.5**—*see Figure 16*), which will flash.

Figure 16: Changing Setpoint



3. Turn or spin the Knob to reset the setpoint (in this example, turn the Knob left to decrease the setpoint to **37.0**).

NOTE:

If you turn the Control Knob slowly, one click left or right will change the setpoint by an increment of one tenth of a degree Celsius (0.1ºC). If you spin the Knob, the value will change by larger increments.

4. Click the Knob in to set and save this new setpoint.

NOTE:

If you highlight an item, change it, but do not save your selection, after a few seconds the screen will revert to its previous setting.

5. The display will automatically return to the actual value.

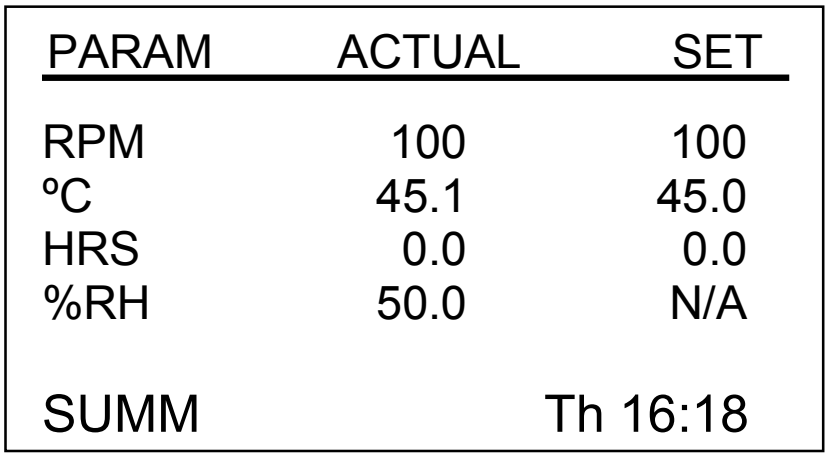
To move out of this screen and into the next:

1. Use the Control Knob to highlight **DISP**, then click the Knob in. **DISP** begins to flash.
2. Turn the Knob to the right until the next screen, Summary (**SUMM**), appears. If you turn too far and enter another screen, just turn the Knob back to the left to recapture the **SUMM** screen.
3. Click the Knob in to select the screen and to work in it.

7.4.2 Summary Screen

In this screen (*see Figure 17*), you can see both the current **ACTUAL** readings and the **SET**points for shaking speed (**RPM**), chamber temperature (**ºC**), elapsed time in a programmed run (**HRS**) and, if you are using the optional Humidity Monitor (*see Section* 9.12.10), the percentage of relative humidity (**%RH**).

Figure 17: Summary Screen



NOTE:

The current day (Su, Mo, Tu, We, Th, Fr or Sa) and time always remains visible in the lower righthand corner.

The only elements you can modify in this screen are setpoints. **To change setpoints in this screen**:

1. Turn the Knob until the desired setpoint is highlighted, then click the Knob in. The setpoint will begin to flash.
2. Turn the Knob to the right to increase the number, or to the left to decrease it. One click left or right will increase the setpoint by an increment of one (one whole unit or one tenth unit, depending on the parameter). Move the Knob more rapidly (you can spin it) to change the value by larger increments.
3. Click the Knob in to set and save the new value.

NOTE:

If you highlight an item, change it, but do not save your selection, after a few seconds the screen will revert to its previous setting.

4. Repeat the above steps to change any or all of the other setpoints.

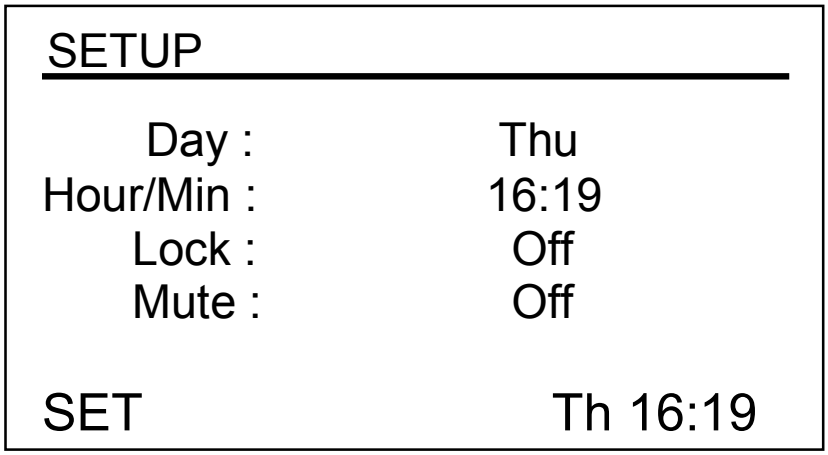
To move out of this screen and into the next:

1. Use the Control Knob to highlight **SUMM**, then click the Knob in. **SUMM** begins to flash.
2. Turn the Knob to the right until the next screen, Setup (**SET**), appears. If you turn too far and enter another screen, just turn the Knob back to the left to recapture the **SET** screen.
3. Click the Knob in to select the screen and to work in it.

7.4.3 Setup Screen

Here you can set the day of the week and the time (on a 24-hour clock). This screen also allows you to lock all of your settings from further changes, and to mute or enable the audible alarm.

Figure 18: Setup Screen



To change the day:

1. Turn the knob to highlight the day (**Thu** in the sample screen above), then click inward once. The day will flash.
2. Turn the knob left or right to select the day of choice: Sun, Mon, Tue, Wed, Thu, Fri or Sat.
3. Click the knob in to set and save your choice.

NOTE:

If you highlight an item, change it, but do not save your selection, after a few seconds the screen will revert to its previous setting.

To change the time (**Hour/Min**):

1. Turn the knob to highlight the time (**16:19** in the sample screen above), then click inward once. The time will flash.
2. Turn the knob left or right to change the time. Left moves backward, right moves forward in time. One click right or left changes by one minute; spin the knob to move more rapidly.
3. Click the knob once inward to set and save your choice.

To lock the settings:

1. Turn the knob to highlight **Lock**, then click inward once. The current status (**Off** in the sample screen above) will flash.
2. Turn the knob in either direction; the only other choice is **On**. Click once inward to select and save **On**, or continue turning to return to **Off**.
3. When you set **Lock** to **On**, a padlock icon (*see Section 5.4*) will appear at the bottom of the screen. This icon will remain on display through all main display screens until you turn the locking function off.

To mute the audible alarm:

1. Turn the knob to highlight **Mute**, then click inward once. The current status (**Off** in the sample screen above) will flash.
2. Turn the knob in either direction; the only other choice is **On**. Click once inward to select and save **On**, or continue turning to return to **Off**.
3. When you set **Mute** to **On**, the  icon will appear at the bottom of the screen. This icon will remain on display through all screens until you turn the muting function off.

To move out of this screen and into the next:

1. Use the Control Knob to highlight **SET**, then click the Knob in. **SET** begins to flash.
2. Turn the Knob to the right until the next screen, Lamps (**LAMP**), appears. If you turn too far and enter another screen, just turn the Knob back to the left to recapture the **LAMP** screen.
3. Click the Knob in to select the screen and to work in it.

7.4.4 Lamps Screen

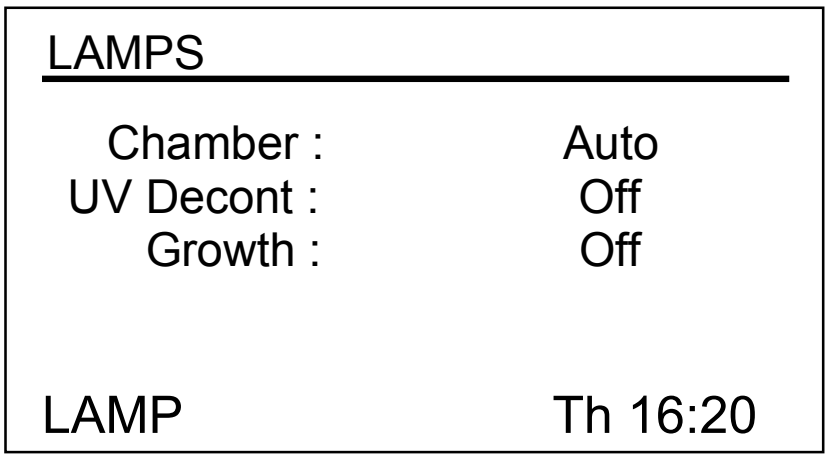
In this screen (*see Figure 19*), you can turn the chamber light (**Chamber**), the optional UV germicidal ("decontamination") lamp (**UV Decont**) and the optional photosynthetic growth lamps (**Growth**) on and off.
On means the light is always on, and **Off** means the light is always off, unless you add additional programming (*see Section 7.5*).

There is an additional mode for the chamber light: **Auto**. In **Auto** mode, the light will go on every time you activate the control knob or open the door. This is the default mode.

NOTE:

The Lamps screen, shown below, will always indicate Chamber **light mode. If the shaker is not equipped with the optional UV germicidal lamp and/or photosynthetic growth lamps,** UV Decont **and/or** Growth **will say** None**.**

Figure 19: Lamps Screen



To change the mode setting for any of the lamps:

1. Turn the Control Knob to highlight the setting for the lamp of choice, then click the knob in. The current setting will flash (in the sample screen, we will use the **Chamber** light as an example.
2. Turn the Knob left or right until the desired mode setting appears (**Auto** in this example).
3. Click the Knob in to save the new setting.

NOTE:

If you highlight an item, change it, but do not save your selection, after a few seconds the screen will revert to its previous setting.

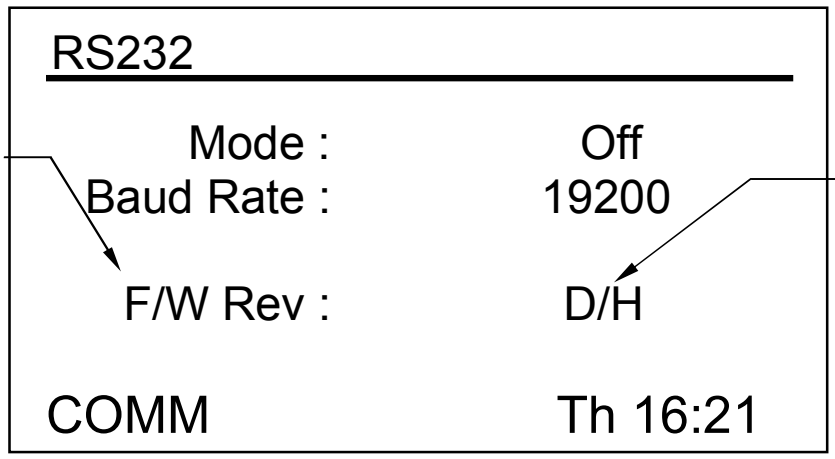
To move out of this screen and into the next:

1. Use the Control Knob to highlight **LAMP**, then click the Knob in. **LAMP** begins to flash.
2. Turn the Knob to the right until the next screen, RS232 (**COMM**), appears. If you turn too far and enter another screen, just turn the Knob back to the left to recapture the **COMM** screen.
3. Click the Knob in to select the screen and to work in it.

7.4.5 RS232 Screen

This screen (*see Figure 20*) is used only if you have connected a personal computer to the RS-232 port (*see Section 5.8*). Here you can select the RS-232 port's **Mode** and the **Baud Rate** appropriate to your PC.

Figure 20: RS232 Screen



FirmWare Revison level (this line is for information only)

In this sample screen, the Display is at Revision D and the FirmWare Control Board at Revision H.

To change the Communication Mode:

1. Turn the Control Knob to highlight the current setting (**Off** in the sample screen above), then click the Knob in. The current setting will flash.
2. Turn the Control Knob left or right until the desired mode setting appears (*see Table 5: Communication Mode*):

Table 5: Communication Mode

Mode	Application
Off	The RS-232 port is not open to communication in either direction.
Slave	The shaker can be fully controlled from the computer.
Talk	The shaker sends current value reports to the computer once per minute.
Monit [Monitor]	The shaker responds only to “Report Requests”.

3. Click the control knob inward once to save the new setting.

NOTE:

If you highlight an item, change it, but do not save your selection, after a few seconds the screen will revert to its previous setting.

To change the Baud Rate:

1. Turn the control knob to highlight the current setting (**19200** in the sample screen above), then click the knob inward once. The current setting will flash.
2. Turn the control knob left or right until the desired setting appears: 9600, 19200 or 38400. The setting you choose should match the baud rate of your computer.

3. Click the control knob inward once to save the new setting.

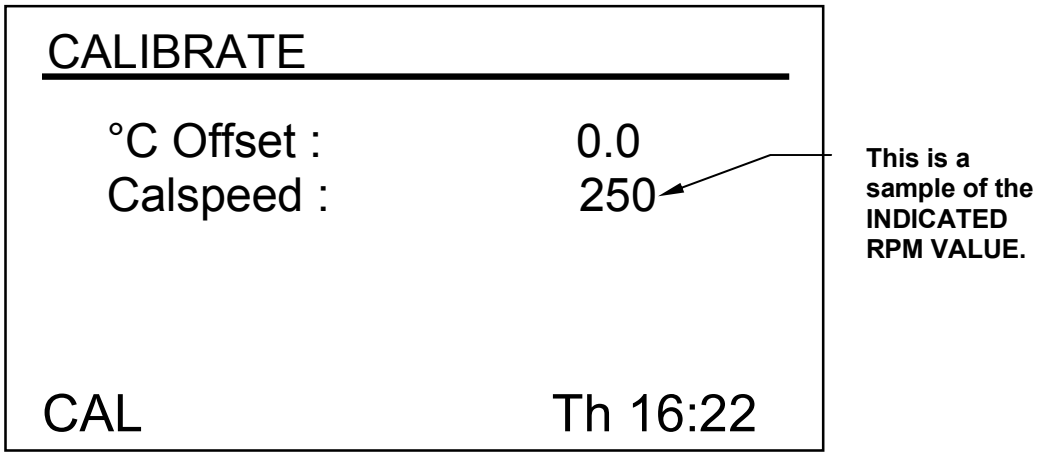
To move out of this screen and into the next:

1. Use the Control Knob to highlight **COMM**, then click the Knob in. **COMM** begins to flash.
2. Turn the Knob to the right until the next screen, Calibrate (**CAL**), appears. If you turn too far and enter another screen, just turn the Knob back to the left to recapture the **CAL** screen.
3. Click the Knob in to select the screen and to work in it.

7.4.6 Calibrate Screen

Use this screen (*see Figure 21*) to create a temperature offset and to calibrate the shaking speed (*for details, see Sections 7.7, Temperature Offset Calibration, and 7.8, Using Calspeed*).

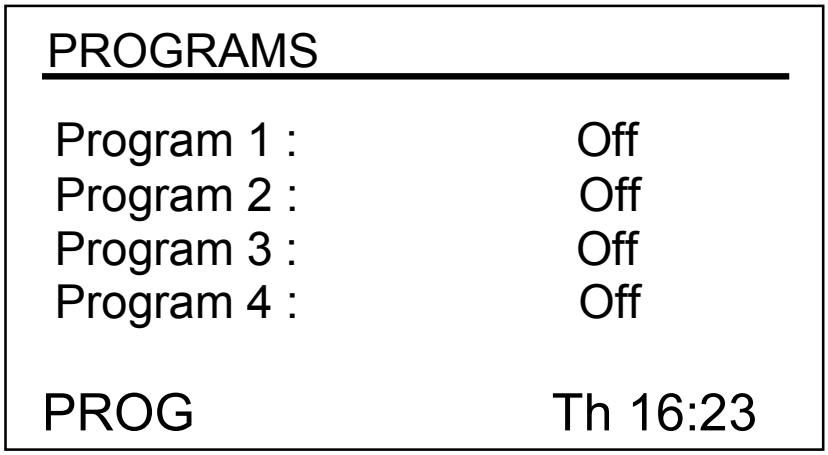
Figure 21: Calibrate Screen



7.4.7 Programs Screen

Use this screen (*see Figure 22*) to set as many as four operating programs for the shaker. Each program can have as many as 15 steps. See Section 7.5 below for complete details.

Figure 22: Programs Screen



7.5 Programming the Shaker

7.5.1 Timer Only

By setting an **HRS** setpoint in the **DISP** or **SUMM** screen, the shaker may be set to automatically stop after a preset time period of 0.1 to 99.9 hours.

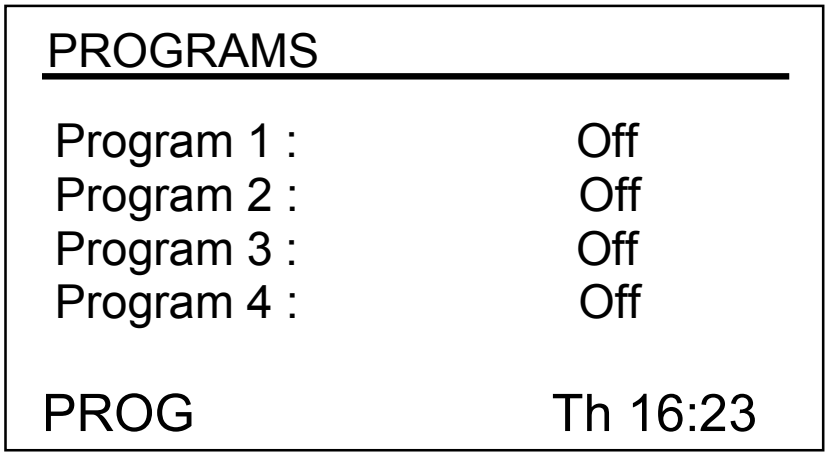
If the time is set to 0.0, the shaker will operate continuously until either the door is opened or the Start/Stop button is pushed.

7.5.2 Programmed Steps

The resident software for the Innova 44/44R can store up to four programs, each having as many as 15 steps. *Each step* can be programmed in one-minute increments, for total periods of one minute up to 99 hours 59 minutes each.

To enter the programming mode, use the Control Knob to select the **PROG** screen (*see Figure 22, repeated below*). At this point, you can **Run** a program, **Edit** a program, generate a **New** program or turn a program **Off**. **Off** is the default mode.

Figure 22: Programs Screen



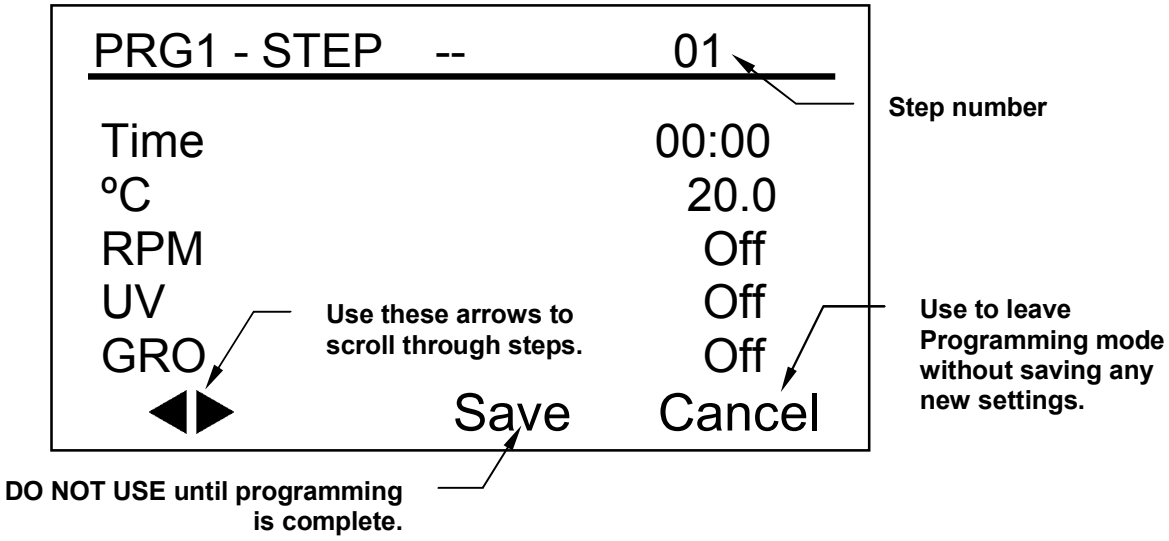
7.5.3 Creating a Program

To write a **New** program:

1. Use the Control Knob to highlight the mode of Program 1 (in our sample screen, Figure 22, it is **Off**), then click the Knob in. The selected field begins to flash.

2. Turn the Knob until the field says **New**. Click the Knob in to select this mode. The screen for Program 1 - Step 1 will open (*see Figure 23*):

Figure 23: Program 1 – Step 1



NOTE:

If your shaker is not equipped with these optional features, "UV" and "GRO" will appear with the word "Off" in this screen but will not be programmable.

3. Turn the Knob to highlight the Time setting (00:00 in the sample screen above), then click the Knob in. The field will flash.

4. Turn the Knob until the desired running **duration** for this step (from 00:01, which means one minute, to 99:59) appears, then click the Knob in to save the setting. We will set Step 1 time to eight hours for this example (*see Figure 24*).

5. Turn the Knob to highlight the **ºC** temperature setting (**20.0** in the sample screen above), then click the Knob in. The field will flash.

6. To set the temperature desired (**ºC** from 4.0 to 80.0) for the time period you have set, turn the Knob (left to decrease, right to increase). When the desired value appears, click the Knob in to save the setting. We will set Step 1 temperature to 37.0ºC (*see Figure 24*).

7. Turn the Knob to highlight the **RPM** setting (**Off** in the sample screen above), then click the Knob in. The field will flash.

8. Turn the Knob to select the desired shaking speed (25 to 400 RPM) for this time period, then click the Knob in to save the setting. We will set Step 1 speed to 150 RPM (*see Figure 24*).

9. *If you do not have the optional* **UV** *lamp, skip this step.* If you have the UV lamp (default setting is **Off**) and you wish to have it on during the time period you have set, use the Control Knob to select the field, click the Knob to select the field (it will flash), turn the Knob to select **On**, then click the Knob in to save the setting. In our sample Step 1 (*see Figure 24*), however, **UV** remains **Off**.

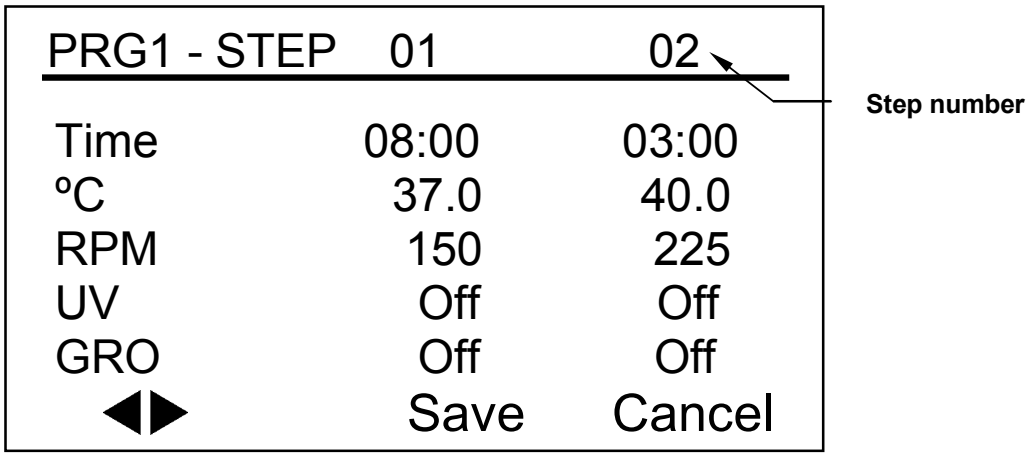
10. *If you do not have the optional* **GRO** *lamps, skip this step.* If you have the photosynthetic lamps (default setting is **Off**) and you wish to have them on during the time period you have set, use the Control Knob to select the field, click the Knob to select the field (it will flash), turn the Knob to select **On**, then click the Knob in to save the setting. In our sample Step 1 (*see Figure 24*), however, **GRO** remains **Off**.

NOTE:

DO NOT select "Save" yet!

11. To program Step 2 (*see sample screen in Figure 24*): use the Control Knob to highlight the arrows at the bottom left of the screen. Click the Knob to make the arrows flash, then turn the Knob to the right until Step 2 appears. Click the Knob in to work in this screen, and repeat Steps 3-10.

Figure 24: Program 1 – Step 2



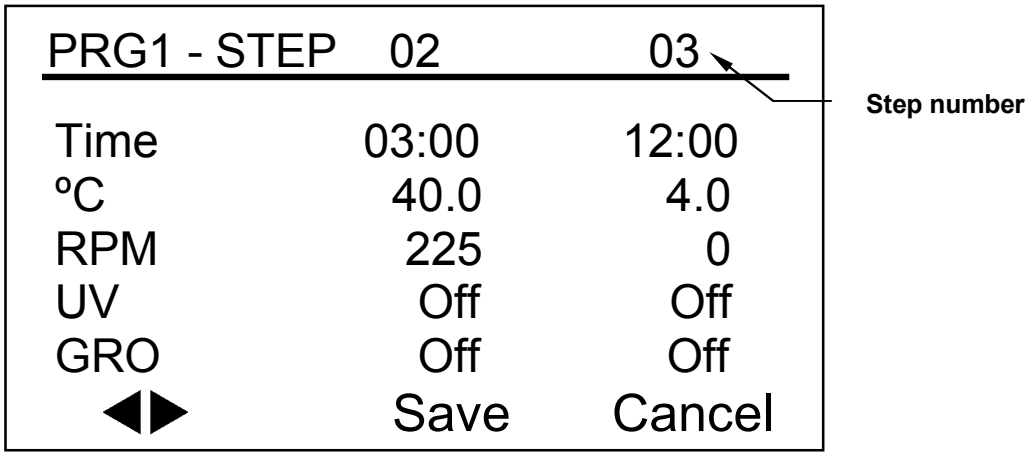
Whatever step is shown on the right-hand side of the display is settable (in Figure 24, it is Step 2). To scroll between steps, select the arrows (bottom left), then turn the Control Knob clockwise or counterclockwise, then select the desired step.

NOTE:

The time entered for each step is <u>for that step only</u>; it is not cumulative (i.e., the elapsed time from the start of the program).

12. Continue to program as many as 15 steps in the same manner. For our sample program, we have only three steps (*see Figure 25*).

Figure 25: Program 1 – Step 3



The three-step program we have illustrated is designed to start incubating cultures at 37ºC and hold that temperature for eight hours, shaking at 150 RPM. After eight hours, Step 2 engages, increasing the temperature setpoint to 40ºC for a temperature induction, holding that temperature for three hours and increasing the shaking speed to 225 RPM. After this interval, the temperature will be cooled to 4ºC and held at that temperature for twelve hours; no shaking will occur during this period, as the speed is set to 0 RPM.

Please note that temperature reductions, even at temperatures above ambient (going from 40º to 30ºC, for example), require refrigeration to be effective.

NOTE:

When the last step of a program is completed, the Innova 44/44R will continue operating according to the parameters of the final step programmed, until the user intervenes.

If you wish the shaker contents to experience different conditions (e.g., a different shaking speed or no shaking at all, and/or return to ambient temperature), set those parameters as the last step in your program.

To save the entire program:

1. Once all your steps are set, use the Control Knob to highlight **Save** at the bottom of the screen, then click the Knob in. The field will flash.
2. Click the Knob in again to save the program. The display will read **Process Running – Saving Profile** for a few seconds, then return to the main Programs (**PROG**) screen.

If you wish, you can set Programs 2, 3 and 4 and save them in the same manner.

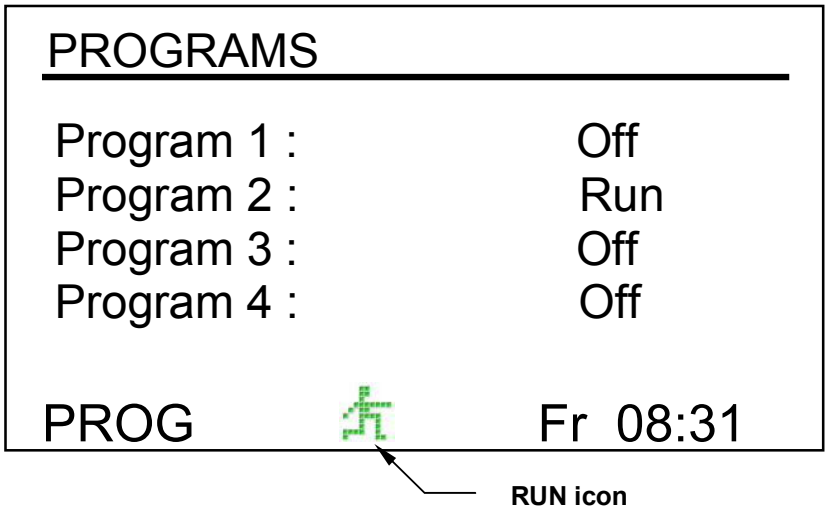
7.5.4 Editing a Program

Use the Edit function to open a program you have already created and saved, in order to modify your settings following the same procedures.

7.5.5 Running a Program

Use the Run fuction to turn a specific program on. Naturally, only one program can run at a time. When you change the mode to **Run**, the screen will show the **Run** icon:

Figure 26: Programs Screen – Running



To stop a program: You can abort a run any time by changing the program's function to **Off**.

7.6 Muting the Audible Alarm

The Innova 44/44R shakers have an audible alarm that is activated under predetermined conditions (*see Table 4*). It may be muted in the following way:

1. Turn the Control Knob until the **SET** screen is highlighted on the display. Click the Knob in to work in this screen.
2. Turn the Knob to highlight the **Mute** mode (**On**), then click the Knob in. The field will flash.
3. Turn the Knob to change the setting to **Off**, then click the Knob to save this selection.

To reactivate the audible alarm at any time, repeat steps 1-3, reversing "off" and "on".

7.7 Temperature Offset Calibration

The temperature probe and the temperature controller are calibrated together at the factory. The temperature probe measures the temperature of the air at the probe's location, near the 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. You can calculate the correction value for this offset and program the shaker to display a corrected temperature.

7.7.1 Calculating the Offset Value

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, then record the Indicated Temperature.
2. Now record the Actual Temperature.
3. Calculate the temperature correction value using this formula:
   Actual Temperature – Indicated Temperature = Temperature Offset Value.
4. To set the Temperature Calibration Offset, follow the procedure outlined in Section 7.7.2 below.

7.7.2 Setting the Offset

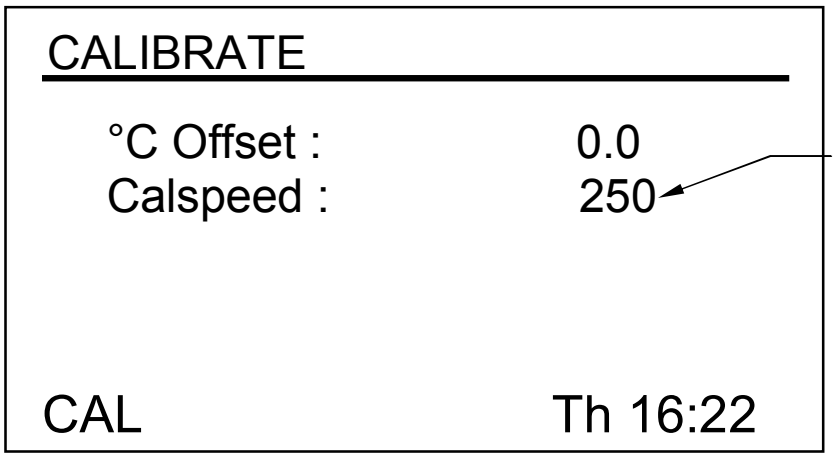
To set the temperature calibration **Offset**:

1. Use the Control Knob to enter the **CAL** screen (*see Figure 21, repeated below*).
2. Turn the Control Knob to highlight the current setting (**0.0** in the sample screen above), then click the Knob in. The current setting will flash.
3. Turn the Knob (left for negative settings or right for positive settings) to display the desired setting. As you turn the Knob, each click represents one tenth of a degree Celsius (0.1ºC).
4. When you reach the desired setting, click the Control Knob in to save the new value.
5. When the Temperature Offset is set to any value other than 0, the  icon will appear next to ºC in the **DISP** and **SUMM** screens.

NOTE:

If you highlight an item, change it, but do not save your selection, after a few seconds the screen will revert to its previous setting.

Figure 21: Calibrate Screen



7.8 Using Calspeed

The **Calspeed** function, which is set in the **CAL** screen (*see Figure 21 above*), is used to calibrate the speed of the shaking mechanism. Calibrated at the factory, speed does not need to be recalibrated until a major operating component (e.g., drive belt) is changed.

NOTE:

Prior to engaging the Calspeed function, make sure that the platform is properly secured to the subplatform, and any flasks present are secured. Run the unit at approximately 250 rpm to ensure stable operation prior to calibration.

When the shaker is running, the **CAL** screen shows the indicated RPM value. If you wish to calibrate the speed, set the speed to a value that can be measured— a setpoint of 250 RPM works well. The use of a strobe is recommended for accuracy. If, after measuring the actual speed, you wish to adjust the indicated value:

1. Click the Control Knob in.
2. Set the new value.
3. Click the Knob in again to save the setting.
4. Turn the shaker **OFF**, wait a few seconds, then turn the shaker back **ON**.

7.9 Power Interruption

In the event of a power failure, the Innova 44/44R Shakers are equipped with an **automatic restart** function. The shaker's non-volatile memory retains all stored information.

If the shaker was in operation prior to the power interruption, the shaker will begin to operate at its last entered setpoints. The alarm/POWER display will flash, indicating that a power interruption has occurred. Turn the Control Knob in any direction to acknowledge the visual alarm. The flashing will stop.

7.10 Slide-Out Platform

The Innova 44/44R is equipped with a slide out platform mechanism as a standard feature. This allows you to easily slide the platform out of the shaker for easy access to the platform without the need for tools.

To operate the platform slide-out mechanism:

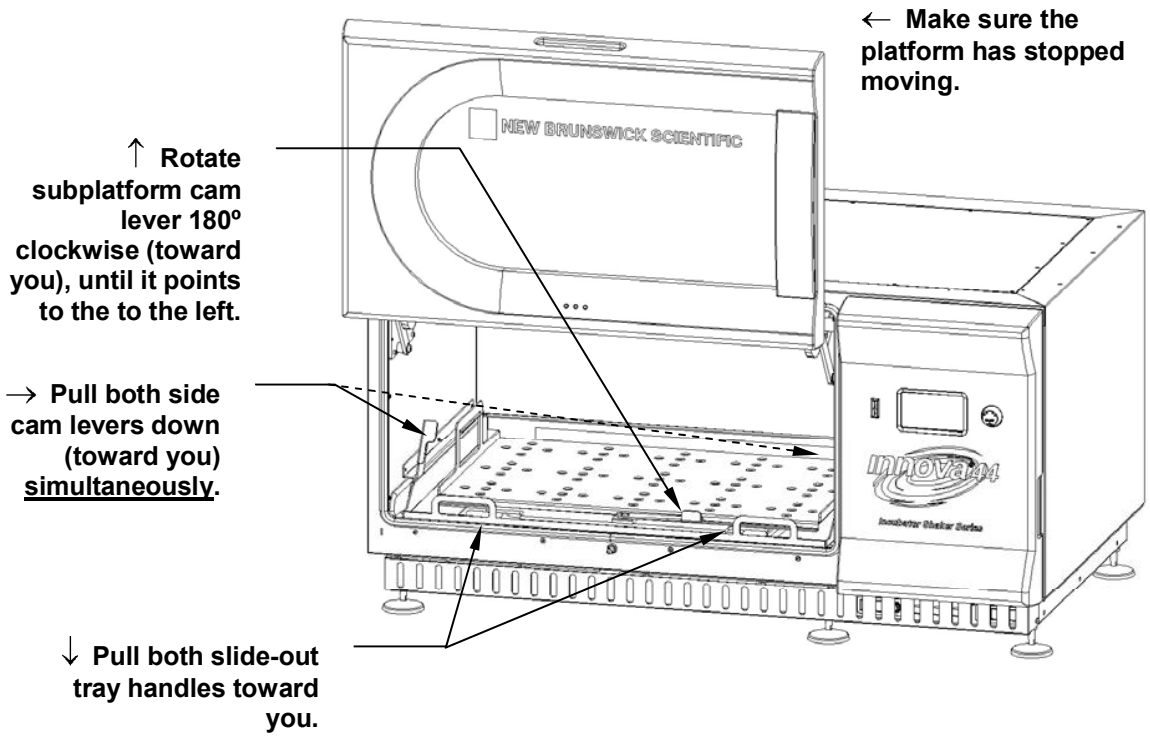
1. Make sure platform has stopped moving.

2. Rotate cam lever located on the subplatform (*see Figure 27 on the following page*) 180º clockwise. It should be pointing to the left.

3. Pull both side levers (*see Figure 27*) down. This will disengage the platform from the subplatform.

4. Pull **both** handles on the slide-out mechanism (*see Figure 27 on the following page*) toward you. This will move the platform to an easily accessible position.

Figure 27: Disengaging Slide-Out Platform



5. To re-insert the platform, reverse this process. Make sure the two slots in the back of the platform are inserted under blocks of subplatform in the back.

NOTE:

Make sure that you have rotated the front cam lever counter-clockwise to lock the platform in position.

8 MAINTENANCE

WARNING!
When cleaning the unit, always turn off the shaker and disconnect the power cord from the power supply.

8.1 Routine Maintenance

No routine maintenance schedule is required for the Innova 44 and 44R.

To ensure that your shaker retains its attractive appearance, an occasional cleaning, using a cloth with conventional household (non-abrasive) cleaner is recommended (*see Section 8.2 below for more details*).

We also suggest that the area around the shaker be vacuumed or swept to remove dust and other debris, ensuring proper air flow in and around the shaker.

8.2 Cleaning External & Internal Surfaces

The unit may be cleaned using a damp cloth or any standard household or laboratory cleaner to wipe down its outer surfaces. Do not use abrasive or corrosive compounds to clean this instrument, as they may damage the unit and void the warranty.

If Biohazard decontamination is required, see Section 8.3 below.

8.3 Biohazard Decontamination

It is the responsibility of the user to carry out appropriate decontamination procedures if hazardous material is spilled on or inside the equipment. Before using any cleaning or decontamination method other than those suggested by the manufacturer, users should check with New Brunswick Scientific that the proposed method would not damage the equipment.

Commercially available household bleach solutions, when diluted at a 1:10 ratio, are effective in routine decontamination of the instrument. The method for decontaminating a spill depends upon the nature of the spill.

Spills involving fresh cultures or samples known to have low concentrations of biomass should be flooded with decontamination solution and soaked for 5 min before cleanup.

Spills involving samples with high concentrations of biomass, or involving organic matter, or occurring in areas warmer than room ambient temperature, should be exposed to decontamination solution for *at least one hour* before cleanup.

WARNING!

Personnel involved in the cleanup of any spill should wear gloves, safety glasses, and a laboratory coat or gown during the cleanup process. Respiratory protection should be considered for spills where aerosolization is suspected.

9 SERVICE & ACCESSORIES

9.1 Troubleshooting

If any problems occur with your shaker, do not attempt to perform any service on the unit other than specified in this manual. Unauthorized servicing may void the warranty. Please contact your local New Brunswick Customer Service Department

In any correspondence with New Brunswick, please refer to the model number and serial number of your unit. This information is on the electrical specification plate, located on the rear panel of the unit, above the power connector. The serial number is also located in the lower right corner panel, below the chamber door seal.

There are some problems, however, that you can investigate and correct yourself. Refer to the following Troubleshooting Guide:

Symptom(s)	Probable Cause(s) & Solution(s)
Shaker does not run.	No power; display is not on; power cord is not plugged in and/or power switch is off: plug in power cord (to working electric outlet), and turn on power switch.
	Door is open—look for Open Door icon on display: close door firmly, making sure latch is engaged.
	Door is closed but Open Door icon is on display: door magnet is not adjusted correctly; call for service.
	On/Off switch is not working: call for service.
	Tilt Switch has been triggered. Alarm condition *Tilt* will be indicated and RPM will be OFF. Check to ensure the load is evenly distributed and that the shaker is level on a solid surface. Restart by pressing the START/STOP button.
	Fuse(s) burned out: check and replace as needed.
	If you recently opened the Service Drawer to replace a fuse, it may not have been seated properly: reopen and reclose carefully.
	Shaking speed has been set to Zero by program running (look for Run icon in display) or by computer interface: reset shaking speed.
	Defective main board: call for service
	Defective display controller board: call for service.
	Jammed shaking mechanism: call for service
	Defective motor: call for service
	Drive belt out of alignment or worn: call for service.

...continued...

Symptom(s)	Probable Cause(s) & Solution(s)
Shaker runs slowly and/or no speed indication.	If you recently opened the Service Drawer to replace a fuse, it may not have been seated properly: reopen and reclose carefully.
	Fuse(s) burned out: check and replace as needed.
	Incorrect speed calibration: recalibrate shaking speed.
	Defective main board: call for service.
	Defective motor: call for service.
	Drive belt out of alignment or worn: call for service.
Shaker does not run at set speed.	Shaker is running in Program mode (look for Run icon in display).
	Shaker speed has been changed by RS-232 command/ computer interface.
	Shaker is overloaded: remove some contents & balance load.
	Defective motor: call for service.
	Drive belt out of alignment or worn: call for service.
Operating noise	Load out of balance: pull out Slide-Out Platform, unload all contents, reload.
	Loose component(s) in Slide-Out Platform, subplatform, and/or drive assembly: call for service.
Incubator does not reach set temperature.	Shaker running in Program mode: Run icon in display.
	Temperature setpoint changed by RS-232/computer interface command.
	Heater fuse blown: replace.
	Compressor fuse blown: replace.
	Compressor over-pressure switch activated: call for service.
	Chamber fans not working: call for service
	Ambient temperature too high or too low: cool or heat the room as needed.
	Door is not completely closed (even though Open Door icon may not be on display): open it and reclose it firmly.
	Sealing gasket between the Service Drawer and the Inner Cabinet is damaged: call for service to replace it.
	Line voltage is too low.
	Frequency on line voltage if set incorrectly: reset.
	Firmware revision does not match the Service Drawer revision: ask for update.
	Defective heater: call for service.
	Defective refrigeration system: call for service.
	Incorrect temperature indication (*see below*).
Incorrect temperature indication.	Temperature Offset has been programmed (look for [adjacent to C on display).
	Defective RTD assembly: call for service.
	Defective main board: call for service.

...continued...

Symptom(s)	Probable Cause(s) & Solution(s)
Incorrect relative humidity %	Defective humidity probe or broken contact: call for service.
Photosynthetic GRO lamp does not work.	Shaker is running in Program mode (look for Run icon in display), and program calls for GRO lamp to be off.
	GRO lamp mode has been changed by RS-232 command/ computer interface.
	Bulb is burned out; replace (*see Section 9.6*).
	Fuse is burned out: replace (*see Section 9.4*)
	Check ballast voltage.
	Check cable connections.
	Check switch settings.
	GRO lamp mode has been changed by RS-232 command/computer interface.
UV germicidal lamp does not work.	Shaker is running in Program mode (look for Run icon in display), and program calls for UV lamp to be off.
	UV lamp is burned out; replace (*see Section 9.8*)
	Fuse is burned out: replace (*see Section 9.4*)
	Check ballast voltage.
	Check cable connections.
	Check switch settings.
	UV lamp mode has been changed by RS-232 command/ computer interface.
Door does not stay in the fully open position.	Adjust the door tension (*see Section 9.7*).

9.2 Product Returns

Should you need to return your Innova 44/44R to New Brunswick for any reason, first contact Customer Service to obtain a Returned Material Authorization (RMA) number. This number must appear on the outside of the shipping container, otherwise New Brunswick Receiving will refuse to accept the shipment.

In addition, you must also certify that the instrument being returned has been thoroughly cleaned and decontaminated. **A form for this purpose is provided in Section 13** of this manual; it can also be downloaded from our website (www.nbsc.com). A copy of this completed Return Authorization and Decontamination Certificate must be attached to the outside of the container, with a second copy packed inside with the instrument.

9.3 Opening the Service Drawer

WARNING!
Before opening the Service Drawer, always turn off the shaker and disconnect the power cord from the power supply.

The Service Drawer (*see Figure 28*) contains the shaker's electronic and temperature control components. It is designed to open partially (allowing access to the fuses—*see Section 9.4 for Fuse Replacement instructions*) or to be removed, **by authorized service technicians only,** from the shaker entirely, to allow easier accessibility for service.

CRUSH WARNING!
Only authorized technicians should open the Service Drawer beyond its stops, giving it proper support, or remove it entirely, which requires two people or one technician with an appropriate lifting device. The drawer weighs approximately 57 kg (125 lb).

9.4 Fuse Replacement

WARNING!
When replacing fuses, always turn off the shaker and disconnect the power cord from the power supply.

There are four fuses that can be replaced by the user. These are located inside the Service Drawer. To access this forward portion of the Service Drawer (*see Figure 28*):

1. Turn the power off and unplug the shaker.
2. Remove the four thumbscrews and washers that hold the front grille in place. Set them aside for reuse.
3. Locate and, using a screwdriver, unlock the handles that are located at the base of the Service Drawer (on the front face).
4. Release the handles by pushing the rectangular buttons.
5. Grasp the handles and pull the Service Drawer out **until it engages the stop mechanism**.

CRUSH WARNING!
Do not try to pull the drawer out beyond its stops.

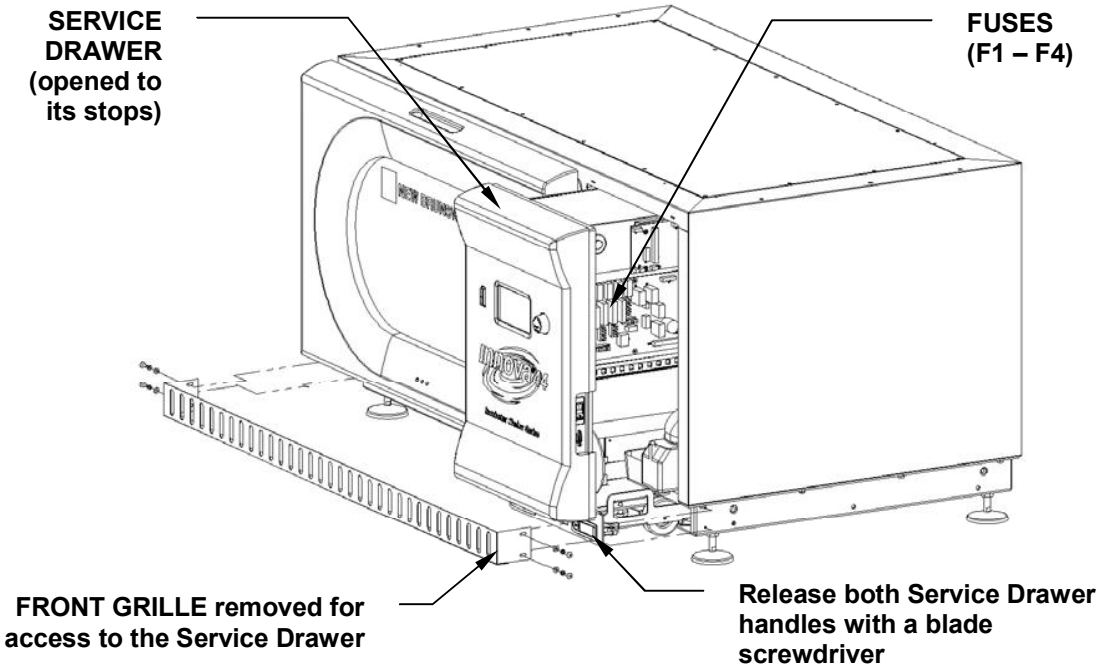
6. Fuses are numbered 1 through 4 (*see Table 6*); access the fuse you wish to replace by using a coin or a blade screwdriver to turn and release the spring-loaded cap.
7. Replace the fuse with a new one of the same type and rating (*see Table 6 below*):

Table 6: Fuses

Fuse No.	Function	Type	Rating
F1	Heater	Slo Blo®	6.3 A
F2	¤GRO Lamps (photosynthetic)		3.15 A
F3	¤UV Lamp (germicidal)		3.15 A
F4	Compressor		10 A

¤ optional equipment

Figure 28: Fuse Replacement



9.5 Replacing Cabinet Lights

WARNING!

Before installing or removing the quartz bulbs:

(1) Make sure power is disconnected from the unit,

(2) Wear plastic gloves to protect the bulb from skin oils and to protect your hands just in case the bulb should break,

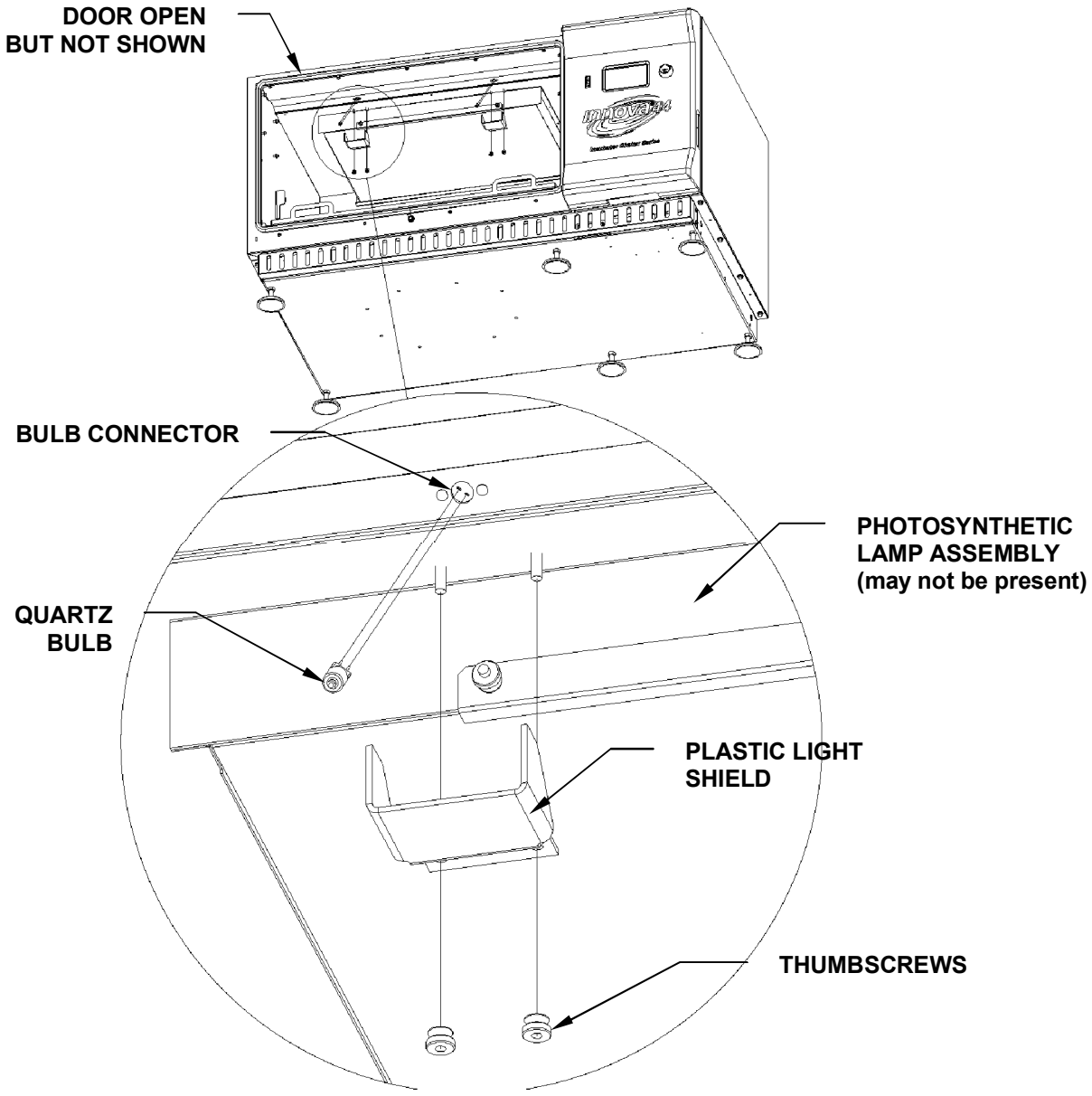
(3) Before removal, make sure the bulb has fully cooled.

NOTE:

Cabinet lights are connected in series. When one burns out, both lights will be off. It is therefore prudent to replace both bulbs at the same time.

Be sure to follow all the **WARNINGS** and the **NOTE** above as well as the procedure outlined below when you replace the cabinet bulbs with reference to Figure 29 below:

Figure 29: Replacing Cabinet Lights

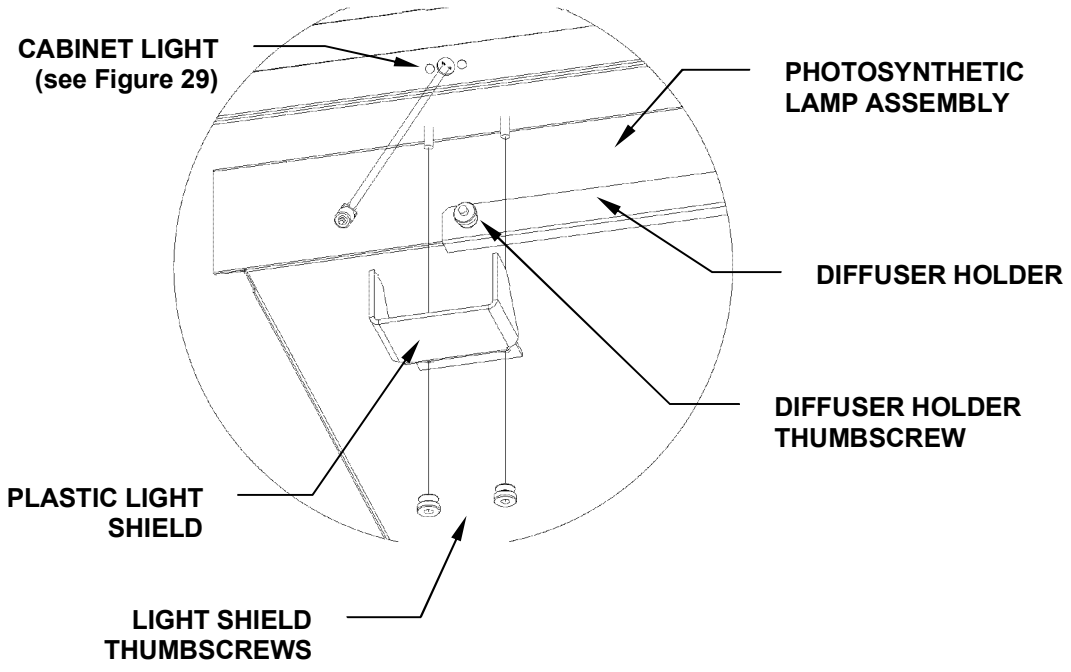


1. Make sure power is disconnected from the shaker.
2. Open the door.
3. Unscrew the thumbscrews and remove (*with reference to Figure 29*) both plastic light shields to gain access to the bulb connectors.
4. Wearing plastic gloves, remove the first used bulb, then carefully insert the new bulb's prongs fully into the connector base.
5. Repeat step 4 for the second bulb.
6. Reinstall the plastic light shields with their thumbscrews.

9.6 Replacing Optional Photosynthetic Lamps

> ***WARNING!***
> **Before removing or installing the photosynthetic "GRO" lamp, make sure power is disconnected from the unit.**

Figure 30: Replacing Photosynthetic Lamps



To replace the photosynthetic GRO lamp bulbs, with reference to Figure 30 above:

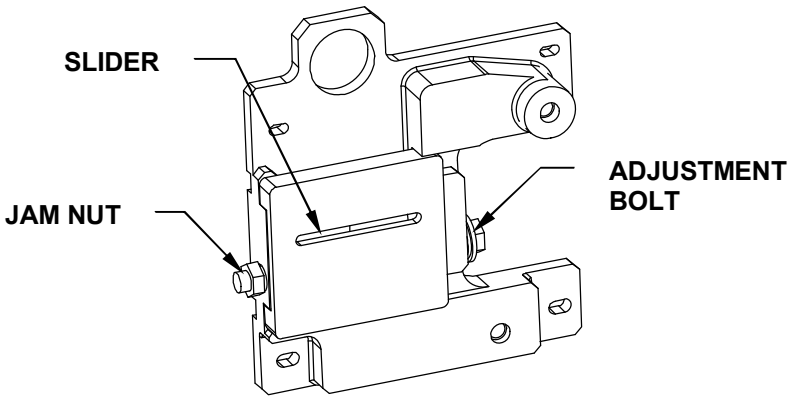
1. Make sure power is disconnected from the shaker.
2. Open the door.
3. Remove the two thumbscrews from the diffuser holder.

4. Remove the diffuser by placing a finger underneath and rotating the diffuser in the slot at the back of the photosynthetic light assembly. All 6 lamps should now be accessible to you.
5. To remove the lamp for replacement, rotate the lamp 90º, taking care to support the lamp before it drops down.
6. To replace the lamp, orient the pins of the new lamp vertically. Simultaneously, gently press both sides of the lamp into the slots.
7. Rotate the new lamp 90º. The lamp should catch in the holders on both ends. Make sure both ends are secure.
8. Put the diffuser back in place, reinstalling the diffuser holder with its two thumbscrews.

9.7 Adjusting Door Tension

In the event the door does not stay in the fully open position, you may want to adjust the door tension. Housed in the counterbalance brackets, located on the side walls of the chamber, is an adjustment mechanism that consists of a slider controlled by the adjuster bolt at the front and a jam nut and lock washer at the rear (*see Figure 31 below*).

Figure 31: Righthand Counterbalance Bracket



To adjust door tension, you will need two 9/16-inch open-ended wrenches and two wood blocks, each approximately ¾ inch x 1½ inches x 6 inches, to protect the door gasket from the upper door arms during this procedure:

1. Fully open the door, placing each wood block between an upper arm and the door gasket.

2. Using the wrenches, loosen the jam nut and lock washer from the back of both counterbalance brackets.

3. Turn the adjuster bolt on the front of each counterbalance bracket to force the upper door arms up. Adjust the placement of the wood blocks as needed to bring the door to the desired height without allowing the upper arms to harm the door gasket.

4. Adjust both sides to the same tension by comparing the position of the slider, which you can see through the slot in the black cover on each bracket.

5. Retighten the lock washer and jam nut on each side; tighten to lock the adjuster bolt in place.

WARNING!
The following procedures are provided for your information only.
Do not attempt to perform these service interventions yourself unless you are an authorized service technician.

9.8 Removing the Service Drawer

When authorized service technicians need to remove the Service Drawer, they will follow this procedure:

CRUSH WARNING!
The Service Drawer is very heavy (approximately 57 kg or 125 lb), so there must be at least two people to handle it, or one technician with an appropriate lifting device.

1. Turn the power off and unplug the shaker.
2. Remove the plastic fitting that positions the temperature probe inside the chamber. This is located on the right side of the inside wall.
3. Use a piece of tape to hold the probe flat against the inside wall.
4. Remove the four thumbscrews that hold the front grille in place.
5. Locate and, using a screwdriver, unlock the handles that are located at the base of the Service Drawer (on the front face).
6. Release the handles by pushing the rectangular buttons.
7. Grasp the handles and pull the Service Drawer out **until it engages the stop mechanism**.
8. Push the Service Drawer back in slightly (approximately one inch).
9. Push down on the Service Drawer (**not** on the plastic bezel) while pulling the drawer out again; this action will bypass the stop mechanism.
10. The Service Drawer is supported for *only two inches* after clearing the stops.

CRUSH WARNING!

Do not pull the Service Drawer out entirely until you are prepared to handle its weight (approximately 57 kg, or 125 lb).

11. Remove the Service Drawer and place it on a stable, flat surface.

When reinstalling the Service Drawer, the authorized technician will be sure to put the temperature probe back in place with its plastic fitting, keeping the probe tip 7.6 – 8.2 cm (3 – 3.25 in) from the front face of the fan cover.

9.9 Replacing Optional Germicidal Lamp

WARNING!

Before installing or removing the germicidal "UV" lamp, the authorized technician will:

(1) Make sure power is completely disconnected from the unit,
(2) Wear plastic gloves to protect the lamp from skin oils and to protect your hands just in case the lamp should break,
(3) Before removal, make sure the lamp has fully cooled.

To replace the UV lamp, your service technician will follow all the **WARNINGS** above and the procedure and **WARNINGS** outlined below, with reference to Figures 32 & 33:

1. Make sure power is disconnected from the shaker.
2. Remove the Service Drawer, carefully following the instructions in Section 9.3.

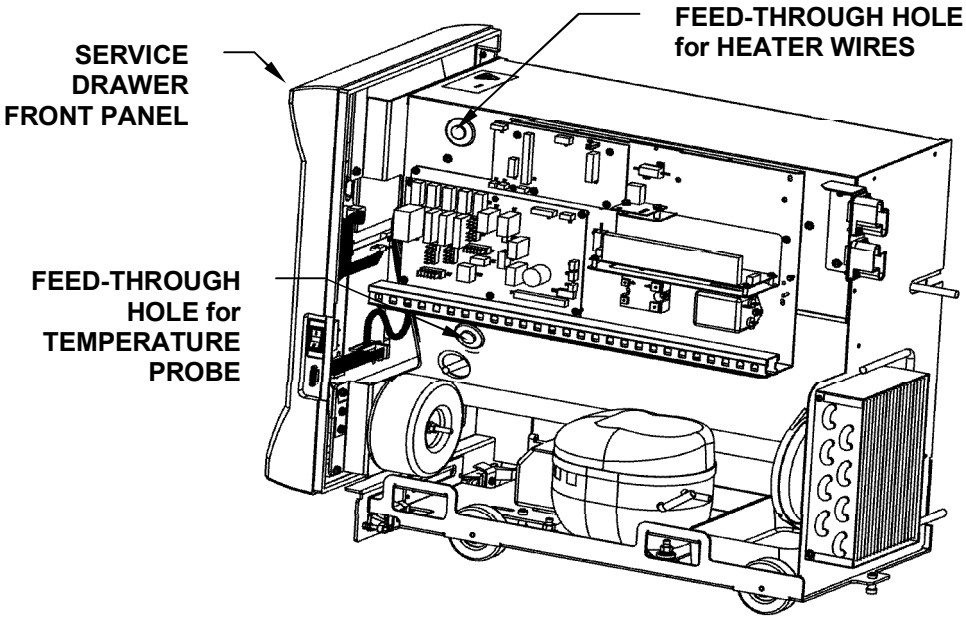
CRUSH WARNING!

The Service Drawer is very heavy (approximately 57 kg or 125 lb), so there must be at least two people to handle it, or one technician with an appropriate lifting device.

Do not pull the Service Drawer out entirely until you are prepared to handle its weight.

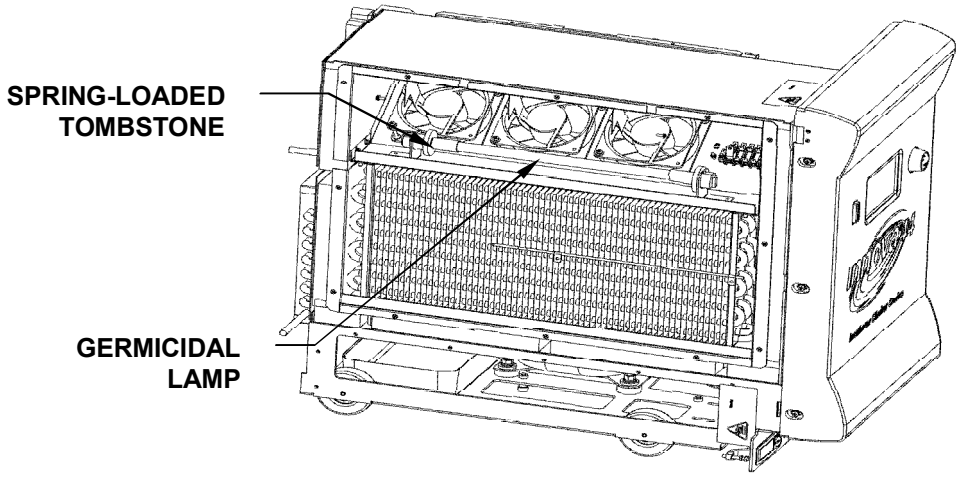
3. With reference to Figure 32 below, free the heater cable harness and the temperature probe from their tie wraps and Permagum®.

Figure 32: Service Drawer Feed-Through Holes (Germicidal Lamp Replacement)



NOTE that wires, tie wraps and Permagum® are not shown above.

Figure 33: Service Drawer, Fan Cover Removed (Germicidal Lamp Replacement)



NOTE that the heater wire is not shown.

4. Remove the fan cover from the Service Drawer, paying careful attention to the heater cable harness and the temperature probe, both of which are attached to the fan cover. If they are freed adequately, the fan cover can be rotated and rested on top of the Service Drawer.

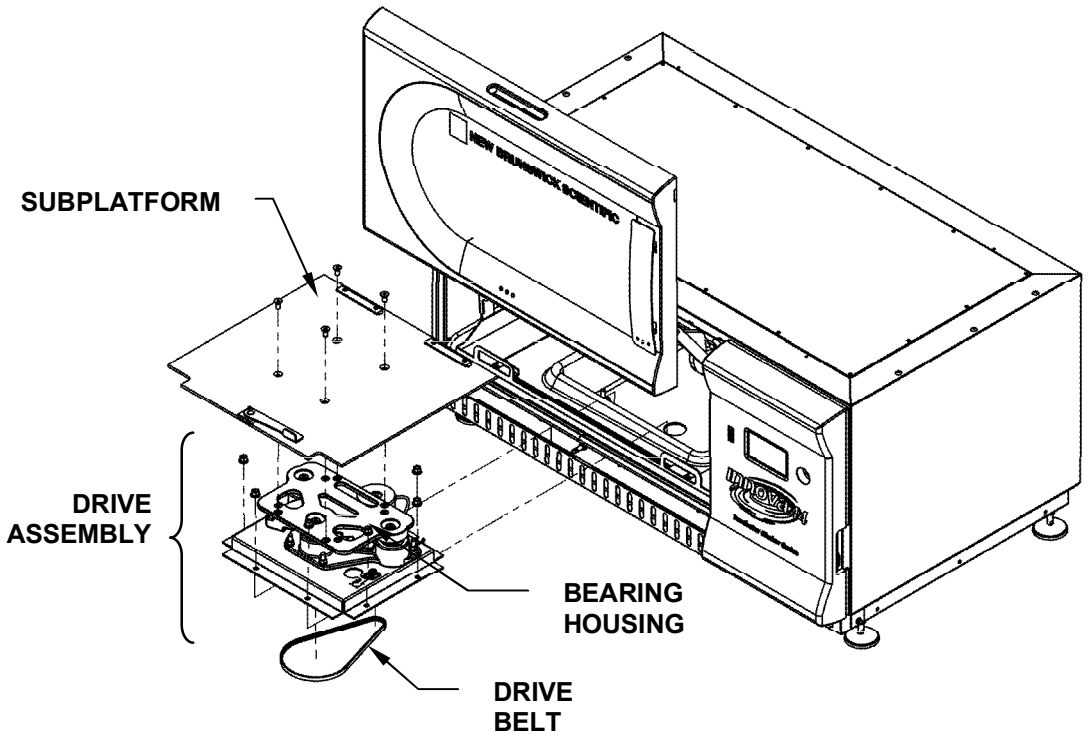
5. *With reference to Figure 33*, and wearing plastic gloves, remove the germicidal lamp by pressing it toward the spring-loaded tombstone. The lamp has a single pin at each end.
6. Still wearing plastic gloves, install a new lamp.
7. Pull the heater cable harness and temperature probe back through the holes in the Service Drawer (*Figure 32*).
8. Replace the fan cover, making sure the heater cable harness wires and temperature probe have been pulled through. Adjust the temperature probe position to ensure that the probe tip can protrude 7.6 - 8.2 cm (3 - 3.25 in) from the fan cover face.
9. Secure the heater cable harness and temperature probe with tie wraps, and add Permagum® to fill the hole.
10. Reinstall the Service Drawer in the unit, following all above **WARNINGS**.
11. With the Service Drawer secured in the unit, use the plastic fitting to hold the temperature probe, ensuring that its tip is 7.6 - 8.2 cm (3 - 3.25 in) from the fan cover face.

9.10 Belt Replacement or Adjustment

To gain access to the drive belt, your service technician will follow these steps with reference to Figures 34 & 35 below:

1. Make sure that the power is switched off and the shaker is unplugged.
2. Remove the platform.
3. Using a 7/32-inch Allen key (hex wrench), remove the four bolts that hold the subplatform in place, and remove the subplatform.
4. Disconnect the tachometer and motor wires by unplugging their connectors.
5. With a wrench, remove the nuts that hold the bearing housing to the bottom weldment.
6. Position the counterweight so it is closest to you, and tie it in place with tie wraps or strong cord, **in order to prevent it from dropping against your fingers or causing you to lose your grip.**
7. Remove the bearing housing with care: it weighs 21.3 kg (47 lb).
8. Turn the bearing housing over to access the belt, motor and pulley.

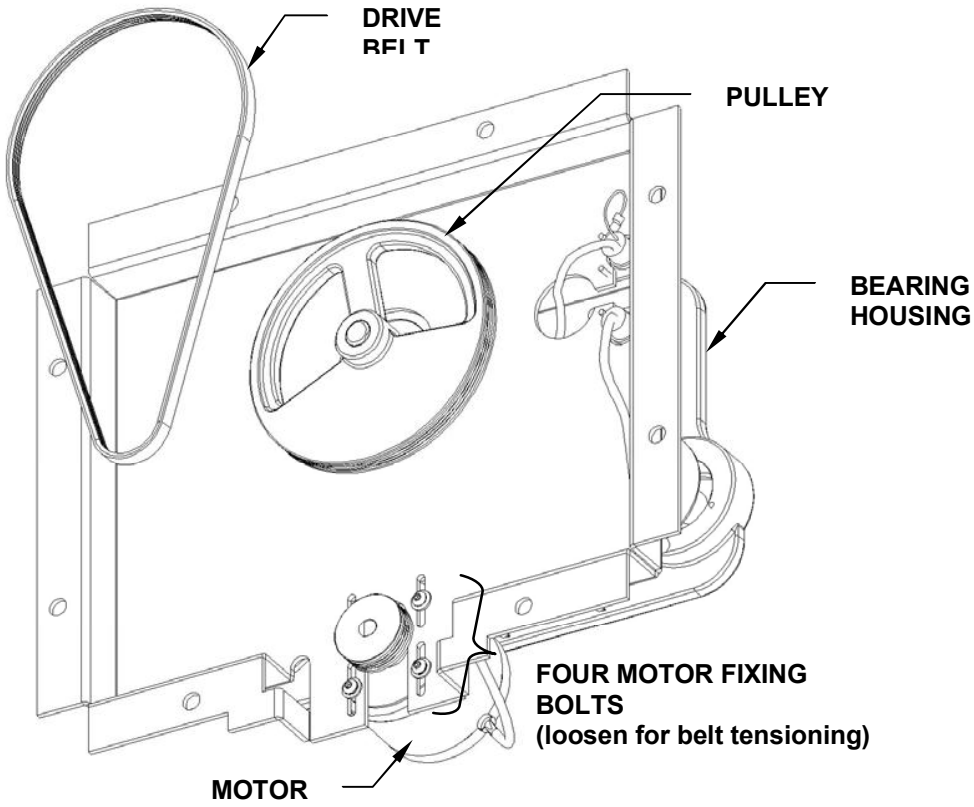
Figure 34: Drive Assembly



To replace the drive belt, follow these steps with reference to Figure 35:

1. Loosen the four hex nuts that hold the motor assembly in place and remove the old belt.
2. Guide the belt onto the two pulley grooves.
3. Tighten the motor nuts.
4. Check the belt adjustment by applying finger pressure to the belt midway between the two pulleys. The belt should deflect approximately 3/8-inch (9-10 mm).
5. If the deflection is not right, loosen the nuts, readjust the belt, then retighten the motor nuts.

Figure 35: Belt Replacement & Adjustment



If an adjustment is required:

1. Loosen the four hex nuts on the motor assembly.
2. Move the motor assembly until the belt is tight.
3. Tighten the hex nuts and recheck the belt tension by exerting pressure on the belt. The belt should deflect approximately 9.5 mm (3/8 in).

Reassembly:

1. In reverse order, reinstall the bearing housing. Once it is securely in place, remove the tie wraps/cord.
2. Secure the wiring to ensure no interference during rotation.
3. Reinstall the subplatform and platform.
4. Recalibrate speed (*see Section 7.8*).

9.11 Replacement Parts

In Table 7 below you will find commonly needed replacement parts for your Innova 44/44R shaker:

Table 7: Replacement Parts

Part Description	*Quantity*	*Part No.*
Spare Parts Kit (includes 1 motor drive poly-V belt, and two each 10A, 6.3A & 3.15A fuses)	1	M1282-6000
Flask Clamp screws, 10-24 x 5/16-inch flat Phillips head (+)	25	S2116-3051
Test Tube Rack screws, 10-24 x ½-inch pan head, and washers (#10 plain and #10 lock washers)	10 each	M1289-0800
Motor Drive Poly-V Belt, 28 inches long	1	P0700-7070
Fuse, 10A	1	P0380-3162
Fuse, 6.3A	1	P0380-3630
Fuse, 3.15A	1	P0380-3460
Chamber Light Bulbs	2	P0300-0470
UV Germicidal Bulb (if so equipped)	1	P0300-0351
Photosynthetic Bulb (if so equipped)	1	P0300-0221
UV Germicidal Light Ballast (if so equipped)	1	P0420-5113
Photosynthetic Light Ballast (if so equipped)	1	P0420-5192

9.12 Accessories

When ordering accessories, you may be asked to provide the model number and serial number of your shaker. This information is on the electrical specification plate, located on the rear panel of the unit. The serial number is also labeled in the lower right corner of the front panel, below the chamber door seal.

9.12.1 Slide-Out Platforms

The Slide-Out Platform allows you to extend the platform in front of the shaker for easy access to all flasks. Here are the various platforms available:

Table 8: Available Slide-Out Platforms

Description	*Part No.*
Universal Platform	M1282-9904
125 mL Erlenmeyer flask Dedicated Platform	M1282-9905
250 mL Erlenmeyer flask Dedicated Platform	M1282-9906
500 mL Erlenmeyer flask Dedicated Platform	M1282-9907
1L Erlenmeyer flask Dedicated Platform	M1282-9908
2L Erlenmeyer flask Dedicated Platform	M1282-9909
2.8L Fernbach flask Dedicated Platform	M1282-9910
4L Erlenmeyer flask Dedicated Platform	M1282-9911

Should you decide in favor of the Universal Platform, following is a list of that particular platform's flask capacity, according to flask size:

Table 9: Universal Platform Flask Capacities

Flask Type	*Capacity**
50 ml Erlenmeyer Flasks	91
125 ml Erlenmeyer Flasks	39
250 ml Erlenmeyer Flasks	30
500 ml Erlenmeyer Flasks	24
1 L Erlenmeyer Flasks	14
2 L Erlenmeyer Flasks	8
2.8 L Erlenmeyer Flasks	6
4 L Erlenmeyer Flasks	6
5 L Erlenmeyer Flasks	6

*Clamps for Universal Platform are sold separately.

9.12.2 Flask Clamps for Universal Platforms

The following clamps, according to flask size, are available for use with the Universal Platform:

Table 10: Flask Clamps

Clamp Size	*Part Number*
10 ml Erlenmeyer Flask	ACE-10S
25 ml Erlenmeyer Flask	M1190-9004
50 ml Erlenmeyer Flask	M1190-9000
125 ml Erlenmeyer Flask	M1190-9001
250 ml Erlenmeyer Flask	M1190-9002
500 ml Erlenmeyer Flask	M1190-9003
1 L Erlenmeyer Flask	ACE-1000S
2 L Erlenmeyer Flask	ACE-2000S
2.8 L Fernbach Flask	ACSB-2800S
4 L Erlenmeyer Flask	ACE-4000S
5 L Erlenmeyer Flask	ACE-5000S

9.12.3 Replacement Clamp Hardware Kits

New Brunswick flask clamps come complete with mounting screws. Additional screws are available separately in packs of 25 (*see Section 9.11*).

9.12.4 Test Tube Racks & Other Accessories

Table 11: Racks & Trays

Accessory Description		*Part Number*	*Platform Capacity*
Adjustable angle Test Tube Rack for tubes 8 – 11 mm diameter	80 tube capacity	M1289-0100	7
	60 tube capacity	M1289-0010	9
	48 tube capacity	M1289-0001	9
Adjustable angle Test Tube Rack for tubes 12 - 15 mm diameter	60 tube capacity	M1289-0200	7
	44 tube capacity	M1289-0020	9
	34 tube capacity	M1289-0002	9
Adjustable angle Test Tube Rack for tubes 15 –18 mm diameter	42 tube capacity	M1289-0300	7
	31 tube capacity	M1289-0030	9
	24 tube capacity	M1289-0003	9
Adjustable angle Test Tube Rack for tubes 18 – 21 mm diameter	30 tube capacity	M1289-0400	7
	23 tube capacity	M1289-0040	9
	18 tube capacity	M1289-0004	9
Adjustable angle Test Tube Rack for tubes 22 – 26 mm diameter	22 tube capacity	M1289-0500	7
	16 tube capacity	M1289-0050	9
	13 tube capacity	M1289-0005	9
Adjustable angle Test Tube Rack for tubes 26 - 30 mm diameter	20 tube capacity	M1289-0600	7
	16 tube capacity	M1289-0060	9
	12 tube capacity	M1289-0006	9
Microplate holder rack (stacked)	3 deep well or 9 standard	M1289-0700	16
Microplate holder rack (single layer)	5 deep well or standard	TTR-221	4
Angled Test Tube Rack Holder* for user-supplied test tube racks that are 10 - 13 mm (4 - 5 in) wide and up to 38 mm (15 in) long.		TTR-210	4
Angled Test Tube Rack Spacer Bar* for use with TTR-210 to accommodate test tubes racks that are less than 13 mm (5 in) wide.		TTR-215	NA

* Universal Platform Required

9.12.5 Optional Bases

Table 12: Bases

Description	*Part Number*
Short Base, raises bottom unit 10 cm (4 in)	M1282-0600
Medium Base, raises bottom unit 30.5 cm (12 in)	M1282-0800
Tall Base, raises bottom unit 40.6 cm (16 in)	M1282-0700

9.12.6 Optional Stacking Kit

Table 13: Stacking Kit

Description	*Part Number*
Stacking hardware (to stack two Innova 44 shakers)	M1282-0500
Stacking hardware (to stack an Innova 4400 on an Innova 44)	M1282-0501

9.12.7 Optional Gassing Port Kit

Table 14: Gassing Port Kit (Factory-Installed}

Description	*Part Number*
Gassing Port Kit	M1282-0291

9.12.8 Optional Photosynthetic Lamps

Table 15: Photosynthetic Growth Lamps (Factory-Installed)

Description	*Part Number*
Photosynthetic Growth Lamp Assembly (9 lamps)	M1282-9922

9.12.9 Optional UV Germicidal Lamp

Table 16: Germicidal Lamp (Factory-Installed)

Description	*Part Number*
UV Germicidal Lamp Assembly	M1282-9921

9.12.10 Optional Humidity Monitor

Table 17: Humidity Monitor (Factory-Installed)

Description	*Part Number*
Humidity Monitor (for use with spill pan as water reservoir)	M1282-5011

9.12.11 Optional Handles

Table 18: Screw-In Handles

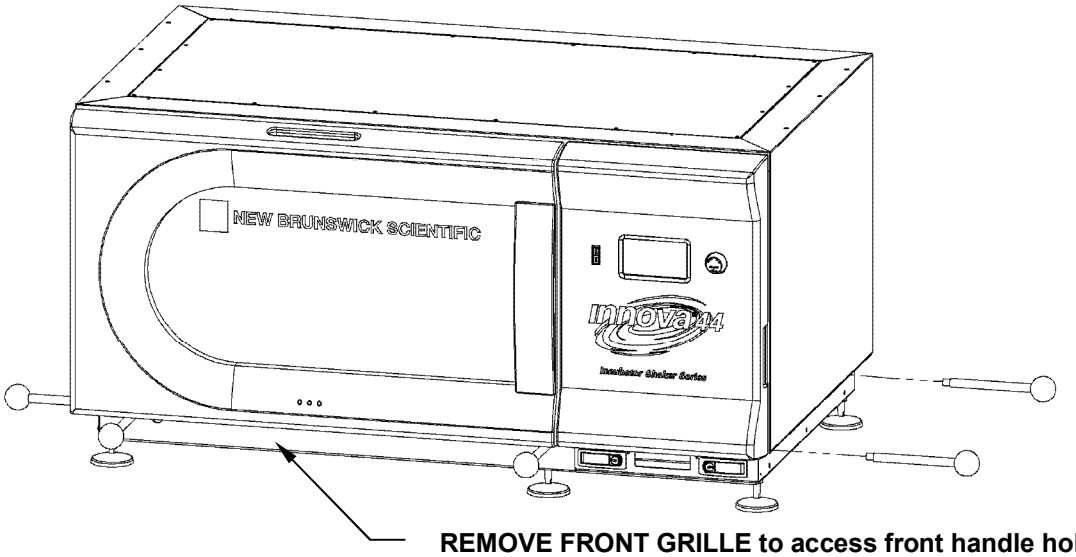
Description	*Part Number*
Screw-In Handles (6 pieces in kit)	M1282-5042

There are three threaded holes in the front of the shaker behind the front grille, two on each side panel, and three on the rear panel. Depending on your need, you can use any of these holes for the screw-in handles (*see Figure 36 below*). Be sure to tighten the handles securely.

CRUSH WARNING!

Make sure that any persons who will use these handles (for minor moves or lifts only) take proper precautions to protect their hands, feet and backs from injury.

Figure 36: Optional Screw-In Handles



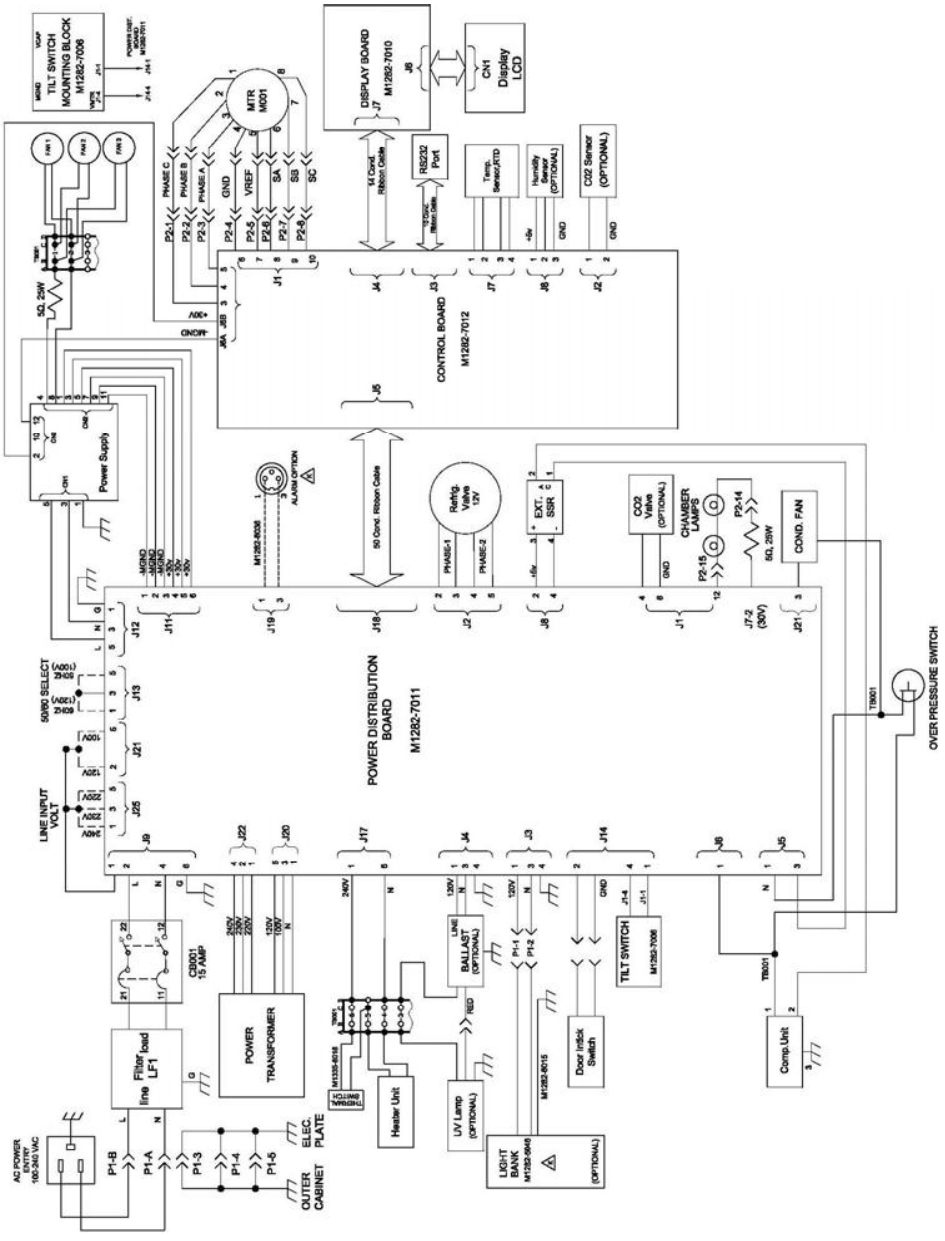
9.12.12 Optional Remote Alarm

The Innova 44/44R can be equipped with a factory-installed remote alarm component (New Brunswick part number M1320-8029). When it is hooked up to your relay and receiving equipment, this device will send notification of an alarm condition to the remote location you choose.

10 DRAWINGS & TABLES

10.1 Schematics

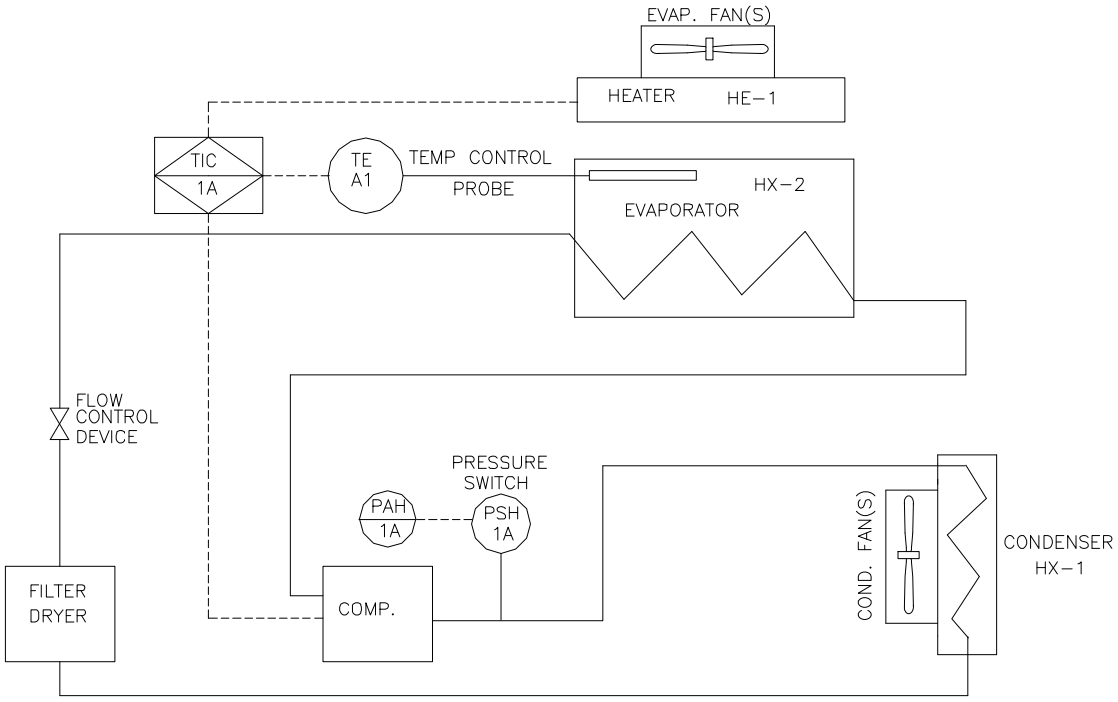
Figure 37: Control Schematics



NOTE:

For a larger version of this drawing, contact your sales or service representative.

Figure 38: Refrigeration Schematic



10.2 List of Drawings

10.3 List of Tables

11 SPECIFICATIONS

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

Innova 44 & 44R Incubator Shaker			
SHAKING			
Speed[1]	25-400 rpm with 2.5 cm (1 in) stroke or 25-300 rpm with 5.1 cm (2 in) stroke; 25-250 rpm for 3 units stacked		
Control Accuracy	± 1 rpm		
Indication	Displayed in 1 rpm increments		
Stroke/Orbit	2.5 cm (1 in) or 5.1 cm (2 in)		
TEMPERATURE			
Range (44)	5ºC above ambient temperature to 80°C[2]		
Range (44R)	20ºC below ambient temperature (minimum 4ºC) to 80°C[2]		
Control Accuracy	± 0.1°C from 30-40 °C, ± 0.5°C over the remaining range.		
Indication	Displayed in 0.1°C increments		
Heater	Long-life, low-watt density resistance-type heater with high temperature thermostat		
ALARMS	Visible and audible warning indication when speed deviates more than 5 rpm or temperature more than 1°C from setpoints, and when timer has expired. Audible alarm can be muted.		
LCD DISPLAY	240 x 128 backlit		
RS-232	Remote control, remote monitoring, remote data logging		
SETPOINT RETENTION	All setpoints and operating status are retained in non-volatile memory		
AUTOMATIC RESTART	Automatic restart after power is restored, indicated by flashing display		
STACKING	Up to three units may be stacked; the second and third units require stacking kit(s).		
DRIVE	Triple-eccentric counterbalanced drive with nine permanently lubricated ball bearings		
DRIVE MOTOR	Solid-state brushless DC motor.		
SAFETY	Drive Interrupt shuts off power to Shaker when door opens. Acceleration/deceleration circuit prevents sudden starts and stops, minimizing both splashing and mechanical damage. Independent mechanical sensing switch also shuts the motor off in unbalanced condition.		
ELECTRICAL REQUIREMENTS	▪ 100V, 50Hz ▪ 100V, 60 Hz ▪ 120 Volts, 60 Hz ▪ 230 Volts, 50 Hz	44: 800 VA per shaker 44R: 1500 VA per shaker	
ETL REGULATORY STANDARDS	UL 61010A-1 UL 61010A-2-010	CAN/CSA-C22.2 No. 1010.1 CAN/CSA-C22.2 No. 1010.2.010	
CE REGULATORY STANDARDS	See the following page		
DIMENSIONS[3]	Single Unit	Two Units	Three Units
Width	135 cm (53 in)	135 cm (53 in)	135 cm (53 in)
Depth (Front to Back)	84 cm (33 in)	84 cm (33 in)	84 cm (33 in)
Height	66 cm (26 in)	132 cm (52 in)	198 cm (78 in)

[1] see first NOTE on following page

[2] depending on ambient factors, such as relative humidity, and options installed

[3] see second NOTE on following page

Innova 44 & 44R Incubator Shaker	
CHAMBER DIMENSIONS	66 cm deep X 91 cm wide X 46 cm high from top of platform (26 in deep X 36 in wide X 18 in high from top of platform)
CHAMBER DOOR	Door glides out and up.
PLATFORM	Aluminum, 46 X 76 cm (18 X 30 in). Select universal or dedicated styles PLEASE NOTE: Innova 44 & 44R platforms are NOT interchangeable with platforms from other New Brunswick shakers.
GROSS WEIGHT	
44	238 kg (525 lb)
44R	259 kg (570 lb)
Short Base	16.4 kg (36 lb)
Medium Base	40.9 kg (90 lb)
Tall Base	57.3 kg (126 lb)

NOTE:

Use of baffled flasks will significantly reduce maximum speed for any shaker. We may be able to improve this maximum speed by using an alternative motor pulley. Contact your New Brunswick representative for more information.

NOTE:

Add 53 cm (21 in) to height and 15.2 cm (6 in) to depth for door clearance.

11.1 Certifications

The Innova 44 and 44R have been tested to ETL standards, to comply with UL and CAN/CSA electrical safety standards (see "ETL Regulatory Standards" in the specifications table).

As attested in the *CE Declaration of Conformity* reproduced on the following page, the Innova 44 and 44R also conform to the appropriate CE standards (see also "CE Regulatory Standards" in the specifications table).

New Brunswick
an eppendorf company

CE CE

DECLARATION OF CONFORMITY

New Brunswick Scientific hereby declares that the product(s) listed below conform to the European Union directive and standards identified in this declaration.

Product(s)

Innova 44/44R

EU Directive(s)

Low Voltage (73/23/EEC93/68/EEC)
Electromagnetic Compatibility (89/336/EEC/93/68/EEC)
CE Marking Directive (93/68/EEC)

Standard(s)

EN61010-1	EN61000-4-2
EN61010-2-010	EN61000-4-3
EN61010-2-081	EN61000-4-4
EN55011 (CLASS B)	EN61000-4-5
EN61000-3-2	EN61000-4-6
EN61000-3-3	EN61000-4-11

The conformity assessment procedures were performed at the following:

- **Intertek testing services, 41 Plymouth Street, Fairfield, NJ 07004**

The technical documentation relevant to the above equipment will be held at:
New Brunswick Scientific
175 Freshwater Blvd
Enfield, CT 06082 U.S.A
Tel. (860) 253-3400
Fax. (860) 741-0859

H. Couture — Henry Couture, Director of QA RA

24-OCT-11 — Date

12 APPENDIX: REMOTE PROGRAMMING

12.1 Setting Up with HyperTerminal

You can use the Microsoft® HyperTerminal program on your personal computer to communicate with your shaker:

1. Before you set up HyperTerminal, be sure to check the **Mode** and **Baud Rate** parameter settings (*see Section 7.4.5*).
2. While you are in the RS232 screen (*see Figure 20*), set the **Mode** parameter to **Slave**, and select the appropriate **Baud Rate**. The default setting, as you see in your screen, is 19200; your other choices are 9600 or 38400.
3. Connect the RS-232 cable between your computer and the shaker's RS-232 port (*see Figure 8*).
4. Start HyperTerminal, and follow the steps for Setting a New Connection. When prompted, select the COM port you will be using, then set the COM parameters (see Table 19 below):

Table 19: COM Parameters for HyperTerminal

Baud Rate	Enter the setting on your shaker (see Step 2 above)
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

5. To be sure that you have established a connection with your shaker, turn the shaker **OFF**, open the HyperTerminal connection, then turn the shaker back **ON**. Once a connection has been made, the shaker will send an **OK** to HyperTerminal.
6. You may wish to send a trial command to the shaker (*see Sample Test below*). We suggest that you enable *Caps Lock* on your computer, because all commands must be sent as capital letters.

Sample Test:

1. To request the current setpoint, type **RS** at the terminal. When you type **R**, you should see the **R** on the computer display. This is an echo character, sent back by the Innova 44/44R. When you type the S, you should see the echo **S** displayed at the computer.
2. Use the ↵**Enter** key to send the carriage return control character. This will move the cursor back over the first character.
3. **RS** is a Request command, so your shaker will send back the data corresponding to the command.

12.2 Overview of Command Sets

Using an optional RS-232 interface, the user has the capability to control various functions of the Innova 44/44R shakers by computer. A detailed command set follows this introduction.

The serial interface uses an echo character protocol that is implemented to indicate that a valid character has been received by the shaker. For every character sent by the user computer, the Innova 44/44R will return a matching character. This echo character should be read by the computer and compared to the character that was sent.

NOTE:

When you are sending a command, do not allow the pause between any two characters of your message to last longer than 10 seconds. If it takes any longer, the shaker's serial port will reset itself.

In the following example, the **Master** (your computer) will command (the **C** in **CS**) the shaker (**Slave**) to set its speed to **150 RPM**:

Master sends:	Innova 44/44R responds:
CS<*Space*>**150**<*CR*>	**CS**<*Space*>**150**<*CR*>

In the next example, the **Master** (your computer) will request that the shaker (**Slave**) report (the **R** in **RV**) the actual parameters:

Master sends:	Innova 44/44R responds:
RV<*CR*>	First the echo: **RV**<*CR*>
	Then the report: <**Arg1**><*Tab*><**Arg2**><*Tab*><**Arg3**>...<**Arg6**><*CR*><*LF*>

NOTE:

On power-up, even if the shaker is not set in Slave mode at the time, the shaker will always send these four characters: OK<*CR*><*LF*>. Before starting any communications, be sure to clear the computer's receive buffer.

This is the command set format:
<**Command**><*Space*><**Arg1**><*Space*><**Argn**…><*Terminator*>

Most Commands are defined as two capital characters using standard ASCII format (see the command sets provided below).

If a command has additional arguments, the ASCII space control character separates each argument. The command is terminated using the ASCII carriage return control character; an optional line feed control character may also be included but must follow the carriage return character.

When a command is sent that returns data, the characters returned are in ASCII format. Each additional argument returned will be separated by the ASCII space or tab control character; refer to the selected command for the actual format. Data returned is terminated with a carriage return line feed control character sequence.

Section 12.3 provides an Index to the 2-character command codes.

Sections 12.4-12.7 provide command sets for your use for Set Commands, Profile Control Commands, Report Request Commands and Set/Get Date & Time.

12.3 Index to Command Codes

Command Code	Meaning
CL	Command Grow Lamp
CS	Command Speed
CT	Command Temperature
CU	Command UV Lamp
PC	Clear Profile
PM	Profile Mode
PR	Read Profile Step in Memory
PS	Profile Stop/Start
PW	Write Profile Step to Memory
RI	Report Software Version
RP	Report Parameter List
RS	Report Setpoint Values
RV	Report Measured Values
=D	Set Date and Time
?D	Get Date and Time

12.4 Set Commands

Code	Meaning	Format
CL	Command Grow Lamp	**CL**<*Space*><**Arg1**><*CR*> where **Arg1**= Set Grow Lamp state (0 = off, 1 = on)
CS	Command Speed	**CS**<*Space*><**Arg1**><*CR*> where **Arg1**= Agitation setpoint (####)
CT	Command Temperature	**CT**<*Space*><**Arg1**><*CR*> where **Arg1**= Temperature setpoint (###.#)
CU	Command UV Lamp	**CU**<*Space*><**Arg1**><*CR*> where **Arg1**= Set UV Lamp state (0 = off, 1 = on)

12.5 Profile Control Commands

Code	Meaning	Format
PC	Clear Profile (clears profile step)	**PC**<*Space*><**Arg1**><*Space*><**Arg2**><*CR*> where **Arg1**= Profile number (range 1 to 4) and **Arg2**=Step number (range 1 to 15) **NOTE:** If **Arg2** is not included, all 15 steps of the selected profile will be cleared.
PM	Profile Mode (returns status of current profile run/hold mode)	**PM**<*CR*> There are no parameters to this command. Return data format: <**Arg1**><*Space*><**Arg2**><*Space*><**Arg3**><*CR*> where **Arg1**=Run/hold status (0 = end, 1 = run), **Arg2**=Profile number and **Arg3**=Step number **NOTE:** If a profile has not been selected to run, a 0 will be returned for Profile number and Step number.

...continued...

Code	Meaning	Format
PR	Read Profile step in memory	**PR**<*Space*><**Arg1**><*Space*><**Arg2**><*CR*> where **Arg1**= Profile number (range 1 to 4) and **Arg2**=Step number (range 1 to 15) Return data format: <**Arg1**><*Space*><**Arg2**><*Space*><**Arg3**><*Space*>...<*CR*><*LF*> where **Arg1**=Profile number (range 1 to 4), **Arg2**=Step number, **Arg3**=Temperature setpoint, **Arg4**=Agitation setpoint, **Arg5**=CO2 setpoint (future option, reads 0.0), **Arg6**=Step hours, **Arg7**=Step minutes, **Arg8**=UV lamp, and **Arg9**=Grow lamp
PS	Profile Stop/ Start (stops or starts a program profile)	**PS**<*CR*> With no other parameters, any profile currently running will be stopped. **PS**<*Space*><**Arg1**><*Space*><**Arg2**><*CR*> where **Arg1**=Profile number (range 1 to 4), and **Arg2**=Step number (range 1 to 15). **NOTE:** If **Arg2** is not included, the profile will start in Step 1.
PW	Write Profile step to memory	**PW**<*Space*><**Arg1**><*Space*><**Arg2**><*Space*><**Arg3**><*Space*> ...<*CR*> where **Arg1**=Profile number (range 1 to 4), **Arg2**=Step number (range 1 to 15), **Arg3**=Temperature setpoint, **Arg4**=Agitation setpoint, **Arg5**=CO2 setpoint (future option); Enter 0.0, **Arg6**=Step hours (range 0 to 99), **Arg7**=Step minutes (range 0 to 59), **Arg8**=UV lamp (0 = off, 1 = on), and **Arg9**=Grow lamp (0 = off, 1 = on)

For example, the following **PW** command:

PW<*Space*>**25.0**<*Space*>**150**<*Space*>**0.0**<*Space*>**2**<*Space*>**30**<*Space*>**0**
<*Space*>**1**<*CR*>

will set Program 1, Step 1 to the following conditions:

- Temperature setpoint 25.0º
- Agitation setpoint 150 rpm
- CO2 setpoint 0.0%
- Step Time 2 hours 30 minutes
- UV Lamp OFF
- GRO Lamp ON

12.6 Report Request Commands

Code	Meaning	Format
RI	Report Software Version	**RI**<*CR*> Return data format: <**Arg1**><*Tab*><**Arg2**><*CR*><*LF*> where **Arg1**=Display module software version, and **Arg2**=Control module software version
RP	Report Parameter List (ASCII text header)	**RP**<*CR*> Return data format: <**Arg1**><*Tab*><**Arg2**><*Tab*><**Arg3**>...<**Arg6**><*CR*><*LF*> where **Arg1**=”Shaker Speed”, **Arg2**=”Temperature”, **Arg3**=”% Relative Humidity”, **Arg4**=”% CO2 Concentration”, **Arg5**=”Grow Lamp Status”, and **Arg6**=”UV Lamp Status”
RV RS	Report Measured Values Report Setpoint Values	**RV**<*CR*> **RS**<*CR*> Return data format: <**Arg1**><*Tab*><**Arg2**><*Tab*><**Arg3**>...<**Arg6**><*CR*><*LF*> where **Arg1**= Shaker Speed, **Arg2**=Temperature, **Arg3**=% Relative Humidity, **Arg4**=% CO2 Concentration (future option, reads 0.0), **Arg5**=Grow Lamp Status, and **Arg6**=UV Lamp Status

12.7 Set/Get Date & Time

Code	Meaning	Format
=D	Set Date & Time	**=D**<*Space*><**Arg1**><*Space*><**Arg2**><*Space*><**Arg3**><*Space*>... <**Arg7**><*CR*>
?D	Get Date & Time	**?D**<*CR*> Return data format: <**Arg1**><*Tab*><**Arg2**><*Tab*><**Arg3**><*Tab*>...<**Arg7**><*CR*><*LF*> where **Arg1**=Hours (range 0-23), **Arg2**=Minutes (range 0-59), **Arg3**=Seconds (range 0-59), **Arg4**=Year (range 00-99), **Arg5**=Month (range 01-12), **Arg6**=Date (range 1-31), **Arg7**=Day (range 1-7; 1=Monday, 2=Tuesday...7=Sunday)

For example, this **=D** command:

=D<*Space*><**01**><*Space*><**30**><*Space*><**00**><*Space*><**04**><*Space*><**07**>
<*Space*><**04**><*Space*><**07**><*CR*>

will set the real date and time on your shaker to:

1:30:00 am, 2004, July 4, Sunday.

13 APPENDIX: PRODUCT RETURNS

13.1 Return Procedure

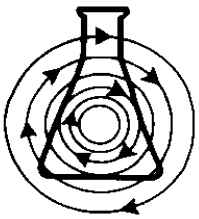
As explained in Section 9.2, should you need to return your Innova 44/44R to New Brunswick for any reason, first contact Customer Service to obtain a Returned Material Authorization (RMA) number. This number must appear on the outside of the shipping container, otherwise New Brunswick Receiving will refuse to accept the shipment.

In addition, you must also certify that the instrument being returned has been thoroughly cleaned and decontaminated. A form for this purpose is provided on the following page; you can photocopy it and fill it out by hand. It can also be downloaded from our website (www.nbsc.com), if you prefer to fill it out electronically.

A copy of the completed Return Authorization and Decontamination Certificate must be attached to the outside of the container, with a second copy packed inside with the instrument.

13.2 Return Authorization and Decontamination Certificate

A sample form for you to copy and fill out is provided on the following page.



New Brunswick Scientific Return Authorization and Decontamination Certificate

Contact New Brunswick Scientific for an RMA number prior to returning any equipment, then complete this form and attach it to the outside container of the equipment being returned to our facility. In addition, please enclose a completed, duplicate copy of this form with the returned item.

Returned Material Authorization (RMA) Number _____

Equipment being returned: Model Number _____Serial Number_____

Reason for its return:

_____

_____

This equipment (check all that apply):

New Product
☐ Never used

Biohazards
☐ Not used
☐ Used, but decontaminated with
_____

Hazardous Chemicals
☐ Not used
☐ Used, but decontaminated with
_____

Radioactive Materials
☐ Not used
☐ Used, but decontaminated with
_____

I certify that the equipment described above has been thoroughly cleaned and decontaminated of all chemical, biological and radioactive contaminants and also certify that the returned unit is safe for unprotected human contact.

By: _____ _____
Signature Print name

Title: _____ Date: _____

Company: _____

Address: _____
_____
_____

Phone: _____ Fax: _____ email: _____

Form 2847

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In touch with life

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