

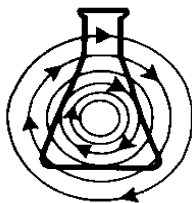


# Guide to Operations

## *innova*<sup>™</sup> 3100

### Digital Water Bath Shaker

MANUAL No. M1231-0050  
Revision J  
August 31, 2001



**NEW BRUNSWICK SCIENTIFIC CO., INC.**

BOX 4005 • 44 TALMADGE ROAD • EDISON, NJ 08818-4005

Telephone: 1-732-287-1200 • 1-800-631-5417

Fax: 732-287-4222 • Telex: 4753012 NBSCO

Internet: <http://www.nbsc.com> • E-mail: [bioinfo@nbsc.com](mailto:bioinfo@nbsc.com)

---



---

## INTERNATIONAL OFFICES:

### THE NETHERLANDS

New Brunswick Scientific BV  
Kerkenbos 1101, 6546 BC Nijmegen  
P.O Box 6826, 6503 GH Nijmegen  
Holland  
Tel: (0)24 3717 600  
Fax: (0)24 3717 640  
E-mail: sales@nbsbv.nl

### FRANCE (Toulouse)

New Brunswick Scientific SARL  
15, allées de Bellefontaine  
31100 Toulouse  
France  
Tel: (0)5 61 43 65 43  
Fax: (0)5 61 41 51 78  
E-mail: sales@nbsar.fr

### UNITED KINGDOM

New Brunswick Scientific (UK) Ltd.  
Edison House, 163 Dixons Hill Road  
North Mymms, Hatfield, Herts. AL9 7JE  
United Kingdom  
Tel: (0)1707 275733  
Fax: (0)1707 267859  
E-mail: bioinfo@nbsuk.co.uk

### CHINA (Beijing)

Room 8-3-B  
No. 1 Heng Fu Zhong Street  
Feng Tai District  
Beijing 100070  
P.R. China  
Tel: 10 6371 0167  
Fax: 10 6374 1107

### BELGIUM

New Brunswick Scientific NV/SA  
't Veldeke, 1  
B-1970 Wezembeek-Oppem  
België/Belgique  
Tel: (0)2 731 6787  
Fax: (0)2 731 8130  
E-mail: sales@nbsnv-sa.be

### GERMANY

New Brunswick Scientific GmbH  
In Der Au 14  
D-72622 Nürtingen  
Deutschland  
Tel: (0)7022 932490  
Fax: (0)7022 32486  
E-mail: sales@nbsgmbh.de

### CHINA (Shanghai)

Room 1406, Aijian No. 1 Bldg.  
Lane 590, WanPing (S) Road  
Shanghai 200030  
P.R. China  
Tel: 21 6481 2658  
Fax: 21 6481 2665  
E-mail: nbschc@online.sh.cn

**THIS PAGE INTENTIONALLY BLANK**

**CAUTION!**

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

**THIS PAGE INTENTIONALLY BLANK**

## Copyright Notice

New Brunswick Scientific Company, Inc.  
Box 4005 44 Talmadge Road  
Edison, New Jersey 08818-4005

© Copyright 2000 New Brunswick Scientific Co., Inc.

All Rights Reserved.

Reproduction, adaptation, or translation without prior written permission from

New Brunswick Scientific is prohibited.

## Disclaimer Notice

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

## Manual Conventions



**NOTE:**

**Notes contain essential information that deserves special attention.**



**CAUTION !**

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



**WARNING !**

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

**Bold**

**Text in bold face type emphasizes key words or phrases.**

**THIS PAGE INTENTIONALLY BLANK**





## WARRANTY

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

**THIS PAGE INTENTIONALLY BLANK**

# TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
<b>2</b>	<b>OVERVIEW &amp; FEATURES.....</b>	<b>3</b>
2.1	GENERAL DESCRIPTION .....	3
2.2	UNIVERSAL POWER CAPABILITY .....	5
2.3	CONTROL PANEL .....	6
2.3.1	<i>LED Display</i> .....	6
2.3.2	<i>User Interface Keys</i> .....	7
2.3.3	<i>Status Indicator Lights</i> .....	7
2.3.4	<i>Function Indicator Lights</i> .....	8
2.4	PLATFORM ASSEMBLIES .....	8
2.5	COOLING COIL OPTION.....	8
2.6	ACCESSORIES & OPTIONS.....	8
2.7	TRIPLE ECCENTRIC DRIVE .....	9
2.8	BEARINGS.....	9
2.9	MOTOR .....	10
2.10	ELECTRONIC BOARDS .....	10
<b>3</b>	<b>INSTALLATION &amp; SET-UP.....</b>	<b>11</b>
3.1	UNPACKING & INSPECTION .....	11
3.2	VOLTAGE CONFIGURATION .....	11
3.3	INSTALLATION.....	12
3.3.1	<i>Space Requirements</i> .....	12
3.3.2	<i>Hose Connections</i> .....	13
3.3.3	<i>Electrical Connections</i> .....	14
3.3.4	<i>Platform Installation</i> .....	15
<b>4</b>	<b>OPERATION.....</b>	<b>17</b>
4.1	STARTING THE INNOVA 3100.....	17
4.2	CONTINUOUS (UNLIMITED) RUN .....	17
4.3	CHECKING A SETPOINT .....	18
4.4	TIMED FUNCTIONS.....	18
4.4.1	<i>Setting the Timer</i> .....	18
4.4.2	<i>Cancelling the Timer</i> .....	19
4.5	ALARM FUNCTIONS .....	19
4.6	TEMPERATURE.....	19
4.6.1	<i>Setting the Temperature</i> .....	19
4.6.2	<i>Deactivating Temperature Control</i> .....	20
4.7	TEMPERATURE OFFSET CALIBRATION .....	20
4.8	TOTAL RUNNING TIME .....	21
4.9	MAINT INDICATOR LIGHT.....	22
4.10	WATER LEVEL CONTROL.....	22
4.11	LOW WATER LEVEL ALARM.....	23
4.12	DRAINING THE BATH .....	23
<b>5</b>	<b>MAINTENANCE &amp; SERVICE .....</b>	<b>25</b>
5.1	MAINTENANCE .....	25
5.2	CLEANING.....	25
5.3	CHANGING FUSES .....	26
5.4	CHANGING VOLTAGE.....	26

---

5.5	REPLACING/ADJUSTING THE MOTOR DRIVE BELT .....	27
5.6	REPLACING THE MOTOR ASSEMBLY .....	28
5.7	ACKNOWLEDGING THE MAINT INDICATOR .....	29
5.8	RECORDER ADAPTATION .....	29
5.9	RETROFITTING THE COOLING COIL OPTION .....	30
5.10	ESD PRECAUTIONS .....	32
5.11	REPLACING THE MAIN CONTROL BOARD .....	33
5.12	REPLACING THE TEMPERATURE CONTROL BOARD .....	34
5.13	SERVICE PARTS LIST .....	35
<b>6</b>	<b>SPECIFICATIONS .....</b>	<b>37</b>
<b>7</b>	<b>ACCESSORIES .....</b>	<b>39</b>
7.1	INTERCHANGEABLE PLATFORMS .....	39
7.2	INTERCHANGEABLE HALF-SIZE PLATFORMS .....	39
7.3	TEST TUBE RACKS FOR SUBPLATFORM .....	40
7.4	ACCESSORIES .....	40
7.5	ACCESSORY FLASK CLAMPS .....	40
7.6	CLAMP MOUNTING HARDWARE .....	41
7.6.1	<i>Hardware for 10 mL to 500 mL Clamps</i> .....	41
7.6.2	<i>Hardware for 1-Liter to 6-Liter Clamps</i> .....	41
<b>8</b>	<b>DRAWINGS .....</b>	<b>43</b>
8.1	CONTROL SCHEMATIC .....	43
8.2	INDEX OF DRAWINGS .....	44
<b>9</b>	<b>INDEX .....</b>	<b>45</b>

# 1 INTRODUCTION

*This Manual is intended to provide the user with a complete understanding of how the Innova 3100 Digital Water Bath Shaker operates, its basic components, and information about preventive maintenance and service issues. This manual also includes a complete guide to the installation and operation of the Innova 3100.*

*The manual is divided into three basic sections. Chapters 1-2 provide an overview of the Innova 3100, with all of its features and options. Chapters 3-4 detail the set-up, installation and operation of the instrument. Chapter 5 outlines troubleshooting and service procedures which should be utilized only by a qualified service engineer. Chapters 6-9 provide additional details of interest: specifications, lists of accessories and drawings. Finally, Chapter 10 is an index to important terms used in the manual.*

*It is recommended that you completely familiarize yourself with this manual, prior to actually operating the Innova 3100.*

The Innova 3100 Digital Water Bath Shaker will provide you with reliable and maintenance-free operation which is characteristic of all NBS shakers. The Innova 3100 is among the newest generation of NBS shakers and incorporates a variety of state-of-the-art components and features to permit the precision operation necessary for your exacting scientific experiments.

**THIS PAGE INTENTIONALLY BLANK**

---

## 2 OVERVIEW & FEATURES

### 2.1 *General Description*

The Innova 3100 is a shaker that incorporates a triple eccentric counterbalanced drive to provide horizontal plane rotary motion in a ½ inch (12.7 mm) circular orbit. A Proportional/Integral (PI) microprocessor controller with instantaneous digital feedback controls the speed over a range of 25-400 RPM. It also provides temperature control over a range of 5°C above ambient to 99.9°C. For lower temperatures an optional water bath cooling coil is available.

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

The Innova 3100 is equipped with audible and visible alarms which are activated when an alarm condition exists as follows:

- The end of a timed run
- Deviations of shaking speed or temperature outside of tolerance limits
- Low water level
- Water overflow

A wide variety of platforms can be used with the Innova 3100. Dedicated platforms are available for a variety of flask sizes. A Universal platform and test tube racks are also available. *(See Chapter 7 for accessories.)*

The Innova 3100 has a built-in water level control system which is infinitely adjustable over a wide range. To compensate for evaporation, water is automatically replenished to the preset level.

Additionally, the Innova 3100 has analog outputs for a chart recorder that will record speed and/or temperature. *See Chapter 5 for recorder adaptation.*

*See Figures 1 and 2 below for the front and rear views of the Innova 3100.*

Figure 1: Front View

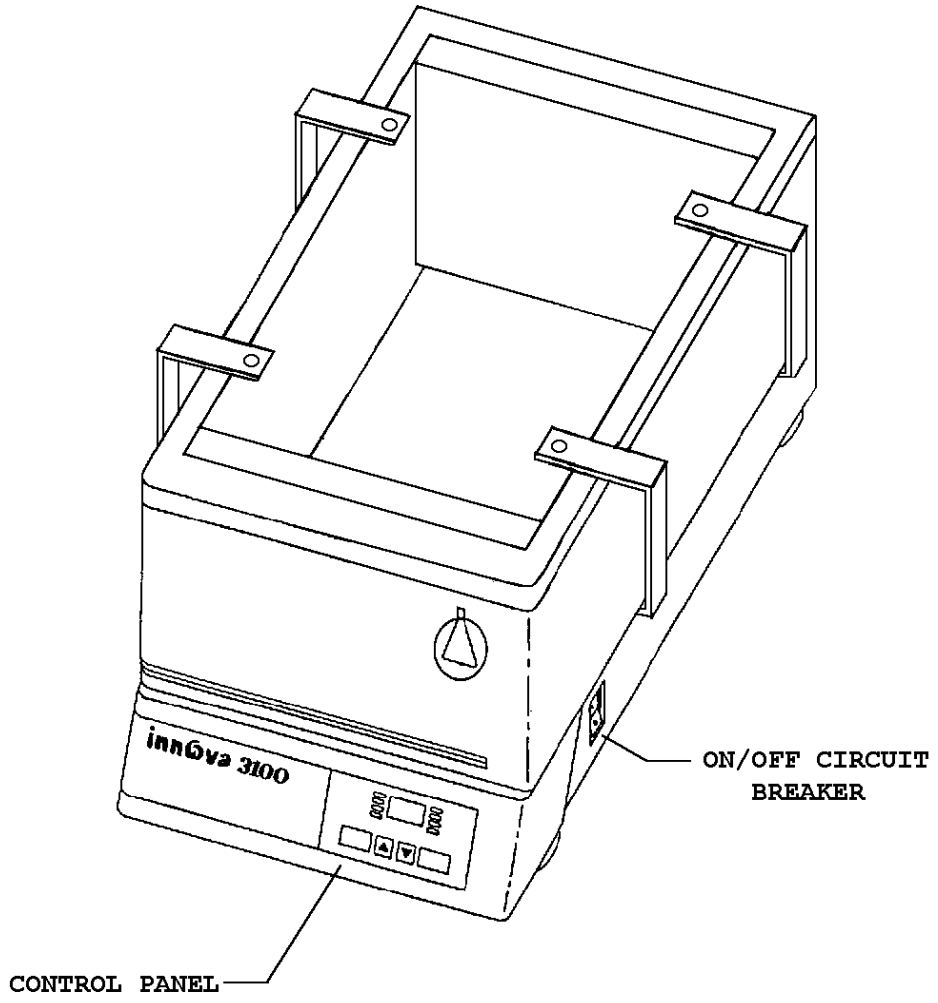
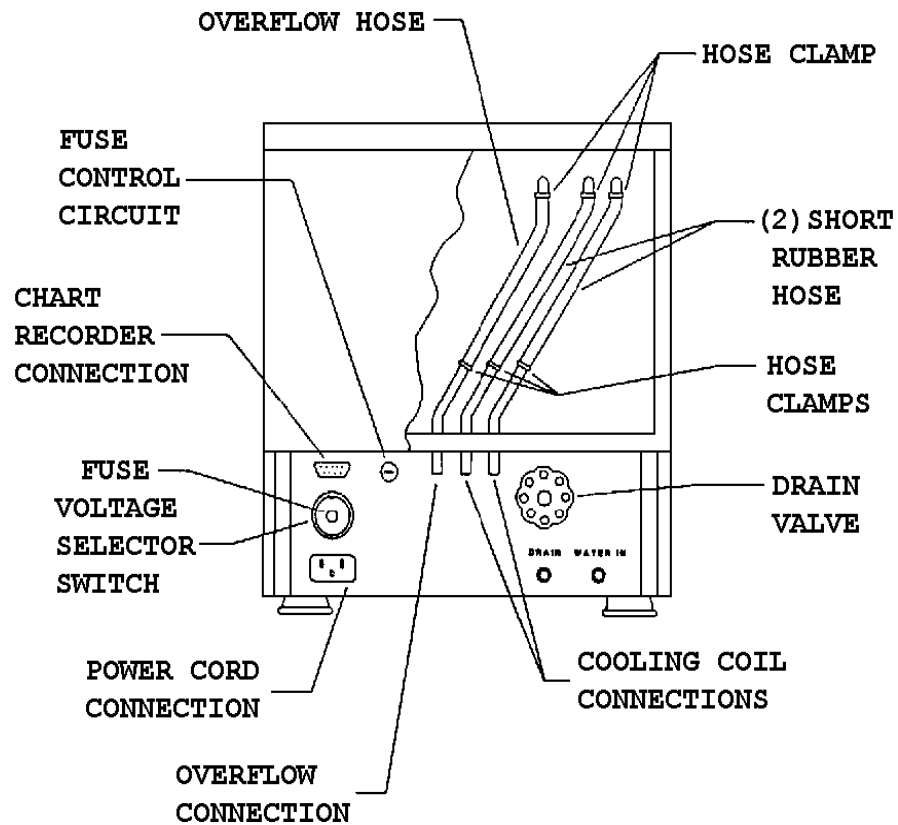




Figure 2: Rear View



## 2.2 *Universal Power Capability*

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



### **WARNING!**

**It is critical that you check the voltage settings before you plug the unit into a power source. See Section 3.2.**

## 2.3 Control Panel

The control panel (*see Figure 3 below*) is located on the front of the instrument. It serves as the operator interface. The keypad has four keys marked **START/STOP**,  $\Delta$ ,  $\nabla$ , and **SELECT**. A three-digit LED display provides numeric values as well as some letter codes. There are four **function indicators** and four **status indicator** lights on the control panel as well. A general description of the display, user interface keys and indicators follows.

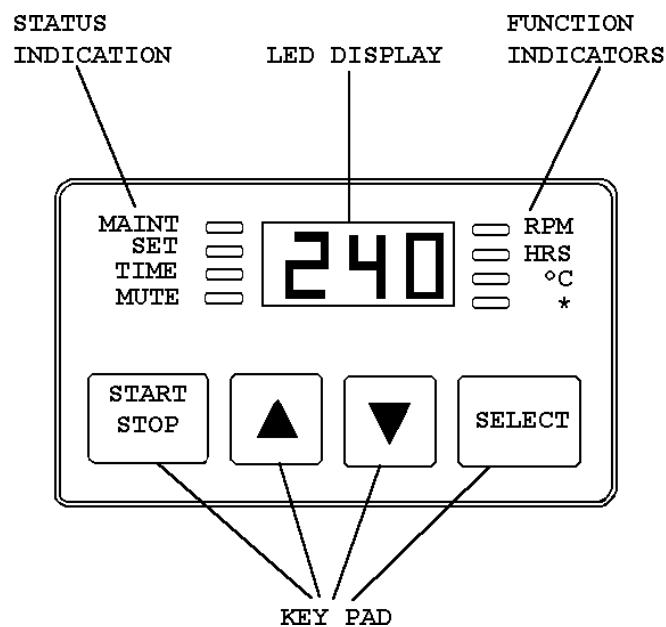
For operation of the control panel, *see Chapter 4*.

### 2.3.1 LED Display

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

- Shaker status (on/off)
- Shaking speed
- Setpoints
- Hours remaining (timed run)
- Measured temperature
- Low water level

**Figure 3: Control Panel**



---

### 2.3.2 User Interface Keys

- **START/STOP**  
This key is used to start or stop the shaking motion. It will also activate or stop the timer when a timed run is desired.
- **SELECT**  
This key is used to change the displayed parameter.
- **Δ, ∇**  
These keys are used to adjust the setpoint of a displayed parameter up or down. They also allow the user to enter the SET mode for setpoint changes.

### 2.3.3 Status Indicator Lights

There are four status indicator lights, located to the left of the LED display:

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

### 2.3.4 **Function Indicator Lights**

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

- **RPM**           Revolutions per minute
- **HRS**           Time remaining
- **°C**             Current Temperature
- **\***               Low Water Level

### 2.4 ***Platform Assemblies***

The Innova 3100 can be used with a wide variety of NBS 12 inch x 16.5 inch platforms which will accept a variety of clamps for flasks and test tubes. Additionally, a subplatform is available to adapt half platforms for flasks and test tubes used on the NBS Model G86 Aqua Therm Water Bath Shaker.

### 2.5 ***Cooling Coil Option***

The Innova 3100 can be ordered with a cooling coil factory-installed. The cooling coil provides the ability to operate at temperatures below ambient.

### 2.6 ***Accessories & Options***

The following accessories are available for use with your Innova 3100:

- Gable Cover (plexiglass or stainless steel).
- Portable cart or space saving dolly.

For operation below ambient temperature, the following kits are available for retrofit (by an NBS-authorized service technician only):

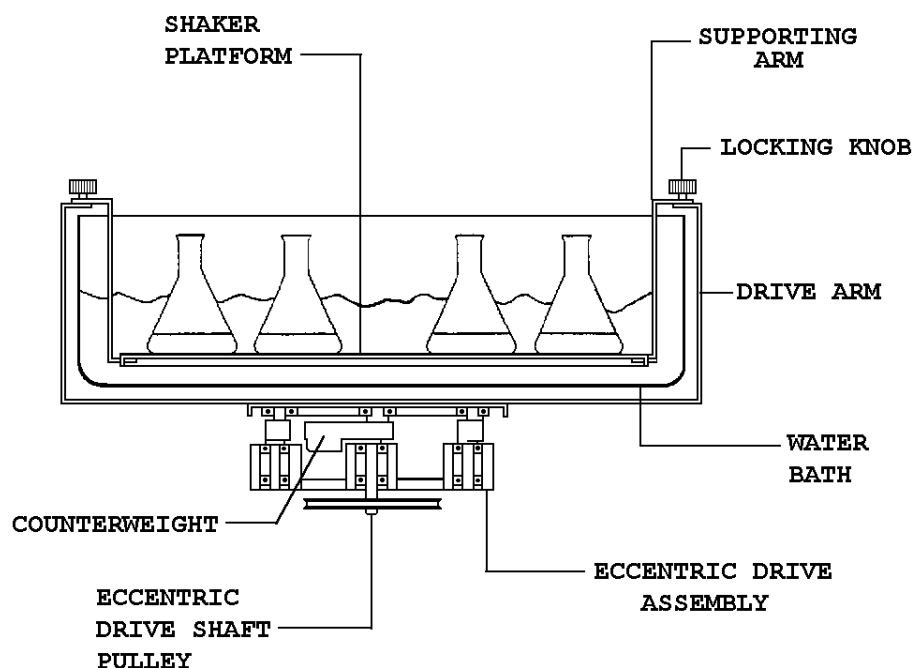
- Cooling coil kit.
- Coolant Circulating System.

## 2.7 Triple Eccentric Drive

The Triple Eccentric Drive (see Figure 4 below) used in the Innova Shakers employs the same proven technology which has driven New Brunswick Scientific's shakers for over 30 years.

This drive mechanism utilizes a counterweight system to stabilize the rotary motion produced during operation. When the workload moves in one direction, opposing forces are generated to stabilize the shaker. This action will help eliminate the problem of "walking" which may occur with less precisely balanced instruments. Vibration is minimized and the life of the unit is extended.

**Figure 4: Counterbalanced Drive Mechanism**



## 2.8 Bearings

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

## **2.9      *Motor***

The Innova 3100 Shaker uses a 3-phase brushless ball bearing DC motor. This low profile motor provides high torque along with quiet, efficient operation and low maintenance. This motor has a rating of 1/15 horsepower.

## **2.10     *Electronic Boards***

The main control board for the Innova shaker has the following functions:

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

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

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

## 3 INSTALLATION & SET-UP

*The Innova 3100 is a versatile instrument that can be operated in a continuous fashion or set for a timed run. The following section describes set up and installation procedures.*

### 3.1 Unpacking & Inspection

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

### 3.2 Voltage Configuration

Determine the voltage of your unit by checking the voltage selector and label on the rear of the unit. Confirm that the correct electrical service package is included with the unit by comparing the part number on the electrical service package to the following table (*also see Chapter 5*).



#### **WARNING!**

**It is critical that you check the voltage settings before you plug the unit into a power source.**

**Confirm that the Voltage setting is correct by checking the voltage setting on the Voltage Selector Switch and the CAUTION label located over the power cord connection (see Figure 2).**

In addition to checking the voltage of your unit as indicated in the WARNING above, be sure to confirm that the correct electrical service package is included with the unit. Compare the part number on the electrical service package to the following table:

<b>Voltage Configuration Table</b>		
<b>Innova 3100 Catalog #</b>	<b>Voltage</b>	<b>Electrical Service Package</b>
M1231-0001	100V 50/60Hz	M1195-0350
M1231-0000	120V 50/60Hz	M1195-0350
M1231-0002	220V 50/60Hz	M1195-0360
M1231-0003	240V 50/60Hz	M1195-0360

**NOTE:**

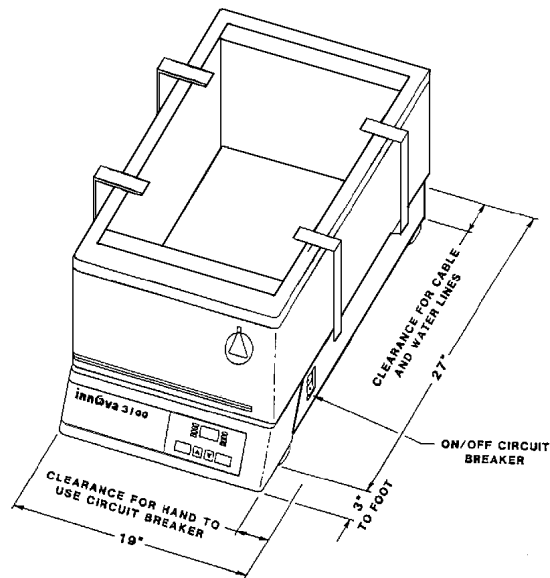
Use of the Innova shakers requires a platform, which is a separate item. Available platforms are listed in Chapter 7.

### 3.3 Installation

#### 3.3.1 Space Requirements

It is essential that the instrument be situated in an area where there is sufficient space for the shaker and service lines (*see Figure 5 below*).

**Figure 5: Space Requirements**



The outside dimensions of the Innova 3100 are:

	<b>Inches</b>	<b>Centimeters</b>
<b>Width</b>	19½	43.2
<b>Depth</b>	27½	69.9
<b>Height</b>	17	36.8



The effective surface area required for operation is:

	<b>Inches</b>	<b>Centimeters</b>
<b>Width</b>	21½	48.3
<b>Depth</b>	30	76.2

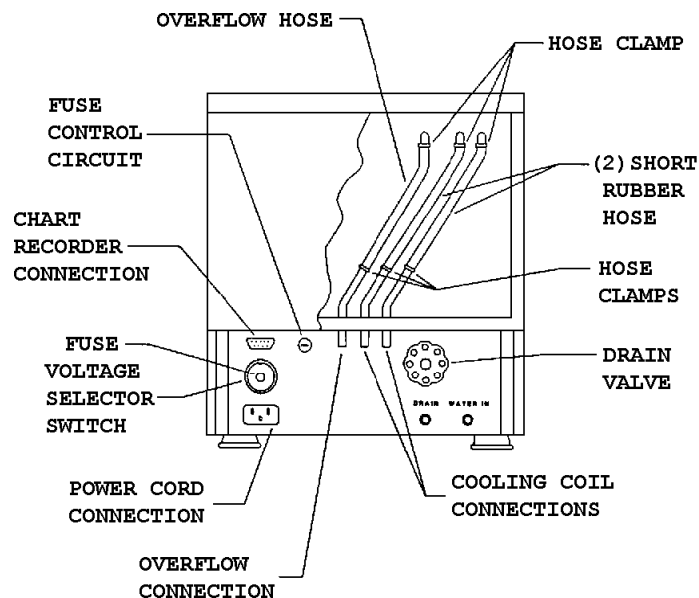
### 3.3.2 Hose Connections

A ½ inch diameter reinforced hose is provided for water addition and drainage. Cut the hose into two lengths, to suit the distances from the water source to the machine.

Install the hosing as follows, using Figure 6 below for reference:

1. Connect one length of ½ inch hose to the WATER IN FITTING.
2. Connect the other length of ½ inch hose to the DRAIN FITTING.
3. Clamp the hoses with the clamps provided.
4. Connect the “WATER IN” hose to a water supply with a maximum water pressure of 100 psi. The drain hose must go to an OPEN drain.
5. Attach the smaller diameter (3/8 inch) hose to the overflow tube, and run it to an OPEN drain.

**Figure 6: Hose Connections**



The overflow tube is the farthest left of the three tubes that project down from the back of the bath. The other two tubes are used only when the cooling coil option is installed.

**NOTE:**

To minimize the development of rust inside the waterbath:

- If you are using tap water in the bath, make sure the water has a low iron content.
- If you are using distilled water, mix it with a small amount of tap water and/or add dissolved salts. Any ultra-pure (distilled, de-ionized or reverse osmosis) water tends to leach the iron from the stainless steel, encouraging oxidation.

If the cooling coil option is factory-installed in your unit, an additional 16-foot reinforced rubber hose is provided, with corresponding clamps, for connection to the coolant or water supply. To install the hose:

1. Cut the hose into two pieces to suit a water supply and drain length requirement.
2. Attach each of the two hoses to the cooling coil connection tubes with clamps, allowing 1/8 - 3/16 inch of hose to extend beyond the clamps.
3. One line must go to an open drain or return to a coolant supply; the other line must be connected to a water or coolant supply.

**NOTE:**

If you are using tap water as coolant for the unit, it is preferable that the supply hose be attached to a supply valve, to minimize water use.

**3.3.3****Electrical Connections****CAUTION!**

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

1. If you have not already done so, check the voltage selector switch at the rear of the unit to be sure that it is set to the appropriate voltage.
2. Remove the caution label from the rear of the unit.
3. Set the circuit breaker on the right side of the unit to the OFF position.

**ONLY THEN:**

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

**CAUTION!**

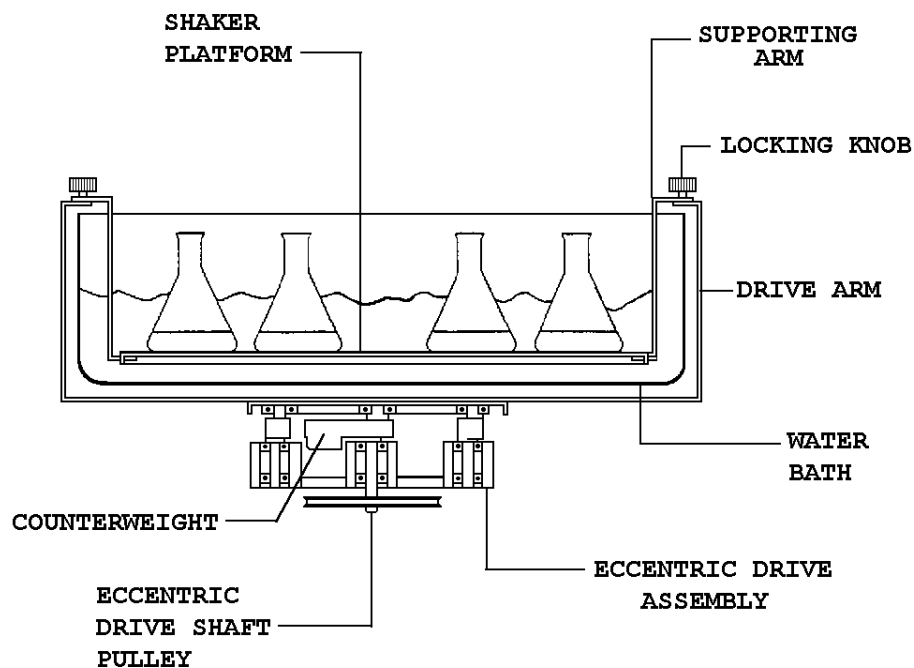
A grounded electrical outlet is necessary for the safe operation of this instrument.

### 3.3.4 Platform Installation

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

1. Make sure the circuit breaker on the right side of the unit is set to the OFF position.
2. Place platform assembly on top of the drive arms (*see Figure 7 below*).
3. Install each of the four locking knobs, through the support, into drive arms.
4. Tighten all four locking knobs.

**Figure 7: Platform Installation**



**THIS PAGE INTENTIONALLY BLANK**

## 4 OPERATION

### 4.1 Starting the Innova 3100

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



#### **NOTE:**

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

Press the **SELECT** key until the RPM indicator lights. If the shaker is running, the LED display will track the speed as it accelerates to the last entered speed setpoint.

The shaking action may be stopped or started by pressing the **START/STOP** key.

### 4.2 Continuous (Unlimited) Run

To set up a continuous run:

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



#### **NOTE:**

**Holding the  $\Delta$  or  $\nabla$  key down will cause the setting to change more rapidly.**

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

### 4.3 *Checking a Setpoint*

To check any setpoint:

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



#### **NOTE:**

**Holding the  $\Delta$  or  $\nabla$  key down for more than 0.5 second will cause the speed, time or temperature setpoint to change. Should this occur, resetting will be necessary.**

### 4.4 *Timed Functions*

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

#### 4.4.1 **Setting the Timer**

To set the timer:

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

#### 4.4.2 Cancelling the Timer

To cancel the timer WITHOUT stopping the shaker:

1. Press the **SELECT** key to light HRS.
2. Set the time by pressing the  $\Delta$  or  $\nabla$  key until the desired setpoint is displayed (0.1 - 99.9 hours).
3. While the SET LED is lit, press the **START/STOP** key. The TIME indicator will go out and the display will read "Off".

#### 4.5 Alarm Functions

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

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

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

#### 4.6 Temperature

This control consists of an internal electrical interface, an RTD temperature probe, and an analog output for chart recorder or computer. The temperature probe is in the water bath. The temperature can be set from 5.0°C above ambient to 99.9°C.

##### 4.6.1 Setting the Temperature

To set the temperature setpoint:

1. Press the **SELECT** key until the function indicator lights on the °C mode.



#### **NOTE:**

**For temperatures above 50°C, the stainless steel gable cover (see Chapter 7 for the part number) is required to minimize heat loss.**

2. Increase or decrease the setpoint by pressing the  $\Delta$  or  $\nabla$  key.

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

#### 4.6.2 Deactivating Temperature Control

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

To deactivate the temperature control system:

1. Press and hold the  $\nabla$  key until the setpoint is at 4.0°C.
2. While holding the  $\nabla$  key, simultaneously press the START/STOP key. The temperature setpoint display shows “Off” and the heater (and the cooling coil, if present) will be deactivated.

To reactivate the temperature control:

- Press the  $\Delta$  key until the desired temperature setpoint is displayed.



#### **NOTE:**

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

#### 4.7 *Temperature Offset Calibration*

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



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

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

1. Let the unit equilibrate at or near the desired temperature. Record the Indicated Temperature.
2. Record the Actual Temperature.
3. Calculate the temperature correction value: Actual Temperature – Indicated Temperature = Temperature Correction Value.
4. Press the **SELECT** key until the °C function indicator illuminates.
5. **Simultaneously** press the  $\Delta$  and  $\nabla$  keys. The SET and MAINT indicators will light.
6. While the SET and MAINT indicators are illuminated, use the  $\Delta$  or  $\nabla$  key to set the display to the calculated Temperature Correction Value.



#### **NOTE:**

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

To return to the factory calibration:

1. Press the **SELECT** key until the °C function indicator illuminates.
2. Simultaneously press the  $\Delta$  and  $\nabla$  keys. The SET and MAINT indicators will light.
3. While the SET and MAINT indicators are illuminated, press the **START/STOP** key.

## **4.8 Total Running Time**

The control module of the Innova Shaker totals the time the shaker has been “ON” to track hours of usage.

To display the accumulated running time:

1. Select HRS using the **SELECT** key.
2. **Simultaneously** press the  $\Delta$  and  $\nabla$  keys.

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

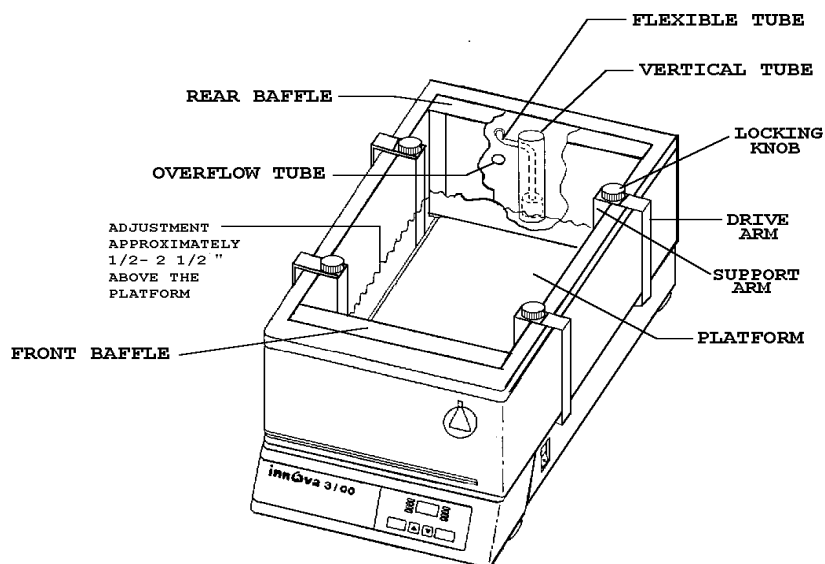
#### 4.9 **MAINT Indicator Light**

After 10,000 hours of operation, the MAINT indicator will light. Preventive maintenance is recommended at this point. The light can be deactivated by NBS service personnel. Alteration of the internal clock by unauthorized personnel will void the warranty.

#### 4.10 **Water Level Control**

The unit is equipped with an automatic water level control that is infinitely variable from approximately  $\frac{1}{2}$  inch to  $2\frac{1}{2}$  inches above the platform level. For proper operation of the water level control system, the drain valve on the rear panel (see *Figure 2 or 6*) must be closed and the external water supply must be on. Naturally, the power must also be on.

**Figure 8: Water Level Control**



The level control maintains a water level slightly above the platform. To adjust the water level:

1. Make sure the power is ON.
2. Remove the rear baffle (*see Figure 8 above*) by lifting it straight up and away. The level control is exposed.
3. Note the position of the water level and decide whether the desired level is higher or lower.
4. To raise the water level, note the position of the flexible tube graduations (these graduations and markings are for reference only).
5. Lift the tube up and push the excess tubing through the rear wall of the tank. As you raise the control, the solenoid will open and water will fill the bath until the new water level is established.
6. To lower the water level, feed the flexible tube back into the vertical stainless steel tube. The drain valve should then be opened. Close the drain valve when you hear the solenoid valve operating.
7. When the water level set is satisfactory, replace the rear baffle.

#### **4.11 Low Water Level Alarm**

To prevent heating when there is no water in the bath, the unit is provided with a safety circuit to ensure that the heater will not activate if no water is present. The \* (Low Water Level) indicator will flash and the audible alarm will sound. The \* indicator will also light if the water level is below the minimum setting.

When the water level alarms are activated, check to be sure that:

- the “Water In” hose is properly in place
- the supply valve is open
- the drain is closed.

When the condition is corrected, the alarms deactivate in approximately 10 seconds.

#### **4.12 Draining the Bath**

To drain the water bath, turn off the external water supply and open the unit’s drain valve (*on the rear panel--see Figure 2 or 6*), after verifying that the drain hose is properly connected to the unit and empties into an open drain.

**THIS PAGE INTENTIONALLY BLANK**

## 5 MAINTENANCE & SERVICE

*The following section describes basic cleaning and maintenance instructions for the user. There are also troubleshooting and service procedures, and instructions to install optional features. **These must be performed by a qualified service technician or engineer.***



### **WARNING!**

**Before cleaning the instrument, and before a qualified Service Engineer performs any maintenance or service procedures, be sure to turn the power off (using the ON/OFF switch on the side). Also disconnect the power cord.**

### 5.1 Maintenance

The Innova Shaker requires no routine mechanical maintenance on the part of the user. The MAINT indicator light goes 10,000 operating hours after the unit was last serviced. At that time, contact your local NBS Service Engineer or call the NBS Service Department at 1-800-631-5417 (within the United States). This periodic maintenance will keep your unit in premium condition.

### 5.2 Cleaning

As most water contains minerals that will deposit on the inside surfaces of the water bath, the unit should be drained and flushed on a weekly basis. Mild household or laboratory detergents can be used in the tank. To remove any caked buildups on the stainless steel surfaces, a **plastic** scouring pad (such as Scotchbrite) may be used. This can be used also to remove scratches from the stainless steel.

The outside painted surface can normally be cleaned with a damp cloth; if necessary, standard household or laboratory cleaners may be used. **Do not use other abrasive or corrosive compounds to clean this instrument**, as they may damage the unit and void the warranty.



### **NOTE:**

**To minimize the development of rust inside the waterbath, do not use steel wool or other abrasive pads to clean the stainless steel bath.**

**WARNING!**

None of the following procedures should be attempted by anyone who is not a qualified Service Engineer or Technician.

The ON/OFF switch must be turned off and the power cord disconnected prior to beginning any of these procedures.

### 5.3 Changing Fuses

The unit is designed with a circuit breaker, which is used as an **ON/OFF** switch. There are two fuses on the rear of the unit. One is to protect the control circuitry and the other is to protect the motor circuit. The motor circuit fuse is mounted in the center of the Voltage Selector Switch.

To remove either fuse:

1. Insert a small, flat-bladed screwdriver and turn counter-clockwise until it disengages and the fuse holder springs free.
2. Check the fuse. If it has failed, replace it with a like fuse as identified in the Spare Parts List (*see Section 5.13*). Spare fuses are supplied with the unit.

### 5.4 Changing Voltage

Innova Shakers are set to the appropriate line voltage prior to shipment. The voltage selector switch (*see Figure 2 or 6*), however, is a universal power-entry device which can be reset to adapt to worldwide power requirements.

If it becomes necessary to set the unit to a different voltage, use the following procedure.

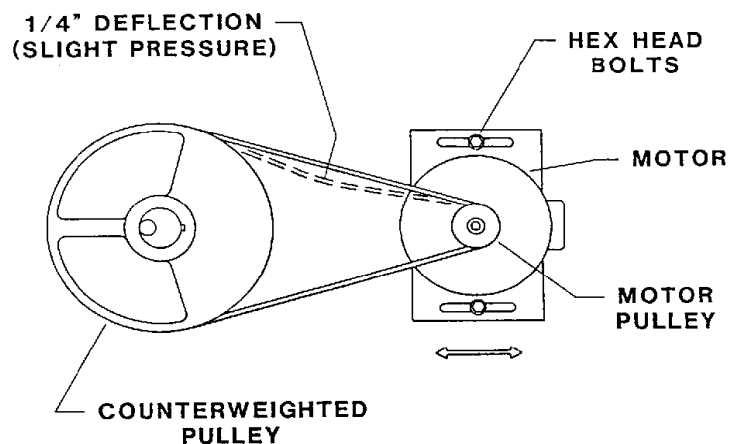
1. Set the **ON/OFF** switch (located on the right side of the unit) to OFF.
2. Disconnect the unit from the power source.
3. Using a small, flat-bladed screwdriver, rotate the center portion of the switch until the fuse is disengaged. Remove the fuse.
4. Using a larger flat-bladed screwdriver or a small coin, rotate the center portion of the switch to the desired voltage. The indicator is at the top of the switch.
5. Replace the fuse and holder.
6. Check that the proper power cord is available for the voltage selected.
7. Plug the power cord into the power cord connection on the unit and the power source.
8. Set the **ON/OFF** switch to the ON position. The unit is ready for operation.

## 5.5 Replacing/Adjusting the Motor Drive Belt

To replace or adjust the motor drive belt:

1. Drain the water out of the bath.
2. Turn off the power and remove the power cord.
3. Lay the unit on its left side, using a soft pad to protect the finish.
4. Remove the bottom cover using a Phillips (+) screwdriver. Retain the screws for reuse.
5. Rotate the large pulley (see Figure 9 below) and exert a light pressure to the belt so the belt feeds out of the pulley groove.

**Figure 9: Belt Replacement & Adjustment**



6. Install a new belt by feeding it onto the motor pulley and guiding it onto the large pulley while rotating the large pulley.



**CAUTION!**

**Be sure to keep fingers clear to avoid pinching them between the belt and pulley.**

7. Check the belt tension with a light side pressure near the center of the belt. It should deflect approximately  $\frac{1}{4}$  inch (6.4 mm). If adjustment is needed, loosen the two bolts holding the motor plate and move the plate to either loosen or tighten the belt. Tighten the bolts when the adjustment is correct.
8. Replace the bottom cover, tightening the Phillips head screws.
9. Connect the power cord.
10. Set the circuit breaker to the "ON" position.

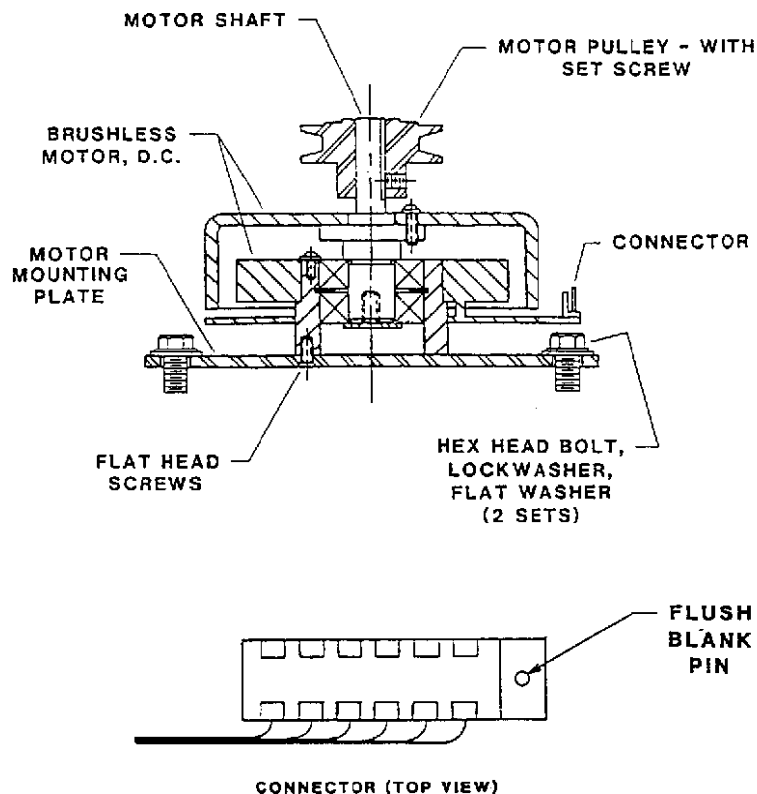
The unit is ready for operation.

## 5.6 Replacing the Motor Assembly

To replace the motor assembly:

1. Drain the water out of the bath.
2. Turn off the power and disconnect the power cord.
3. Lay the unit on its left side, using a soft pad to protect the finish.
4. Remove the bottom cover using a Phillips (+) screwdriver. Retain the screws for reuse.
5. Referring to *Figure 10 below*, remove the connector from the motor by lifting straight up.

**Figure 10: Motor Assembly Replacement**



6. Remove the #8-32 nut, lock washer and ground lug from the motor plate.
7. Remove the two hex head bolts and washers, then lift out the motor and plate assembly.
8. Separate the motor from the plate by removing the three flat head screws. Save the hardware.
9. Loosen the pulley set screw and remove the pulley from the shaft. Save the pulley.



10. Mount the new motor (part #M1195-4000) to the motor plate with the three flat head screws (from step 8).
11. Replace the pulley. Screw the set screw to the shaft flat, but do not tighten.
12. Position this assembly back onto the unit. Replace the two hex head bolts with their associated hardware, but do not tighten.
13. Replace the belt. Adjust the motor pulley height so that the belt is level as related to the drive pulley, then tighten the set screw.
14. Adjust the belt tension as shown in *Figure 9*, then tighten the two hex head bolts.
15. Rotate the large pulley by hand and see that the belt tracks smoothly.
16. Replace the motor connector. Be sure the motor connector is positioned (with the pin visible) as shown in *Figure 10*.
17. Reinstall the ground lug, lock washer and #8-32 nut onto the stud on the motor plate.
18. Reinstall the bottom cover with its Phillips head screws.
19. Reconnect the power cord to the unit and to the power source.
20. Set the **ON/OFF** switch to the ON position.

The unit is ready for operation.

### **5.7      *Acknowledging the MAINT Indicator***

After the shaker has been operating for 10,000 hours accumulated running time (initially, or since the previous maintenance check), the MAINT indicator light on the control panel will light. Only an NBS service engineer can turn it off.

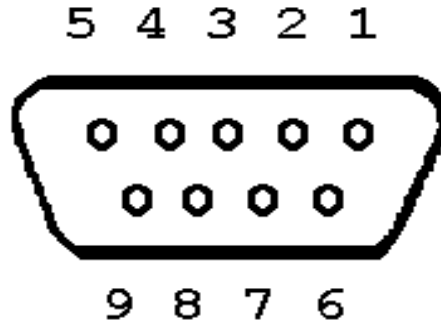
The MAINT light indicates that it is time for a routine maintenance check. A regular schedule of routine maintenance is an excellent way to keep your valuable equipment performing optimally for years of reliable service.

### **5.8      *Recorder Adaptation***

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

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

Figure 11: Recorder Connector



 **NOTE:**

The figure above is the pin-out diagram, as seen from the rear of the unit. The chart below identifies the pin application and scale.

<i>Pin #</i>	<i>Signal Name</i>	<i>Scale</i>
6	Speed	1V = 100 rpm
2	Ground	
7	Temperature	1 V = 20° C
3	Ground	

### 5.9 *Retrofitting the Cooling Coil Option*

The cooling coil option provides the ability to control temperatures below ambient in the Innova 3100. Control can be maintained at a temperature of 5°C or more above the coolant temperature.

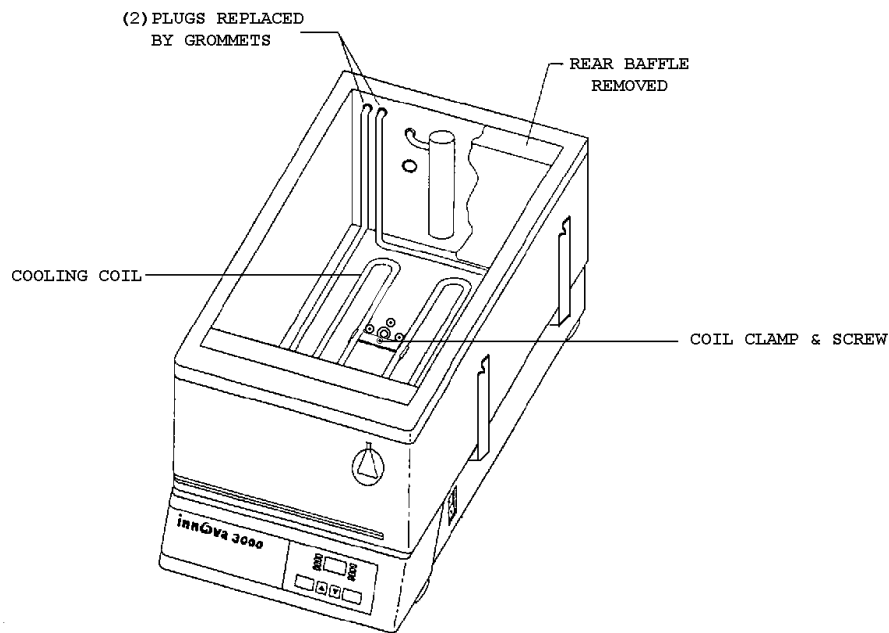
Check the parts in the Cooling Coil Kit to be sure you have everything you need:

<b><i>Cooling Coil Kit (part #M1231-9920)</i></b>	
<b>Quantity</b>	<b>Part Description</b>
1	Stainless steel serpentine coil
1	Coil clamp
2	Short rubber hoses
2	Stainless steel screws
2	Stainless steel lock washers
8	Hose clamps
16 feet	Reinforced rubber hose
2	Rubber grommets

To install the cooling coil kit:

1. Drain the water bath.
2. Turn the power OFF and disconnect the power cord.
3. Referring to *Figure 12 below*, remove the rear baffle by lifting straight up. The baffle will disengage from the retaining clips.

**Figure 12: Cooling Coil Installation**



4. Remove the rear panel by removing the three screws on the lower edge of the panel, then slipping the panel down and away from the unit.
5. Remove the two plugs from the rear upper left side of the tank by prying them out with a flat-bladed screwdriver or knife blade.
6. Remove the platform assembly.
7. Slip the two grommets into the holes where the plugs were.
8. Angle the ends of the coil so they slide through the grommets, then lower the coil so that it centers around the drain in the tank.
9. Snap the coil clamp over the coil so that the formed ends of the bracket face the top of the tank.
10. Remove one screw from the drain port at the bottom of the tank.
11. Insert the cooling coil screws with their lock washers (*see figure 12*); tighten in place with a Phillips (+) screwdriver.
12. Now facing the rear of the unit, slip one end of each of the two short rubber hoses over the coil ends.
13. Slide two hose clamps over each hose and slip each free end of the hoses onto the upper two stainless pipes to the right (from the rear) side of the manifold.

14. Slide the four hose clamps to the ends of the hoses, allowing 1/8 inch to 3/16 inch of hose to extend beyond the clamps. Tighten the four clamps securely.
15. Cut the 16-foot hose into two pieces to suit the water supply and drain length requirement.
16. Attach the two long hoses to the cooling coil tubes with two clamps, allowing 1/8" to 3/16" of hose to extend beyond the clamps (*see figure 2*). One line must go to an open drain or return to a coolant supply, and the other line must be connected to a water or coolant supply.

**NOTE:**

**If tap water is the coolant, it is preferable that the supply hose be attached to a supply line with a control valve, to minimize water use.**

17. Reinstall the rear baffle and mount the platform.
18. Check for leaks, then reinstall the rear panel.

To operate the cooling coil:

1. Turn on the coolant (or water) supply to the cooling coil.
2. Set the temperature control to the desired temperature below ambient.

The heater incorporated in the Innova 3100 will maintain accurate temperature control at any temperature 5°C or more above the coolant temperature.

**WARNING!**

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

**Integrated circuits are extremely susceptible to damage from electrostatic discharge. The Service Engineer or Technician should read and follow the ESD Precautions below before undertaking any work.**

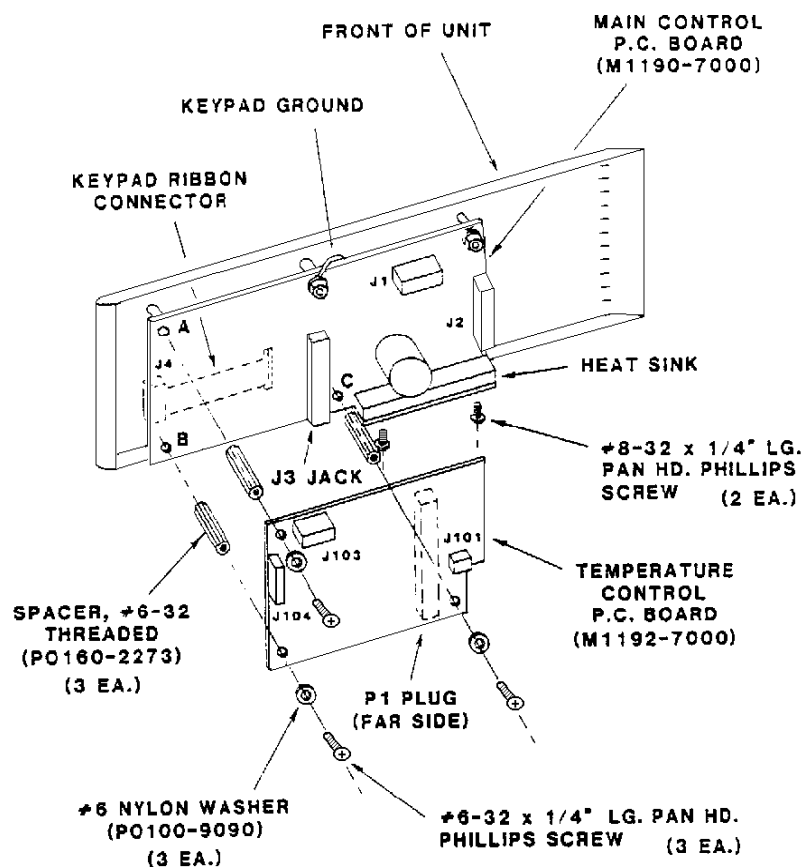
**5.10 ESD Precautions**

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

### 5.11 Replacing the Main Control Board

1. Switch the shaker OFF and disconnect the power cord.
2. Remove the five screws that hold the front panel (two screws on the sides and three on the bottom), and allow the front panel to lie on its face.
3. Remove the temperature control board:
  - a. Disconnect the harness wiring from connectors J101, J102, J103 and J104 (see *Figure 13 below*).
  - b. Remove the three 1/4" screws, the two nylon flat washers and the temperature sensor ground lug.
  - c. Disconnect the temperature control board from the main control board, being careful not to damage the board-to-board connectors. Apply force perpendicular to the plane of the board. **Do not lift from one end.**

**Figure 13: Control Board Replacement**



4. Disconnect the harness wiring from connectors J1 and J2.
5. Remove the three hex spacers and 2 5/16 inch hex nuts.
6. Remove the green wire and keypad ground lead.

7. Remove the two screws that fasten the heat sink to the front panel bracket.
8. Lift the board out of the front panel and disconnect the keypad connector from J4.

**NOTE:**

**Be careful not to lose the five ¼ inch spacers or the gray insulator.**

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

### **5.12 Replacing the Temperature Control Board**

1. Switch the shaker OFF and disconnect the power cord.
2. Remove the five screws that hold the front panel (two screws on the side and three on the bottom); allow the front panel to lie down on its face.
3. Disconnect the harness wiring from connectors J101, J102, J103 and J104 (*see Figure 13 above*).
4. Remove the three ¼ inch screws, the two nylon flat washers and the temperature sensor ground lug.
5. Disconnect the temperature control board from the main control board, being careful not to damage the board-to-board connectors. Apply force perpendicular to the plane of the board. **Do not lift from one end.**
6. Snap the new temperature control board onto the main control board, making sure the board-to-board connectors mate properly.

7. Reinstall one ¼ inch screw and the temperature sensor ground lug at the corner near J103. Reinstall the two remaining ¼ inch screws and nylon flat washers.
8. Reconnect the harness wiring to connectors J101, J102, J103 and J104. Make sure that each connector is properly positioned (keys mate and no pins remain exposed).
9. Replace the front panel and secure with the five screws.
10. Connect the power cord to the rear of the shaker.

### 5.13 Service Parts List

<b>NBS Part Number</b>	<b>Description</b>	<b>Quantity</b>
P0380-3320	0.125A Fuse (Low Voltage)	1
P0380-3410	1.0A Fuse (Selector Switch)	1
P0420-1610	10VA Transformer	1
M1190-5300	80VA Transformer	1
P0320-0350	2100uF Capacitor	1
P0460-4091	Diode Bridge	1
P0360-4040	130V Varistor	2
M1195-4000	Medium Motor Assembly	1
M1190-9940	Main Control P.C.B.	1
M1192-7000	Temp. Control P.C.B.	1
M1190-5000	Membrane Sw. Panel	1
P0400-0980	Voltage Selector Switch	1
P0400-4330	10A Circuit Breaker	1
P0400-3011	10A Solid State Relay	1
P0400-2751	Relay	1
P0620-1370	500W Heater	2
M1195-3020	Float Switch Assembly	1
P0220-0055	Solenoid Valve	1
M1195-8000	RTD Assembly	1
P0460-2090	Snubber-Quencharc	1
P0720-2024	Power Cord 120V 15A	1
P0720-2021	Power Cord 220V	1
M1190-6340	Bearing Assembly	3
P0180-0101	Bearing, Shielded (6 Lower Hsg., 2 Motor)	8
P0700-5302	Belt	1
M1231-6330	Bearing Housing Assembly	1
M1195-9420	Tank Gasket	1

**THIS PAGE INTENTIONALLY BLANK**



## 6 SPECIFICATIONS

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

<b>SHAKING</b>	
<b>Speed</b>	25-400 RPM
<b>Motion</b>	½ inch (12.7 mm) diameter circular orbit
<b>Indication</b>	LED digital electric display, 1 RPM increments
<b>Setpoint &amp; Control</b>	Digital adjustment with PI microprocessor control and instantaneous visual feedback
<b>Accuracy</b>	± 1 RPM
<b>DRIVE</b>	
Triple eccentric counterbalanced ball bearing drive.	
<b>TEMPERATURE</b>	
<b>Range</b>	5.0°C above ambient to 99.9°C
<b>Range with Cooling Option</b>	5.0°C above coolant temperature to 99.9°C
<b>Control Stability</b>	± 0.1°C by use of PI microprocessor controller and pulse width modulation of heater
<b>Setpoint</b>	Digital adjustment increments (0.1°C increments) with instantaneous visual feedback
<b>Accuracy</b>	± 0.1° @ 30-40°C range ± 0.50°C for remaining range
<b>Uniformity</b>	Better than 0.5°C
<b>Safety</b>	Heater shuts off if temperature exceeds operating range. Two safeties provided.
<b>Heater</b>	Low watt density resistance mat heater
<b>TIMER (Shaker)</b>	
<ul style="list-style-type: none"> <li>• Programmable shaking periods from 0.1 hour to 99.9 hours by a digital timer that shuts off at the end of period and energizes status light.</li> <li>• Timer counts down and digital display indicates remaining time. Can be deactivated for continuous operation.</li> <li>• Additionally, unit will display total accumulated running time for service information.</li> </ul>	
<b>AMBIENT OPERATING ENVIRONMENT</b>	
0° - 40°C, 90% humidity, non-condensing	
<b>SELF-DIAGNOSTIC STATUS</b>	
Warning signal (audible and visible) indicates when shaking speed deviates more than 5 RPM or the temperature deviates more than 1.0°C from setpoint and when timer operation has expired. The audible alarm can be deactivated/activated by the operator.	
<b>REMOTE MONITORING</b>	
<ul style="list-style-type: none"> <li>• Chart recorder outputs for speed and temperature (0-5V).</li> <li>• 1V per 100 RPM; 1V per 20°C, accuracy ± 25mV.</li> </ul>	

<b>AUTOMATIC RESTART</b>		
<ul style="list-style-type: none"> <li>• Unit will automatically restart after undesired power interruption.</li> <li>• Setpoints are maintained by non-volatile memory.</li> <li>• Interruption is indicated by a flashing display.</li> </ul>		
<b>MOTOR</b>		
1/15 HP, 3-phase brushless ball bearing DC motor.		
<b>ELECTRICAL SERVICE</b>		
<ul style="list-style-type: none"> <li>• 100V, 120V, 220V, 240V</li> <li>• 50 or 60 Hz</li> <li>• 1100 VA Universal power entry system adapts to U.S. or International requirements.</li> </ul>		
<b>ELECTRICAL PROTECTION</b>		
<ul style="list-style-type: none"> <li>• Circuit breaker for main power.</li> <li>• Control circuits provided with separate fuse.</li> </ul>		
<b>DIMENSIONS</b>		
<b>Width</b>	19½ inches	43.2 cm
<b>Depth</b>	27½ inches	69.9 cm
<b>Height</b>	17 inches	36.8 cm
<b>PLATFORM DIMENSIONS</b>		
	12 inches x 16.5 inches	30.5 cm x 42.4 cm
<b>CONSTRUCTION</b>		
<ul style="list-style-type: none"> <li>• Heavy gauge steel, phosphate-coated and texture-painted cabinet.</li> <li>• Seamless stainless steel water bath.</li> <li>• All metal parts in contact with water are stainless steel.</li> </ul>		
<b>WEIGHT</b>		
<b>Net</b>	105 lbs	47.6 kg
<b>Gross</b>	140 lbs	63.5 kg

## 7 ACCESSORIES

*This chapter outlines the wide variety of accessories available for use with the Innova 3100.*

### 7.1 Interchangeable Platforms

Following are 12 inch x 16½ inch (30.5 cm x 42.4 cm) stainless steel platforms:

<b>Catalog No.</b>	<b>Clamps/holders</b>	<b>Size of Glassware</b>
M1231-9930	XX	Universal Platform <sup>1</sup>
M1231-9933	31	50 mL Erlenmeyer Flask
M1231-9934	22	125 mL Erlenmeyer Flask
M1231-9935	13	250 mL Erlenmeyer Flask
M1231-9936	8	500 mL Erlenmeyer Flask
M1231-9937	6	1 L Erlenmeyer Flask
M1231-9938	2	2 L Erlenmeyer Flask
M1231-9939	XX	Subplatform <sup>2</sup>

1 Flask clamps must be ordered separately

2 This subplatform allows existing half-size platforms for flasks and test tubes (from the AquaTherm Model G86 Water Bath Shaker) listed below to be used with the Innova 3100.

### 7.2 Interchangeable Half-Size Platforms

Following are **half-size platforms**:

<b>Catalog No.</b>	<b>Glassware</b>	<b>Flasks/Tubes per Platform</b>	<b>Platforms per Bath</b>
AG7-50	50mL Erlenmeyer	13	2
AG7-125	125mL Erlenmeyer	8	2
AG7-250	250/300mL Erlenmeyer	5	2

### 7.3 Test Tube Racks for Subplatform

The following racks **must be mounted on the subplatform** (M1231-9939):

<b>Catalog Number</b>	<b>Description</b>	<b>Tubes per Rack</b>	<b>Racks per Bath</b>
AG7-TT13	Rack for 13mm tubes	60	4
AG7-TT16	Racks for 16mm tubes	36	4
AG7-TT20	Racks for 20mm tubes	29	4
AG7-TT25	Racks for 25mm tubes	18	4

### 7.4 Accessories

The following accessories are available for use with the Innova 3100:

<b>Catalog Number</b>	<b>Description</b>
M1231-2010	Gable Cover, Plexiglass
M1231-2000	Gable Cover, Stainless Steel
M1020-1220	Portable Cart
M1231-9920	Cooling Coil Kit <sup>1</sup>
P0620-2190	Coolant Circulating System 120V 60Hz
P0620-2191	Coolant Circulating System 220V 50Hz
M1195-1020	Space Saving Dolly (Under Desk Operation)

<sup>1</sup> Allows cooling to below ambient temperatures. Permits temperature control to 5°C above coolant temperature. Can be field installed by a qualified service technician.

### 7.5 Accessory Flask Clamps

All of the following flask clamps are constructed of stainless steel:




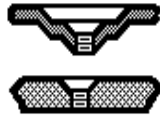


<b>Catalog Number</b>	<b>Type of Clamp</b>
ACE-10S	10mL Erlenmeyer Clamp
ACE-25S	25mL Erlenmeyer Clamp
ACE-50S	50mL Erlenmeyer Clamp
ACE-125S	125mL Erlenmeyer Clamp
ACE-250S	250mL Erlenmeyer Clamp
ACE-500S	500mL Erlenmeyer Clamp
ACE-1000S	1.0L Erlenmeyer Clamp
ACE-2000S	2.0L Erlenmeyer Clamp
ACE-4000S	4.0L Erlenmeyer Clamp

<b>Catalog Number</b>	<b>Type of Clamp</b>
ACE-6000S	6.0L Erlenmeyer Clamp
ACE-2800S	2800mL Fernbach Flask Clamp
ACSB-500S	500mL Media Bottle Clamp
ACSB-1000S	1.0L Media Bottle Clamp




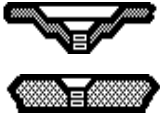


## 7.6 Clamp Mounting Hardware

NBS flask clamps are used on a variety of shaker platforms. Flat head screws of different lengths and thread pitch are used to secure the clamp. The tables below identify the proper screw for your shaker application by reference to the head style:

### 7.6.1 Hardware for 10 mL to 500 mL Clamps

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

### 7.6.2 Hardware for 1-Liter to 6-Liter Clamps

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

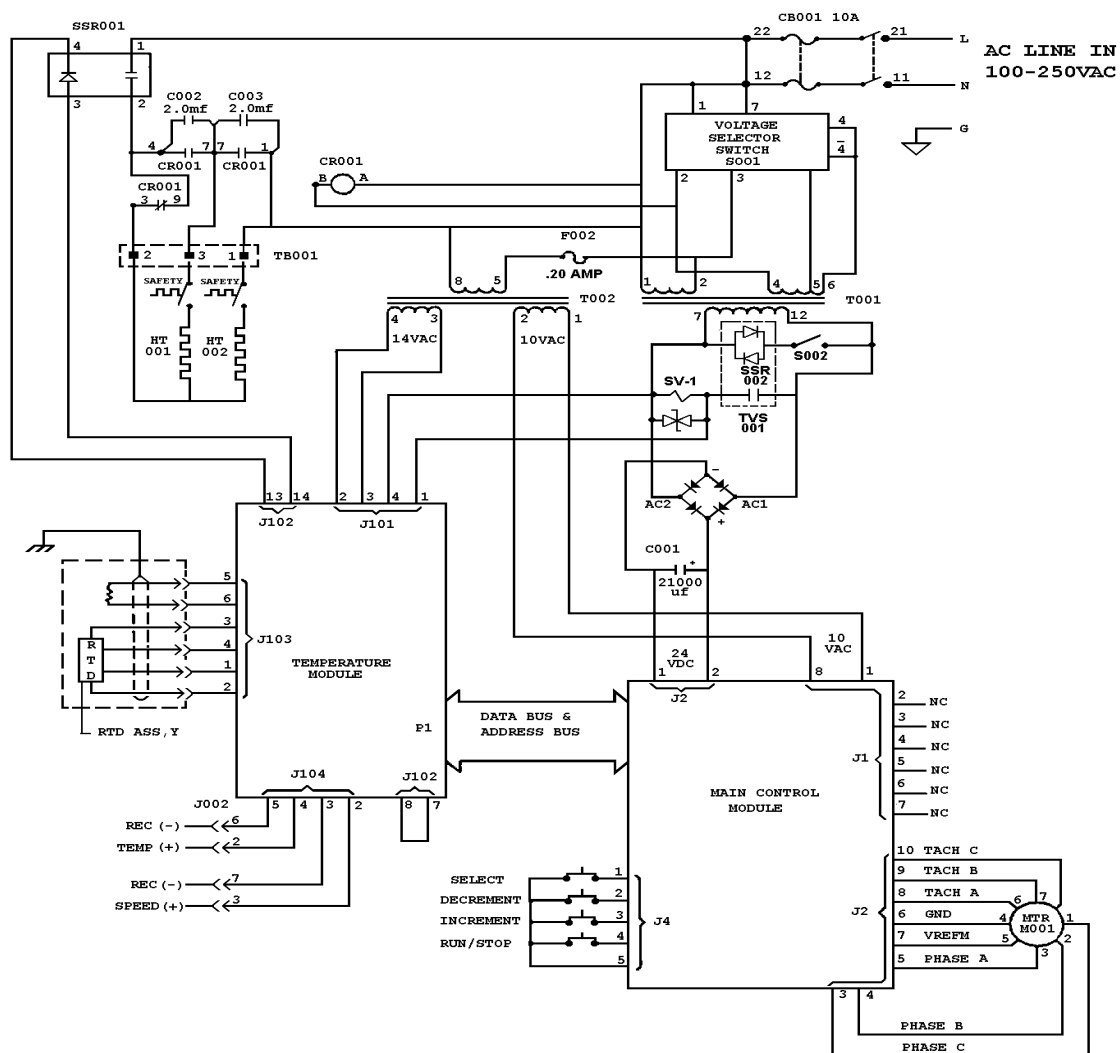


**NOTE:** 2800 mL Fernbach Flask Clamp applicable to above chart.

**THIS PAGE INTENTIONALLY BLANK**

# 8 DRAWINGS

## 8.1 Control Schematic



## 8.2 *Index of Drawings*

<b>Figure</b>	<b>Description</b>	<b>Page</b>
1	Front View	4
2	Rear View	5
3	Control Panel	6
4	Counterbalanced Drive Mechanism	9
5	Space Requirements	12
6	Hose Connections	13
7	Platform Installation	15
8	Water Level Control	22
9	Belt Replacement & Adjustment	27
10	Motor Assembly Replacement	28
11	Recorder Connector	30
12	Optional Cooling Coil Installation	31
13	Control Board Replacement	33
--	Control Schematics	43



# 9 INDEX

#  
 °C Indicator, 8  
   Flashing of, 21

\*  
 \* Indicator, 8

## A

Accessories, 8, 39, 40  
 Accessory Flask Clamps, 40  
 Actual Temperature, 21  
 Adjusting the Motor Drive Belt, 27  
 Alarm Conditions, 3  
 Alarm Functions, 19  
 Alarms, 3, 19, 37  
 Ambient Operating Environment, 37  
 Audible Alarm, 3  
 Automatic Restart Features, 38

## B

Bearings, 9  
 Belt  
   Adjusting the, 27  
   Replacing the, 27

## C

CAUTION  
   Symbol for, vii  
 Changing Fuses, 26  
 Changing Voltage, 26  
 Chart Recorder, 3, 29, 37  
 Chart Recorder Connection  
   Location of, 5  
 Clamp Mounting Hardware, 41  
 Cleaning Materials to Avoid, 25  
 Cleaning the Instrument, 25  
 Construction Features, 38  
 Continuous Run, 17  
 Control Panel, 4, 6  
 Control Schematic, 43  
 Coolant, 14, 32  
 Coolant Circulating System, 40  
 Cooling Coil, 3  
 Cooling Coil Connections  
   Location of, 5  
 Cooling Coil Hoses, 14

Cooling Coil Kit, 40  
   Contents of, 30  
   Installing the, 31  
 Cooling Coil Option, 8, 14  
   Retrofitting the, 30  
 Copyright Notice, vii  
 Counterbalanced Drive Mechanism, 9  
 Counterweight, 9  
 Current Temperature, 8

## D

Damage  
   Reporting, 11  
 Deactivating Temperature Control, 20  
 Deactivating the Alarm, 18, 19  
 Dimensions, 12  
   Outside, 38  
   Platform, 38  
 Disclaimer Notice, vii  
 Down ▽ Key, 6, 7, 17  
 Drain Fitting, 13  
 Drain Valve, 13, 22  
   Location of, 5  
 Draining the Bath, 23  
 Drawings, 43  
   Front View, 4  
   Index of, 44  
   Rear View, 5  
 Drive Arms, 9, 15, 23  
 Drive Mechanism, 3, 9, 37

## E

Eccentric Drive, 9  
 Electrical Connections, 14  
 Electrical Protection, 38  
 Electrical Service, 11, 38  
 Electronic Boards, 10, 32  
 Electrostatic Discharge, 32  
 ESD Precautions, 32

## F

Features, 3  
 Flashing of °C Indicator, 21  
 Flask Clamp Mounting Hardware, 41  
 Flask Clamps, 40  
 Front Baffle, 23  
 Front View, 4  
 Function Indicator Lights, 8  
 Function Indicators, 6

Fuses, 26  
Location of, 5

## G

Gable Cover, 8, 19, 40

## H

Half Platforms, 8, 39  
Heater Description, 37  
Hose Connections, 5, 13  
Hours Remaining  
Display of, 6  
How to Adjust the Motor Drive Belt, 27  
How to Cancel the Timer, 19  
How to Drain the Bath, 23  
How to Replace the Motor Assembly, 28  
How to Replace the Motor Drive Belt, 27  
How to Set the Temperature, 19  
How to Set the Timer, 18  
HRS Indicator, 8

## I

Indicated Temperature, 21  
Inspecting the Instrument, 11  
Installation Instructions, 12  
Installing a Platform, 15  
Installing the Hoses, 13  
Interchangeable Platforms, 39  
International Offices  
List of, iii  
Interrupt Feature, 38

## L

LED Display, 6, 17  
Level Control, 3  
Locking Knobs, 9, 15, 23  
Low Water Level  
Alarm for, 23  
Low Water Level Indicator, 6, 8

## M

Main Control Board, 10  
Replacing the, 33  
MAINT Indicator, 7, 22, 29  
Maintenance, 22, 25  
Manual Conventions, vii  
Mineral Deposits, 25  
Motor, 10, 38  
Motor Assembly  
Replacing the, 28  
Motor Connector, 28  
Motor Drive Belt  
Adjusting the, 27  
Replacing the, 27  
Motor Mounting Plate, 28

Motor Pulley, 28  
Motor Shaft, 28  
Mounting Hardware for 10mL-500 mL Clamps, 41  
Mounting Hardware for 1L-6L Clamps, 41  
MUTE Indicator, 7

## N

NOTE  
Symbol for, vii

## O

On/Off Switch, 4, 17  
Options, 8  
Overflow Connection, 13  
Overflow Hose  
Location of, 5  
Overflow Tube, 13, 23

## P

Platform Assemblies, 8  
Platforms, 3, 15, 39  
Portable Cart, 8, 40  
Power Connection  
Location of, 5  
Pulleys, 27

## R

Reactivating Temperature Control, 20  
Reactivating the Alarm, 19  
Rear Baffle, 23  
Rear View, 5  
Recorder Adaptation, 29  
Recorder Connector, 30  
Pinout Diagram for, 30  
Scale for, 30  
Recording Speed Data, 29  
Recording Temperature Data, 29  
Remote Monitoring, 37  
Replacing the Motor Assembly, 28  
Replacing the Motor Drive Belt, 27  
RPM Indicator, 8  
Rust Prevention, 14, 25

## S

Select Key, 6, 7, 17  
Self-Diagnostic Status, 37  
Service Parts, 35  
SET Indicator, 7  
Setpoints  
Checking the, 18  
Display of, 6  
Setting the Temperature, 19  
Shaker Status, 6  
Shaking Accuracy, 37  
Shaking Indication, 37

Shaking Motion, 37  
 Shaking Setpoint & Control, 37  
 Shaking Speed, 6, 37  
 Space Requirements, 12  
 Specifications, 37  
 Speed Range, 3  
 Start/Stop Key, 6, 7, 17  
 Starting the Instrument, 17  
 Status Indicator Lights, 7  
 Status Indicators, 6  
 Subplatform, 40  
 Supporting Arms, 9, 15, 23

## T

Table of Contents, xi  
 Temperature  
   Display of, 6  
 Temperature Accuracy, 37  
 Temperature Control, 3, 19  
   Deactivating the, 20  
   Reactivating the, 20  
 Temperature Control Board, 10  
   Replacing the, 34  
 Temperature Control Stability, 37  
 Temperature Correction Value, 21  
 Temperature Offset Calibration, 20  
 Temperature Range, 3, 19, 37  
 Temperature Safety Feature, 37  
 Temperature Setpoint, 37  
   Setting the, 19  
 Temperature Uniformity, 37  
 Test Tube Racks, 40  
 TIME Indicator, 7  
 Time Remaining, 8  
 Timed Functions, 18

Timer, 3  
   Cancelling the, 19  
   Features of, 37  
   Setting the, 18  
 Total Running Time, 21

## U

Universal Power Capability, 5  
 Unlimited Run, 17  
 Unpacking the Instrument, 11  
 Up  $\Delta$  Key, 6, 7, 17  
 User Interface Keys, 7

## V

Visible Alarm, 3  
 Voltage Configuration Table, 12  
 Voltage Selector Switch, 5, 11, 14, 26  
   Location of, 5  
 Voltage Setting, 5, 11, 14  
   Changing the, 26

## W

WARNING  
   Symbol for, vii  
 Warranty, ix  
 Water In Fitting, 13  
 Water In Hose, 23  
 Water Level Control, 3, 22  
 Weight  
   Gross, 38  
   Net, 38