TurboVap® II

User's Manual

CE

P/N 128099 Rev. 00

Preface

Copyright

Trademarks

Content

The information in this manual may contain typographical errors or technical inaccuracies and is subject to change without notice. Modifications may also be made to the product described in this manual at any time.

Proper Equipment Operation

The TurboVap II Concentrator uses a patented gas vortex shearing technique to concentrate samples quickly. It is a microprocessor-controlled instrument for simultaneous, automated concentration of multiple samples with unattended operation, convenience, and speed. It is the customer's responsibility to design suitable methods for evaporation of their own samples.

WARNINGS

- *The TurboVap II is **NOT** designed for* in vitro *testing or for use with highly corrosive samples.*
- *To reduce the risk of electric shock, do not remove the cover. No user serviceable parts are inside. Refer to qualified service personnel if help is required.*
- *Use this product only in the manner described in this manual. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.*

AVERTISSEMENTS

- *Pour réduire le risque de choc électrique, ne pas retirer le couvercle. Ce produit ne contient aucune pièce pouvant être réparée par l'utilisateur. Au besoin, confier l'appareil à un réparateur qualifié.*
- *Ce produit ne doit être utilisé que comme décrit dans ce manuel. Si cet appareil est utilisé d'une manière autre que celle spécifiée par le fabricant, la protection fournie par l'appareil peut être entravée.*

Product Safety Warning

The TurboVap II power switch is the same kind of power switch used on most laboratory equipment such as gas chromatographs, spectrophotometers, liquid chromatographs, and computers. The TurboVap products are safely used in the laboratory when “Good Laboratory Practices” are followed as with any other lab equipment. All fans are brushless motor fans and will not ignite vapors. The TurboVap is not classified as “Explosion Proof” and its use is at the discretion and risk of the operator or laboratory supervisor/manager. Your TurboVap product has been designed with safety as a foremost consideration. These products are equipped with a non-arcing fan, solid state electronics, and provisions for vapor collection. Do not change the configuration of the TurboVap II ventilation system. Please consult with Biotage if you have any questions or concerns.

WARNING

TurboVap products are NOT classified as “Explosion Proof.” The power switch is an arcing source and could ignite explosive vapors if present.

Contact Biotage 1-Point Support

Biotage 1-Point Support provides expert services including telephone troubleshooting of products, repair instructions, service dispatching and replacement part information.

Before you call:

Check the online Help and the manual for a probable cause and solution to your question.

Have the following information available for the customer support representative:

- Workstation serial number(s)
- If applicable, the error displayed on the LCD display

To reach the **Biotage 1-Point Support**:

US: 1-800-446-4752 or 1-pointsupport@biotage.com

Europe and Rest of the World: +46 18 56 57 11 or 1-pointsupport@eu.biotage.com

Japan: +81 422 28 1233 or JP-1-Pointsupport@biotage.com

Biotage Product Repair Depot

The Biotage Product Repair Depot offers product repair services, upgrades, refurbishment and installation at reasonable costs and with quick turnaround for all customer-owned equipment and accessories. For further information or to obtain a quotation for services, contact the Depot:

US: 1-800-446-4752 or 1-pointsupport@biotage.com

Europe and Rest of the World: +46 18 56 57 11 or 1-pointsupport@eu.biotage.com

Japan: +81 422 28 1233 or JP-1-Pointsupport@biotage.com

Features of the Biotage Product Repair Depot:

- Factory-trained repair technicians
- Two week turnaround from receipt at Biotage

Shipping:

Customers are responsible for shipments both to and from Biotage, specifying the carrier and choice of service.

Return Policy:

To ensure a safe environment for all our technicians, it is mandatory for each returned product to include our chemical questionnaire stating contact chemicals, chemicals used during application and cleaning steps taken prior to shipment.

Processing:

Once the product is returned, it is evaluated for necessary repairs. The customer is contacted with an estimate and may choose to go ahead with the repair or decline service. If service is denied, a minimum evaluation charge may apply. Upon completion of the repair, a purchase order or appropriate means of payment is required before return shipment.

Service and Customer Support Plans

Biotage offers a full range of services to ensure your success. From our original factory warranty through a comprehensive line of customer support plans, Biotage AB offers you Field Service Engineers and In-house Specialists who are dedicated to supporting your hardware, software and application development needs.

US: 1-800-446-4752 or 1-pointsupport@biotage.com

Europe and Rest of the World: +46 18 56 57 11 or 1-pointsupport@eu.biotage.com

Japan: +81 422 28 1233 or JP-1-Pointsupport@biotage.com

Our programs can include such useful services as:

- preventative maintenance
- diagnostic servicing performed on-site by Biotage AB field service engineers
- extended use of the Biotage AB 1-Point Support Center
- automated, remote troubleshooting
- software updates
- after-hour, weekend and holiday support
- repair depot servicing
- parts, labor and travel expense coverage
- other customized services upon request

FCC

This device complies with part 15 of the FCC (United States Federal Communications Commission) Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation.

CE

This device complies with all CE rules and requirements.

NOTE

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

REMARQUE

Tout changement ou modification apporté à cet instrument non expressément approuvé par l'entité responsable de la conformité peut annuler l'autorisation d'opérer l'appareil accordée à l'utilisateur.

Table of Symbols

Table 1 contains symbols that identify particularly important information and alert you to the presence of hazards. These symbols may appear in this manual and/or on the product it describes.

Table 1. Important Symbols

Symbol Symbole	Description Description
	**DANGER:** An imminently hazardous situation, which, if not avoided, will result in death or serious injury. **DANGER:** Situation présentant un danger imminent qui, s'il n'est pas éliminé, peut entraîner des blessures graves, voire la mort.
	**WARNING:** Caution, risk of danger. Refer to the User's documentation. **AVERTISSEMENT:** Attention, danger potentiel. Se reporter à la documentation de l'utilisateur.
	**NOTE:** A cautionary statement; an operating tip or maintenance suggestion; may result in instrument damage if not followed. **REMARQUE:** Énoncé indiquant une précaution à prendre, un conseil de fonctionnement ou une suggestion d'entretien; son non-respect peut provoquer des dommages à l'instrument.
	Hazardous voltage; risk of shock injury. Tension dangereuse; risque de blessure par électrocution.
	Crush hazard. Risk of body parts, hair, jewelry, or clothing getting caught in a moving part. Danger d'écrasement. Faire attention que les parties corporelles, les cheveux, les bijoux ou les vêtements ne soient pas pris dans une pièce mobile.
	Risk of puncture injury. Risque de blessure par piqûre.
	Risk of eye injury; wear safety glasses. Risque de lésion oculaire; porter des lunettes de sécurité.

Table 1. Important Symbols (Continued)

Symbol Symbole	Description Description
	Risk of exposure to biohazards. Risque d'exposition à biohazards.
	Risk of fire. Risque d'incendie.
	Risk of poison. Risque d'empoisonnement.
	Risk of explosion. Risque d'explosion.
	Hazardous fumes. Émanations dangereuses.
	Hot surface; risk of burns. Surface chaude; risque de brûlures.
	Protective ground symbol. Symbole de terre de protection.
	Ground symbol. Symbole de terre.
	Fuse. Fusible.
	Alternating current. Courant alternatif.
	On (supply). Marche (alimentation).
	Off (supply). Arrêt (alimentation).
	CE compliance mark. Marque de conformité CE.
	Signifies that the unit has passed safety tests for grounding, power line transience, and current leakage. Signifie que l'appareil a réussi les tests de sécurité pour la mise à la terre, le courant transitoire de ligne d'alimentation et la perte de courant.
	Input. Entrée.
	Output. Sortie.

Table 1. Important Symbols (Continued)

Symbol **Symbole**	**Description** **Description**
Equipment labels are color coded: Les étiquettes de l'appareil sont codées couleur:	**Yellow** Caution, risk of danger **Red** Stop **Blue** Mandatory action **Green** Safe condition or information **Jaune** Attention, danger potentiel **Rouge** Arrêter **Bleu** Intervention obligatoire **Vert** Condition sûre ou informations de sécurité
☞	Helpful hints, additional information Conseils utiles, informations supplémentaires

Table of Contents

Introduction

The TurboVap II Concentration Workstation is a microprocessor-controlled concentrator that provides automated sample evaporation, unattended operation, convenience, and speed. The concentrator uses a patented gas vortex shearing action to maintain high evaporation rates under mild thermal conditions regardless of sample height in the tubes.

This section of the manual describes the features of the TurboVap II evaporator.

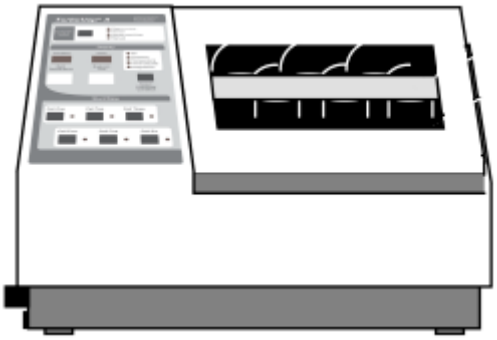


Figure 1. TurboVap II

Gas Vortex Shearing Action

The evaporator uses a patented “gas vortex shearing action” that maintains high evaporation rates regardless of sample height in the tubes. A helical flow of air (see Figure 2) is created by the stream of gas directed into each sample tube. The helical flow sets up a vortexing action that provides for sample homogeneity and continuous rinsing of the tube wall. The vapor-laden gas exits via an unobstructed path up the center portion of the tubes and is removed by an exhaust fan to the exhaust port in the back of the unit.

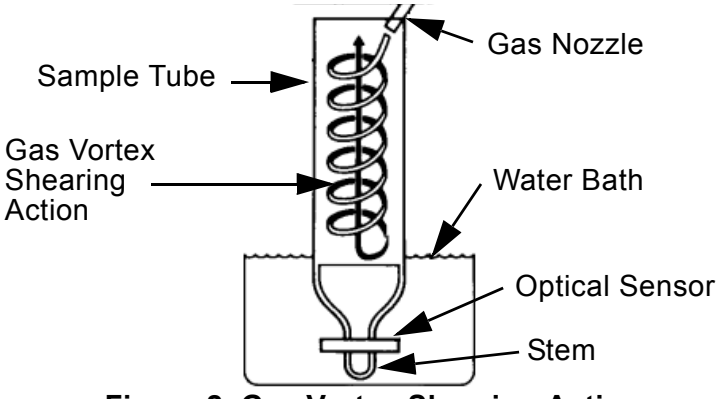


Figure 2. Gas Vortex Shearing Action

Automated Evaporation

The TurboVap II uses an integrated microprocessor to automatically time the concentration, control the water bath temperature, automatically turn off the gas, and perform operational diagnostics.

Sensors

Optical sensors in the water bath enable the TurboVap II to automatically stop the concentration when the sample level in the tube passes below the optical sensor. The final volume of the concentration, either 0.5 mL or 0.75 mL, depends on the size of the sample tube being used. The optical sensor tracks any slow changes in the optical density of the sample to assure that darkening or brightening samples do not stop the concentration prematurely. Once the sample passes below the optical sensor and remains below the sensor for a few seconds, the TurboVap II stops the concentration or starts the timer to concentrate for additional time.

The stem size of the concentrator tubes determines the final volume when using the sensor endpoint. Tubes with a 0.5 mL stem concentrate to 0.5 mL; tubes with a 1.0 mL stem concentrate to 0.75 mL and have a calibrated mark on the tube for you to reconstitute to 1.0 mL.

Adjustable

The TurboVap II enables you to:

- concentrate for a set time,
- use the sensor endpoint to detect a level of 0.5 mL or 0.75 mL,
- continue concentrating for a set time after reaching the sensor endpoint,
- concentrate until stopped manually,
- optimize the concentration rate by adjusting the gas pressure and water bath temperature.

NOTE

- *Time, temperature, and gas pressure can be changed at any time.*

Convenience

The TurboVap II enables you to start a run of samples and leave the instrument unattended. When the concentration has finished, the gas turns off automatically and the concentrator sounds an alarm every 30 seconds until the samples are removed or **Start/Stop** is pressed.

Mild Conditions

The water bath provides sufficient warming without harming sample recovery.

Multiple Sample Processing

The concentrator nozzle block has six nozzles that extend into the tubes to supply gas for concentration. This allows up to six samples to be processed simultaneously.

Requires No Hood

The flip-down cover and exhaust system permit the unit to be placed on the bench rather than taking up valuable hood space.

Independent Operation

Concentration for each cell can be independently started or stopped at any time.

Vapor Removal

The solvent vapors are removed by an exhaust fan to the exhaust port in the back of the unit. From the exhaust port, the venting hose must be routed to a suitable outside ventilation system.

TurboVap II Hardware

TurboVap II - Front

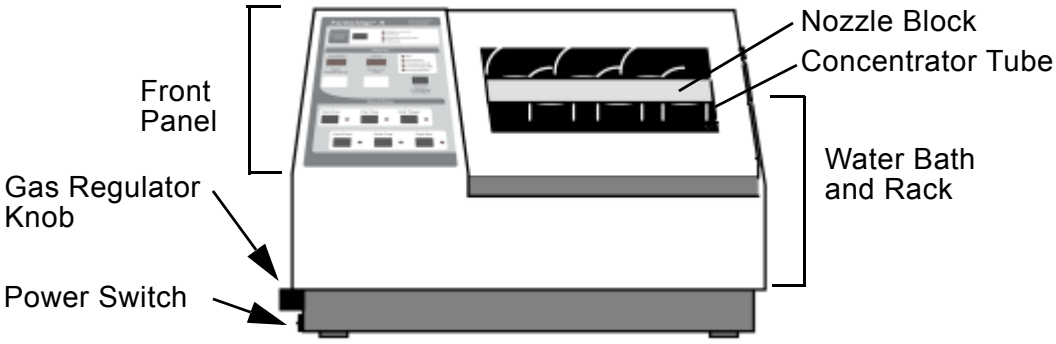


Figure 3. TurboVap II Hardware, Front View

Front Panel

Controls the setup and operation of the concentrator. See *"Front Panel Controls" on page 18* for details.

Nozzle Block

Directs the stream of gas into the sample tubes to create the gas vortex shearing action.

Concentrator Tube (or sample tube)

Holds the sample for concentration. Two types of tubes are available for detecting endpoints of 0.5 mL or 0.75 mL.

Water Bath

Warms the sample during concentration. The water bath operates over a temperature range of ambient to 90°C.

The TurboVap II evaporator is not designed to cool, but the water bath temperature can be brought down as much as 15°C by using the evaporation as a cooling source. Cooling ability varies with the evaporation rate.

WARNING

Fire and burn hazard. DO NOT operate the TurboVap II without water in the water bath.

Rack

Holds sample tubes during concentration.

Cover

Operation automatically pauses when the water bath cover is opened and resumes when the cover is closed. After an evaporation, open the cover to prevent condensation within the unit.

Gas Regulator Knob

Set the external gas supply to the instrument to be between 30 psi and 80 psi. Use the regulator knob to adjust the internal pressure (0 to 20 psi) for a desired helical gas flow directed at each of the sample tubes. The pressure gauge on the front panel displays the internal gas pressure.

The gas is routed through a stainless steel manifold to each sample tube.

WARNING

- *To avoid injury to yourself, damage to the instrument, or loss or samples, DO NOT exceed 20 psi maximum gas pressure in the TurboVap II.*
- *Never use hydrogen or other flammable gases. The wrong gas may explode or catch on fire.*

Power Switch

Turns the power on or off.

WARNING

The power switch is an arcing source and could ignite excessive explosive vapors if present. DO NOT change the position of the unit's on/off power switch when explosive vapors are present.

TurboVap II - Rear

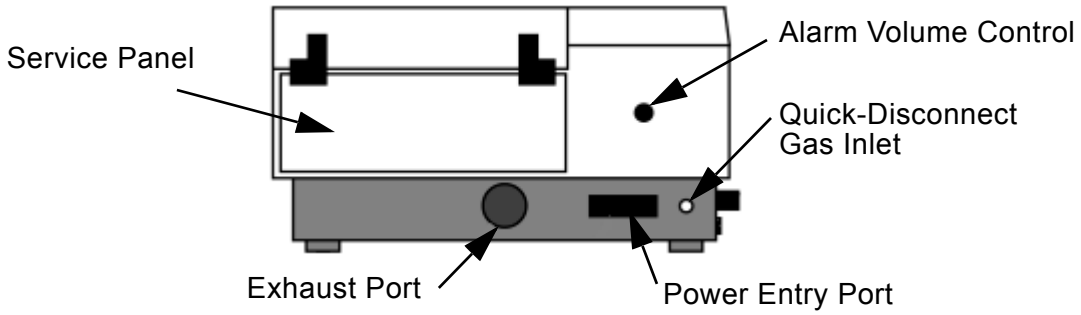


Figure 4. TurboVap II Hardware, Rear View

Alarm Volume Control

The Alarm Volume control knob is located on the back of the TurboVap II. Turn the knob in either direction to change the volume of the alarm.

- A repeating beep indicates a completed run.
- A long beep indicates interrupted operation.
- A short beep indicates a recognized key input.

Quick-Disconnect Gas Inlet

Connects the gas supply to the unit. The fitting has an internal shutoff that allows you to disconnect the concentrator from the gas supply without turning off the gas supply.

WARNING

- *To avoid injury to yourself or damage to the instrument, DO NOT exceed 80 psi maximum inlet pressure.*
- *Never use hydrogen or other flammable gases. The wrong gas may explode or catch on fire.*

Service Panel

Provides service access to the sensor connectors.

Exhaust Port

Solvent vapors are removed by an exhaust fan and routed to the exhaust port on the back of the unit. You must route the venting hose from the exhaust port to a proper ventilation system venting to the outside. The TurboVap II's design ensures that vapors are properly contained and are removed automatically from the laboratory environment when the system is operating properly.

WARNING

- *Exhaust gases may be hazardous and can contaminate the surrounding air. Consult the Material Safety Data Sheets (MSDS) for all of the solvents used. Use the exhaust hose provided to vent the gas to a hood or other ventilation device.*
- *Do not operate if the exhaust system is not working properly.*

Power Entry Port

Supplies power to the unit and houses the fuses.

WARNING

- *To avoid the risk of fire or electrical shock, plug the power cord securely into a properly grounded outlet.*
- *Replace fuses ONLY with the same type and rating.*

Front Panel Controls

The control panel allows you to control concentration in the six tube positions. (Samples are not required in each position.) The microprocessor constantly monitors the control panel settings, enabling you to change the settings at any time during evaporation. Lights indicate when each cell is evaporating or has reached the selected endpoint. The Cell buttons enable you to stop the evaporation manually if desired. The two displays on the front panel can display the pressure, bath temperature, or time remaining.

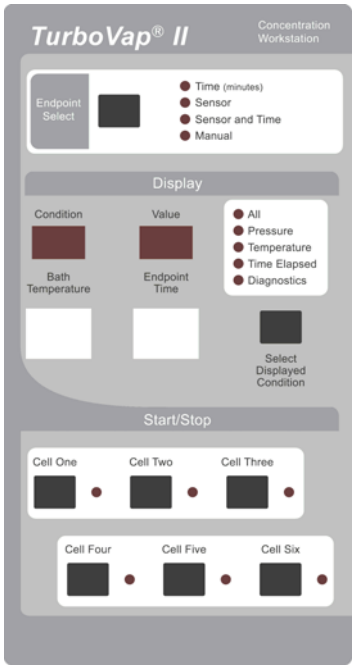


Figure 5. TurboVap II Control Panel

Endpoint Selections and Functions

Endpoint Select Button

Selects the mode used to determine the endpoint of concentration.

- **Time (minutes)** - to concentrate for the period of time in minutes specified by the **Endpoint Time** setting on the panel
- **Sensor**- to concentrate until sensor detects a level of 0.5 or 0.75 mL (depending upon the style concentrator tube)
- **Sensor and Time** - to concentrate past the 0.5 or 0.75 mL setting by the amount of time in minutes specified by the **Endpoint Time** setting on the panel
- **Manual** - to concentrate until the operator presses the **Start/Stop** button for each cell

Bath Temperature Pushwheel

Sets the desired water bath temperature.

Endpoint Time Pushwheel

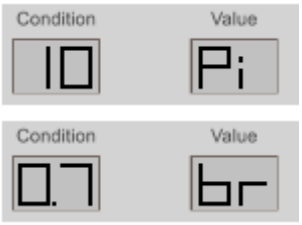
Sets the desired time in minutes (total concentration time or additional time after sensor endpoint detection).

Select Displayed Condition Button

Selects the condition to be represented in the four digits displayed by the **Condition** and **Value** displays.

- **All** - cycles the current conditions for pressure, water bath temperature, and time elapsed in the display fields.
- **Pressure** - displays the current gas pressure in psi and bars.
- **Temperature** - displays the current water bath temperature in °C.
- **Time Elapsed** - displays the time elapsed for each concentration process in minutes.
- **Diagnostics** - displays the cell diagnostics.

Condition and Value Display Examples

When...	Then...
Pressure is selected	the digits alternate between “xxPi” (psi) and “x.xbr” (bars), where xx is replaced with the *actual* value. Example: At 10 psi, the display alternates between the two displays shown below: 
Temperature is selected	the digits show “xx°C” where x is replaced with the actual value in °C. Example: At 38°C, the display shows:  **Note:** The display blinks if the water bath temperature is more than 2° higher or lower than the set temperature.

When...	Then...
Time Elapsed is selected	the digits show “#=xx” in sequence for all cells where # is replaced by the cell number and x is replaced with the *actual* value in minutes. Example: For a sample in cell position 5 where 12 minutes of concentration has elapsed, the display shows: 

Note:

- “SE” appears in the **Value** display during the sensor portion of a **Sensor** & **Time** concentration.
- “≡≡” appears in the **Value** display whenever the time exceeds 99 minutes during a **Sensor** or **Manual** concentration.
- “--” appears in the **Value** display if the cell has been stopped or was not started.

All is selected	The digital display cycles through the pressure, temperature, and time elapsed readings.
Diagnostics is selected	The digits display the selected diagnostics (see “Software Diagnostics” on page 62).

Cell Selections and Functions

Selections	Functions
Start/Stop buttons	Used to start or stop concentration. **Note:** Upon power up, the Start/Stop buttons will not work until an endpoint is selected.
Cell Light	When OFF, that cell position is not performing concentration. When ON, that cell position is currently performing a concentration. When BLINKING, that cell position has reached its endpoint.

Installing the TurboVap II Concentrator

Unpacking the TurboVap II

Unpack the shipping container and verify that all items listed below are included. If any parts are damaged or missing, contact Biotage (see page 3).

Parts Supplied

The Biotage TurboVap II Concentration Workstation comes with the following parts:

- Concentrator Unit
- Water Bath Rack
- Rack Adapter Kit for 1.0 mL stem glassware (already installed in 1.0 mL units)
- Power Cord(s) - 220V models include two power cords, one for EU and one for UK
- Venting Hose
- 1/4” ID Gas tubing
- Bag of two 1/4” Barb Fittings (1/8” NPT and 1/4” NPT)
- Coupling Insert
- *Clear Bath*™ Kit
- Water Bath Siphon Pump
- Plastic Water Bath Closures (six)
- Startup Glassware (six pieces) - for ASE TurboVap II, see Other Required Items below.
- Auxiliary Rack
- User’s Manual CD
- Reference Card

Other Required Items

- Startup Glassware for ASE TurboVap II must be purchased from Dionex at 1-800-346-6390
- Inert Gas Supply (nitrogen)
- Distilled Water
- Timer

Site Preparation Requirements

You must have an appropriate location with available gas and electrical sources and adequate ventilation as specified by these site preparation requirements before installing the TurboVap II concentrator.

Space:

Minimum bench space for the concentrator and any accessories:

- Height: 12 inches (30.5 cm)
- Width: 21.2 inches (53.8 cm)
- Depth: 12 inches (30.5 cm)
- Open Cover: 20 inches

Work Area:

Flat, level, stable surface

Compressed Gas Supply:

Clean, dry, regulated, nitrogen or other suitable gas, regulated to 30 psi minimum, 80 psi maximum.

Biotage suggests using the supplied tubes and fittings. Devices added to the inlet supply line (such as moisture traps or filters) must not drop the pressure below 30 psi (2.1 bars) measured at the TurboVap II inlet fitting.

NOTES

- *Use of compressed air could contribute to the oxidation of some phenolic compounds and reduce sample recoveries.*
- *A ¼" line is recommended. Larger tubing might be necessary to maintain pressure if devices such as moisture traps and filters are added to the line.*

WARNING

- *To avoid injury to yourself or damage to the instrument, DO NOT exceed 80 psi maximum supply pressure.*
- *Never use hydrogen or other flammable gases. The wrong gas may explode or catch on fire.*

Exhaust Duct:

Requires a 2 inch diameter venting hose (exhaust duct tubing is supplied). The exhaust duct *MUST* go to a suitable ventilation system vented *outside* the laboratory.

WARNING

Exhaust gases may be hazardous. Consult the Material Safety Data Sheets (MSDS) for all of the solvents used.

Power:

100/120VAC model	220/240 VAC model
100/120VAC +/- 10%	220/240 VAC +/- 10%
50 - 60 Hz	50 - 60 Hz

Fuses:

100/120VAC model	220/240 VAC model
(1) 10A, T250V (P/N 39164)	(2) 5A, T250V (P/N 44412)

Bath Capacity:

- 6.4L maximum distilled water. DO NOT overfill.

Gas Supply Fitting:

To fit 1/4” ID gas tubing, for connection of gas supply

Clear Bath Additive:

2 oz. kit supplied with unit

WARNING

Exposure to liquids may cause bacterial or viral hazards. Liquids can also be corrosive, flammable and/or toxic. Use good laboratory operating procedures when dealing with liquids. Refer to the MSDS (Material Safety Data Sheet) for detailed information.

- *Avoid direct contact with liquids.*
- *Wear protective gloves and safety glasses.*
- *Dispose of liquids and containers properly.*
- *Do not overfill containers.*

Installing the TurboVap II

Select the Location for the TurboVap II

Select a flat, stable, dry bench space within 12 feet of adequate ventilation, and available sources of electricity and gas.

NOTE

While a laboratory hood is an ideal location for installation of the TurboVap, any location adequately vented through a proper ventilation system to the outside is acceptable. DO NOT vent the TurboVap through a trap.

Clean the Glassware

Glassware should be cleaned before use in the TurboVap II. Clean and rinse the glassware according to your laboratory protocol. Residue remaining on either the inside or outside of the stem can impact sensor operation.

Remove the Sensors for Operation Above 60°C (if necessary)

If you will be operating the TurboVap II at temperatures above 60°C, you must remove the sensors. See *"Removing and Replacing the Sensors" on page 50* for detailed instructions on removing the sensors.

Confirm That Your Racks and Sample Tubes Match

Confirm that the sample tubes you are using are compatible with the racks.

Connect the Gas Supply

Determine if an inline carbon trap is necessary and then connect your gas supply using the ¼ inch tubing supplied.

To connect the gas supply:

1. Turn off the gas supply.
2. Connect one end of the 1/4" ID gas tubing to the gas supply and connect the other end to the barbed fitting on the Coupling Insert (see Figure 6 on page 25).

Connect the Gas Supply (Continued)

WARNING

Never use hydrogen or other flammable gases. The wrong gas may explode or catch on fire.

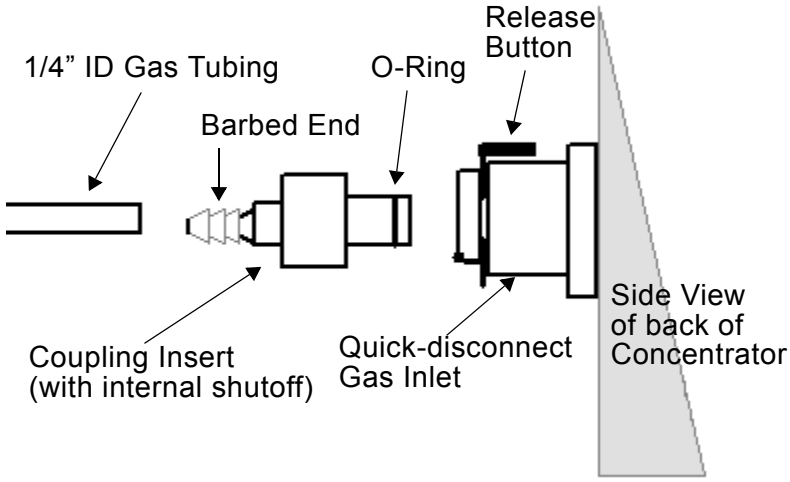


Figure 6. Connecting the Gas Supply

3 Snap the Coupling Insert (O-ring end) into the Quick-disconnect Gas Inlet on the back of the concentrator.

4 Turn on the gas supply.

WARNING

To avoid injury to yourself or damage to the instrument, DO NOT exceed 80 psi (5.52 bars) maximum inlet pressure.

Install the Exhaust Tubing

If the concentrator is *not* placed in a hood:

1. Slide one end of the venting hose over the exhaust port.
2. Route the hose to a suitable external air ventilation system or hood. Ensure that the ventilation system is operating whenever the TurboVap II is in use.

WARNING

- *Health hazard. Gas fumes exiting this instrument can contaminate the air you breathe. Maintain proper ventilation.*
- *Use only venting hoses with appropriate length and internal diameter (I.D.) to avoid excessive pressure drop.*

The following hoses can be used to vent the TurboVap II:

Maximum Hose Length	Internal Diameter
12.5 ft (3.8m)	2 inch (5cm) I.D.
30 ft (9.1m)	2.5 inch (6.4cm) I.D.
60 ft (18.2m)	3 inch (7.6cm) I.D.

Fill the Water Bath

When you are filling the water bath, make sure that:

- placing the sample tubes in the water bath does not cause an overflow.
- the water level in the bath is as high as the initial solvent level in the sample tube.

To fill the water bath:

1. Place a concentrator tube in five positions.
2. Pour about 1 Liter of distilled water into the bath through the empty position.
3. Add 15 drops of Clear Bath.
4. Add distilled water until the water's surface is as high as the initial solvent level in the sample tube.

WARNING

To avoid the risk of fire or burn injuries, do NOT operate the TurboVap II without water in the bath.

Connect the Power Cord

1 Plug the power cord securely into the receptacle on the back of the unit. Make sure the plug is fully inserted.

2 Connect the 3-pronged end to an appropriate power source.

WARNING

To avoid the risk of fire or electrical shock, plug the power cord into a properly grounded outlet.

Turn On the Power

To turn on the concentrator, turn ON the switch located on the lower left side of the TurboVap. When the power is turned on, the Power-Up diagnostics described below will run automatically.

Note: Upon power up, the **Start/Stop** button for the six cells will not work until an endpoint has been selected.

Power-Up Diagnostics

When the power is turned ON, the following diagnostics occur:

Display Test - During the first four seconds after power up, *all* display lights are lit. Confirm that all lights are working properly.

Also during this time, raising and lowering the cover sounds the beeper to confirm the cover switch is functioning.

Normal operation begins after four seconds.

Determine Optimal Concentration Conditions

You should determine the settings that will best concentrate your samples before operation. You should determine the desired:

- water bath temperature
- gas pressure
- endpoint selection

To prepare the TurboVap II:

1 Turn the evaporator's power ON.

NOTE: The unit should always be ON whenever it contains samples so that the fan can remove exhaust.

2 Turn the gas supply ON.

3 Set the pressure on the gas supply regulator to 0 (zero) psi.

4 Remove all tubes from the evaporator.

Determine Appropriate Water Bath Temperature

Since the concentrator's high evaporation rates eliminate the need for a high temperature water bath, the bath operates over a mild temperature range of ambient to 95°C. This eliminates hot spots and improves sample recovery for more volatile compounds. The water bath also can be brought down below room temperature by using evaporative cooling. Cooling ability varies with the concentration rate.

Precautions When Setting Water Bath Temperature

Remove the sensors if you intend to set the water bath temperature at or above 60°C. See *"Removing and Replacing the Sensors" on page 50* for detailed instructions on removing the sensors.

WARNING

- *Do not operate at a temperature greater than 60°C unless the sensors have been removed from the bath.*
- *Do not operate the unit without water in the water bath.*

NOTES

- *Open the cover and leave the power on after concentration until the fan chamber is dry. If operating with a high water bath temperature (for example, concentrating water samples), condensation may form on the inside cover, drip through the vents into the fan chamber, and cause corrosion if the cover is left closed.*
- *When the concentrator is not in use, place plastic closures over the bath positions and keep the lid open. If power is left on, the bath heater automatically turns off after the lid has been opened for one hour.*

When selecting the water bath temperature, consider the following:

- Faster evaporation occurs as the water bath temperature is increased. However, highly volatile analytes can be lost if allowed to sit for extended periods of time in a warm bath.
- You can select a water bath temperature just *below* the boiling point of the solvent in the sample tube. Boiling the solvent affects sensor operation and can risk loss of sample.
- You can use a water bath temperature *above* the boiling point of your solvent if the gas pressure is high enough to create a cooling effect over the solvent. Using a higher water bath temperature speeds the concentration and can increase recoveries.

  For example: the bath temperature may be 42°C but the solvent temperature could be *less than* 42°C if the gas flowing over the solvent causes cooling.
- A temperature setting of “00” turns off the heaters.

Setting the Water Bath Temperature

1. Set the water bath temperature using the numeric pushwheel.
2. Place plastic closures over any empty water bath positions.
3. Press the **Select Displayed Condition** button until **Temperature** is selected.
4. Allow the bath to come to temperature (display stops blinking) before using the concentrator.

NOTE

As the bath warms up, bubbles may form around the sensor. If given enough time (approximately 1/2 hour), bubbles should dissipate. In most cases, sample tube insertion will free bubbles.

Determine Appropriate Gas Pressure & Time Settings

When selecting the gas pressure, keep in mind that:

- higher gas pressure causes faster evaporation rates
- excessively high operating pressure can cause loss of analyte due to splashing
- for the best results, always use the highest gas pressure possible without causing splashing
- as the sample volume decreases during a concentration, increase the operating pressure. This will reduce the overall concentration time.
- To avoid damage, supply inlet pressure to the instrument must not exceed 80 psi (5.52 bars).
- For proper operation, pressure to the instrument must be at least 30 psi (2.07 bars) and operating pressure within the TurboVap II usually should be between 8 and 15 psi (0.6 and 1.0 bars).

WARNING

- *To avoid injury to yourself or damage to the instrument, do NOT exceed 80 psi maximum supply pressure.*
- *To avoid injury to yourself or damage to the instrument, do NOT exceed 20 psi maximum pressure in the TurboVap II.*

Setting the Gas Pressure

1. Pull the regulator knob out and turn it fully counterclockwise to start at a pressure of zero.
2. Press the **Select Displayed Condition** button until **Pressure** is selected.

   *The **Condition** and **Value** displays alternate between a pressure reading in psi and in bars.*
3. Press the **Endpoint Select** button until **Manual** is selected.
4. Place a concentrator tube with a typical starting volume of sample or solvent into one of the concentrator positions.

Setting the Gas Pressure (Continued)

5 Press the **Start/Stop** button for the cell position.

6 Slowly turn the regulator knob clockwise to increase the gas supply pressure until a swirling action without splashing is observed. The reading is normally between 8 and 15 psi (0.6 and 1.0 bars). Push the knob in to lock in place.

7 If you will be using any of the endpoint selections that require a time setting, use a stopwatch or clock to time how long it takes to evaporate the sample to the desired endpoint. *The **Time Elapsed** display can be used, but it will not show times more than 99 minutes.*

8 When you are ready to stop concentration, press the **Start/Stop** button for the cell position.

Note: It is normal for the pressure reading to rise slightly when concentration is complete (gas is not flowing).

9 Make necessary adjustments to water bath temperature and gas pressure to achieve the best settings, then record this information along with the final **Endpoint Time** (if required).

Determine the Appropriate Endpoint and Time Settings

There are four ways to complete concentration.

- concentrating for a set time (in minutes)
- concentrating until the sensor detects a liquid level
- concentrating for a set time *after* the sensor detects a liquid level
- concentrating until the operator presses Start/Stop (manual mode)

A description of each method follows.

Endpoint Selection Notes

- All selection lights flash after power up until a selection is made.
- The endpoint selection applies to *all* cells.
- **Endpoint Select** *cannot* be changed during concentration.

When to Use Each Method

The following table gives some example of when you would choose a particular endpoint selection.

Use...	When...
Time (minutes)	• the sensors are removed because the water bath temp. is >60°C. • sample coats the glass or darkens too rapidly. • sample evaporates too slowly. • a volume greater than 0.5 or 0.75 mL is desired as the endpoint.
Sensor	You want full automation of sample concentration to a fixed endpoint volume (acceptable for most samples at a water bath temperature under 60°C).
Sensor and Time	You want to concentrate past the endpoint of the glassware (0.5 mL or 0.75 mL) or to dryness (acceptable for some samples at a water bath temperature under 60°C).
Manual	• water bath temp. is >60°C so the sensors are removed • sample coats the glass or darkens too rapidly • you need to concentrate for a time greater than 99 minutes

Time - Concentrating for a Specified Time

To concentrate for a set time, select the Time endpoint. Perform the following steps to set the front panel.

1 Press the **Endpoint Select** button until Time is selected.

2 Use the **Endpoint Time** wheels to set the desired time, in minutes, for concentration.

3 Press the **Start/Stop** button for the desired cell position(s).

Reading the Time Elapsed Display During a Timed Concentration

To view the actual time elapsed for each sequential cell position during a timed concentration, select either **Time Elapsed** or **All**. The **Condition** display shows the cell position, and the **Value** display shows the time elapsed.

Example:

Figure 7. Time Elapsed - Time Endpoint

When the concentration is finished, **Time Elapsed** continues to show the time until the cover is raised and closed, or the **Start/Stop** button is pressed, at which time the **Time Elapsed** display shows "--".

Sensor - Concentrating Until the Sensor Detects the Endpoint

To use the optical sensors to concentrate to a volume of either 0.5 mL or 0.75 mL, select the Sensor endpoint. The volume at which concentration stops depends on the stem length of the concentrator tube. Perform the following steps to set the front panel.

1. Press the **Endpoint Select** button until Sensor is selected.
2. Press the **Start/Stop** button for the cell position(s).

Reading the Time Elapsed Display During a Sensor Detect Concentration

To view the time elapsed during a concentration using the Sensor endpoint, select either **Time Elapsed** or **All**. The **Condition** display shows the cell position, and the **Value** display shows the time elapsed.

Example:

Figure 8. Time Elapsed - Sensor Endpoint

Sensor Endpoint Considerations

Two conditions affect optical sensing:

Water Bath- If the water bath temperature is set above 60°C, the sensors must be removed. See *"Removing and Replacing the Sensors" on page 50* for detailed instructions on removing the sensors.

Sample Clarity - clear, slowly darkening or opaque (at 940 nm) samples reliably concentrate using the **Sensor** endpoint selection. Samples which darken too rapidly as concentration proceeds may actuate the sensor prematurely. If this happens, press the **Start**/**Stop** button for the sensor to start with a new baseline reading and continue concentration.

If starting a new baseline is unacceptable, determine concentration time and use the **Time** (minutes) option, or operate manually by using the **Manual** selection.

Sensor and Time - Concentrating for a Set Time Past Endpoint Detection

To continue concentration *after* the sensor detects a 0.5 or 0.75 mL endpoint (depending on glassware), select the Sensor and Time endpoint. Perform the following steps to set the front panel.

1. Press the **Endpoint Select** button until **Sensor and Time** is selected.
2. Use the **Endpoint Time** wheels to set the desired time, in minutes, for concentration to continue AFTER endpoint detection.
3. Press the **Start/Stop** button for the cell position(s).

Reading the Time Elapsed Display when Concentrating for a Set Time Past Endpoint Detection

While performing a concentration using the **Sensor and Time** endpoint, the **Value** display shows the letters "SE" until the endpoint is reached. Once the endpoint is reached, the elapsed time after the endpoint is displayed in the **Value** field as shown in Figure 9.

Figure 9. Time Elapsed - Sensor and Time Endpoint

Sensor and Time Endpoint Considerations

The same considerations exist for this selection as for the SENSOR selection. See “Sensor Endpoint Considerations” on page 34.

Manual - Concentrating Until the Start/Stop Button is Pressed

To operate manually, select the **Manual** endpoint. Perform the following steps to set the front panel.

1 Press the **Endpoint Select** button until **Manual** is selected.

2 Press the **Start/Stop** button for the cell position(s).

Reading the Time Elapsed Display During a Manual Concentration

To display the actual time elapsed for each sequential cell position while performing a manual concentration, select either **Time Elapsed** or **All**. The **Condition** display shows the cell position, and the **Value** display shows the time elapsed as shown in Figure 10.

Figure 10. Time Elapsed - Manual

If the elapsed time exceeds 99 minutes, the **Value** display is replaced with “≡≡”. as shown in Figure 11.

Figure 11. Time Elapsed - Manual, more than 99 minutes

Optimizing Recoveries with 1mL Sample Stem Tubes

To achieve the best recoveries:

- Clean and bake the sample tubes according to the standard cleaning techniques for your method.
- Adjust the concentration conditions as needed:
  - Operate at a gas pressure between 8 and 15 psi (0.6 and 1.0 bars).
  - If the concentrator tubes are initially FULL, start with a low gas pressure, and increase the pressure as the volume in the tube decreases.
  - Select a water bath temperature carefully.
    For methylene chloride acceptable temperatures can range from 40-45°C.
- Remove samples promptly, once the endpoint is achieved.
- Use the proper technique for removing the samples from the concentrator tubes.

1mL tubes used with the 1mL concentration rack can eliminate the need for traditional triple quantitative transfer techniques. The final crude or cleaned up extract can be taken to 1mL directly in the TurboVap concentrator tube.

1 Choose **Sensor** for your Endpoint Selection; set gas pressure at 10 psi and the bath temperature at 39°C.

2 Working on the bench or in a fume hood, add the sample to the TurboVap tubes. Do not add samples to the tubes while the tubes are in the TurboVap.

3 Start the concentration.

4 When the alarm sounds, remove the sample tube from the water bath. Failure to remove the tube promptly may result in analyte loss.

5 With a Pasteur pipette, add solvent to the 1mL line.

Optimizing Recoveries with 1mL Sample Stem Tubes (Continued)

6 Take the entire 1 mL sample into the Pasteur pipette and rinse the lower 25% of the TurboVap tube (i.e. 2 inches above the cone shape on the cylinder wall) ten to fifteen times as shown in Figure 12.

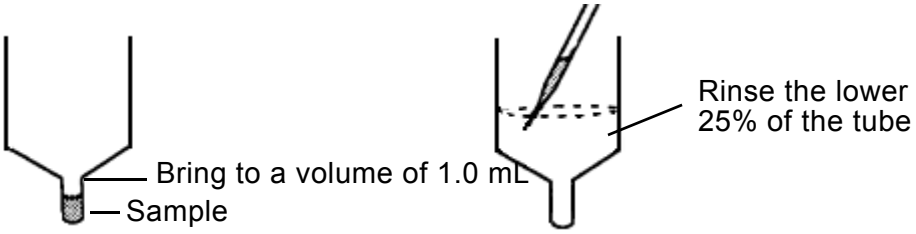


Figure 12. Rinsing the Concentrator Tube

7 Solvent evaporation during this rinsing will have reduced the volume. Add fresh solvent to bring the sample to 1 mL. Rinse the tube walls two more times and transfer the sample to an autosampler vial.

Final Concentration Conditions Established for Your Sample

After experimenting with the selections presented in this section, you should have established your settings for the following concentration conditions:

Water Bath Temperature

Endpoint Selection:

- Time (minutes)
- Sensor
- Sensor and Time
- Manual

Gas Pressure

Use this information when following the routine operation steps provided in the next section.

Operation

This section describes how to operate the TurboVap II Concentration Workstation using the following procedures:

- preparing the unit (see below)
- starting the concentration process (see page 39)
- stopping (if running in manual mode or need to interrupt) (see page 40)
- removing the sample tube (see page 42)
- removing the concentrated sample (see page 42)
- shutting down after operation (see page 43)

Preparing the Unit

Prepare the concentrator by performing the following steps.

1 Check that the incoming gas supply is turned on and has sufficient reserve for the sample run.

2 Confirm that the water bath rack accommodates your sample tube's stem size.

3 Check the water level in the water bath. It should be about as high as the initial solvent level in the sample tube.

4 With the cover down, turn the unit on and set the **Bath Temperature** pushwheel.

5 Select the **Temperature** display and allow time for the water bath to come to temperature (temperature display stops blinking).

Note: If using sensors, dislodge bubbles from around the optics.

6 Place clean concentrator tubes in the auxiliary rack and add sample.

7 Remove the plastic closures from the concentrator positions to be used.

8 Open the cover and place the concentrator tube (with sample) in the water bath.

9 Close the cover.

Starting the Concentration

Starting concentration involves the following steps:

1. Press **Endpoint Select** until the desired mode is selected.
2. If applicable, set the **Endpoint Time** pushwheel to the desired time.
3. Press **Select Displayed Condition** until **Pressure** is selected. Pull out the regulator knob, adjust the gas pressure as needed, and push in to lock the knob in place.
4. Press the cell position **Start**/**Stop** button. The corresponding cell light comes on.

NOTE

Time, temperature, and gas pressure may be changed at any time.

Display During Operation

While the concentrator runs, the **Condition** and **Value** displays reflect the status of whichever condition is selected - Pressure, Temperature, Time Elapsed, Diagnostics, or All.

Gas Flow During Operation

When you are concentrating using the **Sensor** or **Sensor** & **Time** selection, the gas flow may stop and start several times as the meniscus of the sample approaches the sensor optics.

If the pressure drops below 3 psi (0.2 bars) during a concentration, the unit will beep rapidly, alerting you to check the incoming gas supply.

Stopping the Concentration

When...	Then...
running **manually** (last endpoint selection)	Press **Start**/**Stop** button for the corresponding cell.
you need to **pause** the concentration process	Lift the cover. (Lowering the cover resumes operation).
you need to **stop** the concentration process unconditionally	Press **Start**/**Stop** button for the corresponding cell. (This resets the time.)

Notes About Stopping

- Starting & stopping is independent for each cell.
- If concentration is stopped and restarted, the time is cleared and a new elapsed time begins - *it does not continue from where it was stopped*.
- Opening the cover turns off the gas flow and suspends timing; lowering the cover resumes operation. **Note:** Timing is not cleared as when **Start**/**Stop** is pressed.
- It is normal for the gas pressure to rise slightly when concentration finishes or is stopped (gas is not flowing).

When the Endpoint is Reached

When a cell reaches its selected endpoint, the light next to its **Start**/**Stop** button blinks and the beeper sounds briefly every thirty seconds.

To Silence the Alarm

To silence the beeper, raise the cover.

Note: If there is a rapid beeping or continuous beep, refer to the diagnostics section and check inlet pressure.

Cell Light Behavior

The light for each cell that has reached its endpoint will continue to blink when the cover is raised, indicating which cells require attention. When the cover is lowered, all blinking lights turn off.

Time Display Behavior

When the concentration is finished, **Time Elapsed** continues to show the time until the cover is raised and closed, or the **Start**/**Stop** button is pressed, at which time the **Time Elapsed** display shows "--".

Manual Operation

If operating the concentrator manually, the cell light blinks when you press the cell's corresponding **Start**/**Stop** button. Pressing the **Start**/**Stop** button again turns the light off.

Removing the Sample Tube from the Unit

1 Promptly remove the concentrator tube from the water bath and place it in the auxiliary rack.

Note: Prompt removal of the completed tube is important since

- highly volatile compounds can be lost if allowed to sit for an extended period of time.
- steam from the water bath could condense on the cover and may drip into sample tubes if they are left in place.

WARNING

- *Avoid spilling solvents into the water bath. If solvents do spill into the water bath, follow MSDS safe handling instructions and immediately change the water in the water bath. Rinse the unit with distilled water.Refer to MSDS (Material Safety Data Sheets).*
- *To avoid injury to yourself or damage to the instrument, handle broken glass (broken tubes) with care.*

2 If your initial sample volume exceeded the tube capacity, add remaining sample to the tube *after* it has been transferred to the auxiliary rack - *not while the tube is still in the water bath* - and repeat the concentration process.

3 Place plastic closures over empty bath positions.

4 Clean the concentrator tubes between samples according to your laboratory practice.

5 Add distilled water to the bath, if necessary.

Removing the Sample from the Tube

The gas vortex shearing action automatically rinses the vertical side walls as evaporation occurs, but for optimum recoveries, you should rinse the lower, angled portion of the concentrator tube to recover any sample left behind. See “Optimizing Recoveries with 1mL Sample Stem Tubes” on page 36.

Shutting Down

When the unit is no longer in use:

1 Replace the plastic closures in each cell position.

2 Leave the cover open to keep moisture from accumulating on the inside cover.

NOTES

- ***After concentration, keep the cover open and the unit on until the fan chamber is dry.*** *If operating with a high water bath temperature (for example, concentrating water samples), condensation may form on the inside cover, drip through the vents into the fan chamber, and may cause corrosion over time.*
- ***When concentrator is not in use, place plastic closures over the bath positions and keep the lid open.*** *If power is left on, the bath heater automatically shuts off after the lid has been opened for one hour.*

3 Clean the concentrator tubes according to your laboratory practice.

4 Turn off the power and incoming gas supply. (optional)

Maintenance

This section contains the following maintenance procedures:

Daily Maintenance

- During Power Up diagnostics, confirm all displays are accurate.
- Check to ensure water bath is full and clean.
- Check that your tank has enough nitrogen for daily operation.

WARNING

Never use hydrogen or other flammable gases. The wrong gas may explode or catch on fire.

- Avoid spilling any solvents on the control panel.
- Avoid spilling any solvents in the water bath.

WARNING

Exposure to liquids may cause bacterial or viral hazards. Liquids can also be corrosive, flammable and/or toxic. Use good laboratory operating procedures when dealing with liquids. Refer to the MSDS (Material Safety Data Sheet) for detailed information.

- *Avoid direct contact with liquids.*
- *Wear protective gloves and safety glasses.*
- *Dispose of liquid and container properly.*
- *Do not overfill containers.*

Routine Maintenance

The routine maintenance procedures listed below should be performed every one to three months, or as necessary.

- Empty, clean and refill the water bath (see page 48).
- Perform Power Up Diagnostics and Cell Diagnostics (see page 62).

To perform routine maintenance on the TurboVap II Concentration Workstation, use the following procedures for each part listed:

Part	Action
Panel	Avoid contact with solvents.
	To clean, use a mild cleaning solution on a damp cloth. Do not spray cleaner directly onto the control panel.
Exterior	Clean exterior surfaces with a damp cloth and mild cleaning solution when necessary.
Water Bath	Maintain a water level approximately equal to or greater than the initial level of solvent in the tubes.
	Clean the water bath as needed.
Sample Tubes	Only use CLEAN concentrator tubes.
	To avoid interference with sensor endpoint detection, clean glassware stems are very important. The tubes are Pyrex® and can be baked at 450°C. Clean the tubes according to your lab practice.
General Operation	Periodically test the lights, sensors, gas pressure, and valves.
Fan Chamber	If condensation has dripped through the vents into the fan chamber as a result of running at high water bath temperatures, keep the cover open and the unit on until the running fan dries the chamber.

Typical Yearly Consumables

- Sample Tubes: 6 tubes are included. Additional tubes can be purchased in cases of 12 tubes.
- Sensors: 6 sensors are installed. Additional sensors can be purchased individually or in quantities of 6 or more with a discount.
- Auxiliary rack: 1 included with the unit. Additional racks can be purchased.

Sensor Maintenance

The sensors in the TurboVap II are optical sensors. Sensors have a wear life of up to 1 year with average use and up to 6 to 9 months for labs that may be operating 2 shifts daily. Six sensors come installed and ready to operate.

To prolong the life of the sensors, keep the water bath clean and free from solvent spills. The sensors may be quickly damaged by solvent in the water. To check sensor operation, follow the “Cell Diagnostics” on page 64. As routine maintenance, run the sensor diagnostics periodically to confirm proper operation.

Water Bath Maintenance

Always use distilled or de-ionized water. Add *Clear Bath* additive whenever the water is changed.

WARNING

Exposure to liquids may cause bacterial or viral hazards. Liquids can also be corrosive, flammable and/or toxic. Use good laboratory operating procedures when dealing with liquids. Refer to the MSDS (Material Safety Data Sheet) for detailed information.

- *Avoid direct contact with liquids.*
- *Wear protective gloves and safety glasses.*
- *Dispose of liquids and containers properly.*
- *Do not overfill containers.*

Periodically change the water in the bath. With average use, change the water at least every 2 months, or sooner if it becomes cloudy. The cleaner the water is, the better the sensors operate. If residue begins to build up in the bath, the sensors may give false readings.

Glassware Maintenance

Clean and rinse the TurboVap sample tubes following your laboratory protocol. Residue remaining on either the inside or outside of the stem can impact sensor operation.

Replacing the Fuses

Fuse Requirements:

100/120VAC model	220/240 VAC model
(1) 10A, T250V (P/N 39164)	(2) 5A, T250V (P/N 44412)

WARNING

- *Electrical shock hazard. Turn the power switch off and disconnect the power supply before changing the fuses.*
- *For continued fire protection, replace fuses only with ones of the same type and rating.*

1 Turn OFF the AC power and unplug the power cord.

2 Locate the Power Entry Port fuse holder on the side of the unit. 220/240V units have two fuse holders in the power entry port. Always replace both fuses at the same time.

3 Use a flatblade screwdriver to turn the fuse holder(s) from horizontal to vertical (see Figure 13).

4 Remove the fuse holder and fuse.

5 Remove the fuse from the fuse holder and replace it with one of the same type and rating.

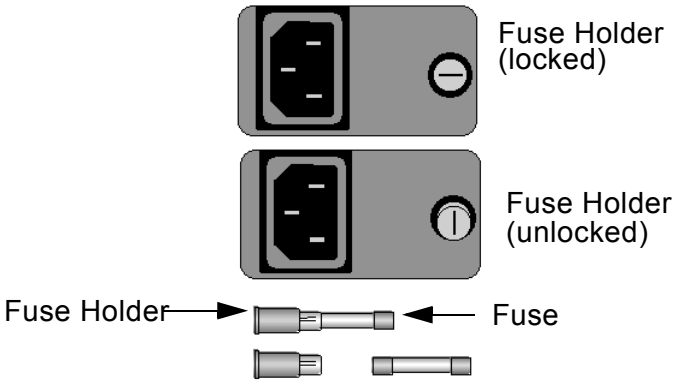


Figure 13. Replacing the Fuses

6 Replace the fuse holder(s) in the power entry port.

7 Plug in the power cord and turn on the AC power.

Cleaning the Water Bath

Turbid water may affect sensor operation. The addition of *Clear Bath* (a biological growth retardant) helps eliminate the need for frequent cleaning. Keep the water in the bath clean to ensure excellent recoveries.

Tools required:

- Phillips screwdriver
- Water Bath Siphon Pump supplied with unit
- Cleaning supplies
- *Clear Bath*

To clean the water bath:

1 Turn the unit off and unplug the power cord.

2 Remove all glassware.

3 Remove the Phillips head screws that secure the top plate and remove the plate.

4 Carefully lift the rack out of the bath. If you want to disconnect the rack so it can be completely removed, remove the sensors.

5 Siphon the water out of the bath by following these steps:

a Close siphon bulb vent.

b Place siphon's suction tube in water bath.

c Place drain tubing in sink.

d Squeeze siphon bulb to start.

6 Wipe and rinse the bath walls. Siphon the rinse water out of the bath.

7 Clean the rack by rinsing with water.

8 Replace the rack in the water bath.

9 Replace the top plate and see "Refilling the Water Bath" on page 49.

WARNING

Fire and burn hazard. Do NOT operate the TurboVap II without water in the water bath.

Refilling the Water Bath

To refill the water bath:

1. Place concentrator tubes in *five* positions.
2. Pour about 1 Liter of distilled water through the empty position.
3. Add 15 drops of *Clear Bath*.
4. Add more distilled water until the water level is as high as the initial solvent level in the sample tube without causing an overflow when all six tubes are in position.
5. Plug in the power cord and turn the power on.
6. Allow 20-30 minutes for the bath to reach temperature, for the air to come out of solution, and for most of the bubbles to dissipate.
7. Dislodge any remaining bubbles (see “Procedure for Dislodging Bubbles” on page 61*)*.

Removing and Replacing the Sensors

This section describes how to remove and replace the sensors. You must remove all of the sensors from the bath whenever the water bath temperature is set at or above 60°C.

Normal maintenance procedures require replacing each worn sensor as required. You should complete the Sensor Test in “Cell Diagnostics” on page 64 whenever you replace a sensor.

Tools Required

Tools used in this procedure are:

- Flatblade screwdriver
- Phillips head screwdriver
- Wire cutters
- Indelible marker

Remove the Covers and Unplug the Connectors

Follow these disassembly steps before removing the optical sensors:

1. Remove all glassware from the unit.
2. Turn the concentrator’s power off and unplug the power cord.
3. Use the flatblade screwdriver to remove the rear service panel screws. Set the screws and service panel aside.
4. Unplug the six sensor connectors from their receptacles on the sensor interconnect board. Note that the receptacles and connectors are numbered 1-6. If you are replacing a single sensor, only disconnect and remove the one that needs to be replaced.
5. Use wire cutters to *carefully* cut any ty-wraps from the sensor wires.
6. Use the Phillips head screwdriver to remove the four screws that hold the black top plate to the water bath. Set the screws aside.
7. Remove the top plate and set it aside.

Remove the Sensors

1 Gently lift the rack out of the bath and allow the water to drain. Perform steps 2-5 for *one sensor at a time*.

2 Locate the sensors on the underside of the rack. Use the flatblade screwdriver to remove the two screws that hold the sensor to the sensor mount (see Figure 14), and set the screws aside. Store the screws in a safe place if you will replace the sensors at a later date.

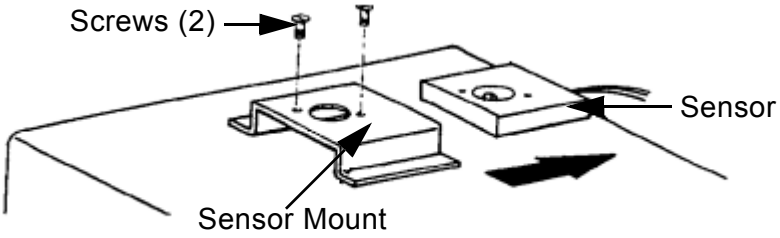


Figure 14. Removing the Sensor

3 Slide the sensor out of the mount, then use an indelible marker to mark the sensor with the appropriate cell position.

4 Remove the sensor wires from the retaining clips on the bottom and side of the rack.

5 Feed the connector-end of the sensor wires up through the hole in the left corner of the unit's top surface and set the sensor aside.

Replace the Rack and Covers to Operate Without Sensors

Continue with these steps if you plan to operate the TurboVap II with water bath temperatures at or above 60°C. Otherwise follow the instructions for installing a new sensor on page 52.

1 Replace the rack in the bath, making sure the four holes on the top of the rack align with the holes on the upper lip of the bath.

2 Position the black top plate over the rack, making sure the cutout on the underside of the plate faces the back of the unit.

3 Secure the top plate with four Phillips screws.

4 Replace the rear service panel with the flathead screws.

5 Plug in the power cord and turn the unit on.

Operating Requirements When Sensors Are Removed

You *must* only use **Time** (minutes) and **Manual** endpoint selections when the sensors are removed.

Installing the Sensors

To reinstall all of the sensors or to replace a single sensor, follow the steps below. Match the cell position with the correct sensor number and reverse the removal steps.

1. If the sensors are new, use an indelible marker to mark the cell position on the new sensor's connector.
2. Slide each sensor into the sensor mount, making sure that the holes in the sensor align with the holes in the mount.
3. Use the screws previously removed to fasten the sensor to the mount. Make sure that the sensor's wires run in the same direction as the existing sensors.
4. Fit the sensor wires into the rack's retaining clips.
5. Feed the connector through the back corner of the unit and plug the connector into the properly numbered receptacle on the interconnect PC board.
6. Replace the rack in the bath, making sure the four holes on the top of the rack align with the holes on the upper lip of the bath.
7. Position the black top plate over the rack, making sure the cutout on the underside of the plate faces the back of the unit.
8. Secure the top plate with four Phillips screws.
9. Replace the rear service panel and secure with the flathead screws.
10. Fill the water bath, plug in the power cord, turn the unit on, and dislodge any bubbles that may have formed around the sensor optics.
11. Confirm correct sensor placement and connection by completing the "Cell Diagnostics" on page 64.

Changing the Rack

This section provides instructions for changing your concentrator's rack to accommodate sample tubes with a different stem size. Start with the procedure below and then change the rack using the appropriate instructions, either:

- "Changing a Rack from 0.5 mL to 1.0 mL (Installing Spacer)" on page 54
- "Changing a Rack from 1.0 mL to 0.5 mL (Removing Spacers)" on page 55

Tools and Kits Required

Tools and parts used in these procedures are:

- Flatblade screwdriver
- Phillips head screwdriver
- Rack Adapter Kit - provided with unit, and used in Procedure 1
- Six plastic water bath closures that come with concentrator

Before Changing the Rack

Follow these preliminary steps whenever you need to change tube sizes.

1 Turn the concentrator's power off and unplug the power cord.

2 Remove any tubes from the concentrator.

3 Use the Phillips screwdriver to remove the four screws that hold the black top plate to the water bath. Set the screws aside.

4 Remove the top plate and insert the six plastic closures at each location on the plate.

5 Remove the back panel and carefully cut the tie wraps that hold the wires connectors to the interconnect board.

6 Carefully lift the rack out of the water bath.

7 Place the black top plate across the top of the water bath, then lay the rack on top of the plate with the sensors facing up. This orientation will prevent the possibility of sensor mount fasteners falling into the water bath.

Changing a Rack from 0.5 mL to 1.0 mL (Installing Spacer)

To change a 0.5 mL rack to a 1.0 mL rack, you must install four spacers on each optical sensor mount to move the sensor to the correct height.

1. Place one hand inside the rack and under one of the sensors to capture the nuts and washers. Use the flatblade screwdriver to remove the four screws that hold the sensor mount to the rack. Set the fasteners aside.
2. Install a spacer beneath each sensor mount screw location and fasten the sensor to the rack with the fasteners just removed (see Figure 15). This raises the sensor to the correct height for 1.0 mL stems.

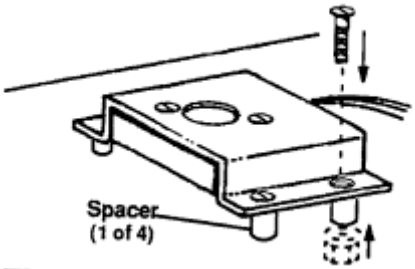


Figure 15. Installing the Sensor Spacers

3. Repeat steps 1 and 2 at each sensor location.
4. Lift the rack and remove the top plate. Reinsert the rack in the water bath, making sure the four holes on the top of the rack align with the holes on the lip of the water bath.
5. Position the top plate, making sure the cutout on the underside of the plate faces the back of the unit and goes over the sensor wires.
6. Fasten the top plate to the bath with the four Phillips screws previously removed. Remove the six plastic closures.
7. Reconnect the power cord and turn the unit on.

Replacing the rack in the water bath may trap air bubbles around the sensor. If given enough time (approximately 1/2 hour after bath has reached operating temperature), bubbles should dissipate. In most cases, sample tube insertion will free bubbles. Otherwise, refer to *"Procedure for Dislodging Bubbles" on page 61*.

Changing a Rack from 1.0 mL to 0.5 mL (Removing Spacers)

To change a 1.0 mL rack to a 0.5 mL rack, you must remove the four spacers from the optical sensors to move the sensors down to the correct height.

1. Place one hand inside the rack and under one of the sensors to capture the nuts and washers.
2. Use the flatblade screwdriver to remove the four screws that hold the sensor mount to the rack (see Figure 16) and set the fasteners aside.
3. Remove the four spacers and set them aside for future use. Re-fasten the sensor to the rack with the fasteners just removed.

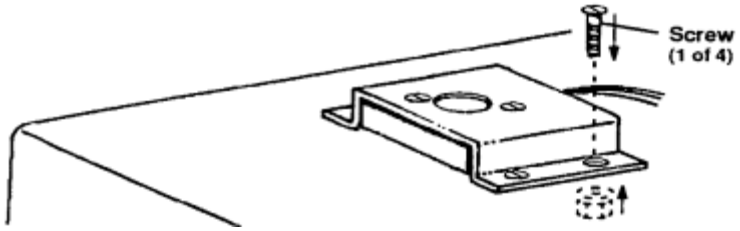


Figure 16. Removing the Sensor Spacers

4. Repeat steps 1 and 2 at each sensor location.
5. Lift the rack and remove the top plate. Reinsert the rack within the water bath, making sure the four holes on the top of the rack align with the holes on the lip of the water bath.
6. Position the top plate, making sure the cutout on the underside of the plate faces the back of the unit and goes over the sensor wires.
7. Fasten the top plate to the bath with the four Phillips screws previously removed. Remove the six plastic closures.
8. Reconnect the power cord and turn the unit on.

Replacing the rack in the water bath may trap air bubbles around the sensor. If given enough time (approximately 1/2 hour after bath has reached operating temperature), bubbles should dissipate. In most cases, sample tube insertion will free bubbles. Otherwise, refer to *"Procedure for Dislodging Bubbles" on page 61*.

Long Term Storage

If the TurboVap will be stored for an extended period of time:

1 Turn the unit off and unplug the power cord.

2 Remove all glassware.

3 Turn off and disconnect the air/gas supply.

4 Empty the bath.

5 Wipe the bath walls with an appropriate cleaner. Rinse and re-siphon the water from the bath.

6 Remove, clean, and replace the rack.

7 Leave the cover open until the inside is completely dry.

8 When dry, close the cover.

9 Cover the unit to prevent dirt or dust accumulation.

Troubleshooting

This section provides:

- Charts for troubleshooting your concentrator.
- Procedures referenced in the Solution columns.

  If the solution listed in the chart is to replace a part, see the page 68.

  If the solution listed is to contact Biotage 1-Point Support, see page 3.

Troubleshooting the Concentration Process

To diagnose problems related to the concentration process, locate the description of the condition in the table below.

Condition	Probable Cause	Solution
Gas flow keeps turning on and off near the end of concentration	Meniscus of sample approaches the sensor optics	Normal behavior.
Gas flow keeps turning on and off and the tube is still full	Air bubbles around the sensor optics	Perform *"Procedure for Dislodging Bubbles" on page 61*, evaluate status of the concentration, reset, and restart.
Stops prematurely (using **Sensor** selection)	Sample darkens too rapidly	Restart to establish a new baseline reading or use the **Manual** selection.
	Air bubbles around sensor optics	Perform *"Procedure for Dislodging Bubbles" on page 61*, evaluate status of the concentration, reset and restart.
	Faulty or worn sensor	Perform **Cell Diagnostics** (see page 64), and replace sensor if the test fails.
Doesn't stop (using **Sensor** selection)	Sample concentrates too slowly or opaque sample coats the glass	Use **Time** or **Manual** selection or change conditions to speed concentration.
	Faulty or worn sensor	Perform **Cell Diagnostics** (see page 64), and replace sensor if the test fails.
	Turbid bath water	Clean and use *Clear Bath* additive.

Condition	Probable Cause	Solution
Concentration rate too slow	Low water bath temperature	Increase bath temperature.
	Low gas pressure	Increase pressure.
Concentration rate too fast	High water bath temperature	Decrease bath temperature.
	High gas pressure	Decrease gas pressure.
No concentration at only one tube	Plugged nozzle or defective valve	Contact Biotage 1-Point Support (see page 3).
Sample splashing	High gas pressure	Decrease gas pressure.
Low recovery of sample	Sample boiling	Decrease bath temperature.
	Sample left too long after completion of concentration	At the end of concentration, remove the sample promptly.
	Sample splashing	Decrease gas pressure.
	Improper sample removal	Reconstitute to 1.0 mL and use this volume to rinse the angled part of the tube and stem several times.
Gas pressure drops when concentration starts		Normal behavior.

Troubleshooting the Panel Display

To diagnose unexpected behavior of the panel display, locate the description of the condition in the table below.

Condition	Probable Cause	Solution
Temperature display blinking	Temperature not in range	Allow enough time to come to temperature. Contact Biotage Technical Support if continues.
	Cover open	Close cover.
Temperature display shows “St” unit beeps rapidly, and bath heater shuts off	Temperature setting exceeds maximum allowed when the sensors are installed in the unit (60°C).	Decrease temperature setting OR remove sensors and use an endpoint selection that doesn’t use the sensors.
Temperature display shows “Lo”	Bath temperature sensor shorted	Contact Biotage 1-Point Support (see page 3).
Temperature display shows “hi”	Bath temperature sensor open or unplugged	Contact Biotage 1-Point Support (see page 3).
Time Elapsed display in **Value** field shows “≡≡”	Elapsed time has exceeded 99 minutes - using **Manual** endpoint selection	Normal behavior.
Time Elapsed display in **Value** field shows “SE”	Using **Sensor** & **Time** endpoint selection	Normal behavior.
Time Elapsed display in **Value** field shows “**--**”	**Start**/**Stop** was pressed during concentration, or cell position has not been started	Normal behavior.
Endpoint selection lights blinking and **Time**=00	Power failure occurred	Evaluate the concentration status, reset, and restart.
Light out on panel	Faulty LED	Contact Biotage 1-Point Support (see page 3).
Condition or **Value** display does not work	Faulty display board	Contact Biotage 1-Point Support (see page 3).
Bath Temp or **Endpoint Time** pushwheel does not work or shows the wrong value in the display	Faulty pushwheel switch	Perform the *Pushwheel Connection Test* (see page 63). If it is not a connection problem, replace the electronics cover.

Troubleshooting the Unit

To diagnose problems with the unit, locate the description of the condition in the table below.

Condition	Probable Cause	Solution
Unit inoperative	Power switch off	Check that power switch is turned on.
	Loose power cord	Check that power cord is fully seated.
	Faulty fuse	Replace fuse.
	Faulty control board	Contact Biotage 1-Point Support (see page 3).
Turbid bath water	Bacterial growth	Clean and use *Clear Bath* additive.
Beeping rapidly after setting conditions (also, **Temperature** display shows “St” and bath heater shuts off)	Temperature setting exceeds maximum allowed when the sensors are installed in the unit (60°C)	Decrease temperature setting OR remove sensors and use an endpoint selection that doesn’t use the sensors.
Beeping rapidly during concentration	Pressure to unit has dropped below 3 psi (0.2 bars)	Check gas supply.
Continuous beep	Bath temp above 97°C	Turn off unit and contact Biotage 1-Point Support (see page 3).
Condensation or fan chamber corrosion	Running at a high water bath temperature	At the end of concentration, lift the cover and leave the unit on until the chamber under the vents on the top of the unit is dry.

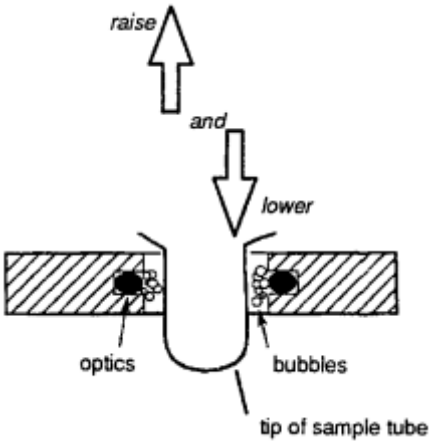
Procedure for Dislodging Bubbles

As the water bath begins to warm up, air comes out of solution and bubbles may form around the sensor's optics. Also, whenever you have removed the water bath rack for servicing, replacing the rack may trap air bubbles.

In most cases, sample tube insertion frees any bubbles trapped around the sensor's optics.

In cases where bubbles trapped in the sensor's optics affect the concentration process (described in the Diagnostic chart), perform the following steps to dislodge the bubbles:

1 Grasp the sample tube, and using a pumping motion, raise and lower the tube about one inch. Pump the tube up and down several times.



2 Perform step 1 on each cell position.

3 Test the sensors by performing the **Cell Diagnostics** test (see page 64).

Software Diagnostics

The concentrator software provides diagnostic capabilities to test the function of hardware and check the software version. The following diagnostics are provided:

Power-Up Diagnostics to

- test the lights and cover switch on the unit
- check the software version running the unit
- test the **Endpoint Time** and **Bath Temperature** pushwheel connections
- check the gas pressure

Cell Diagnostics to

- test the sensors
- test the valves

To enter the TurboVap II Concentrator's diagnostics mode:

1. Turn the power on.
2. Within four seconds of turning the power on, press the **Select Displayed Condition** button.

Exit the diagnostics mode at any time by pressing the **Endpoint Select** button.

Power Up Diagnostics

The Power Up diagnostics are available each time the power is turned on. Within the first four seconds of turning on the unit, the lights are tested and you can check the:

- the cover switch,
- the software version,
- the pushwheel connections and
- the gas pressure.

Display Test

For the first four seconds after power up, all display lights are lit. Confirm that no lights are out.

If any lights are out, check to make sure all connectors are seated.

If condition persists, order the Electronics Cover Replacement Kit. (See "Replacement Parts" on page 68)

Cover Switch Test

Raise and lower the cover during the first four seconds after turning the power on to test the cover switch. The TurboVap will beep each time the cover is opened or closed. If a beep does not sound, contact Biotage 1-Point Support (see page 3).

Software Version

Press the **Select Displayed Condition** button within the first four seconds to display the software version in the **Condition** and **Value** displays. The software version may be requested when calling Biotage for assistance.

Pushwheel Connection Test

The **Bath Temperature** and **Endpoint Time** pushwheel connections should be tested after replacing the control board or electronics cover. After displaying the software version for 3 seconds, the **Condition** and **Value** displays reflect the pushwheel settings.

To test the pushwheel connections:

1. Press the set buttons to set each pushwheel to all ten values. The corresponding display “tracks” the switch.
2. If the displays do not reflect the pushwheel settings, the cables may not be connected in the right orientation or at the right receptacle.

If setting the pushwheel affects the wrong side of the corresponding display, **then** cables are plugged into the correct receptacle, but in the wrong orientation.

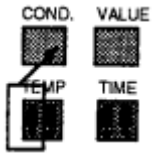


Figure 17. Wrong Orientation

If setting the pushwheel affects the display for the other pushwheel, **then** cables are plugged into the wrong receptacle.

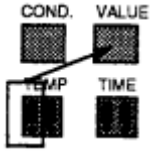


Figure 18. Wrong Receptacle

Gas Pressure Test

Press and release the **Select Displayed Condition** button after testing the pushwheel connections. The **Pressure** light turns on and the **Condition** and **Value** displays alternately show the pressure in psi and bars.

Check the gas pressure after replacing the control board or valves, or if you are experiencing low sample recoveries, sample splashing, or erratic concentration rates.

To view the gas pressure:

1. Set the gas pressure for the Valve Test to 5 psi (0.3 bars) by pulling the regulator knob out and turning the knob (turn the knob clockwise to increase pressure, counter-clockwise to decrease pressure).
2. When the pressure reads 5 psi, push the regulator knob in to retain the setting of 5 psi (0.3 bars). This prepares the unit for the valve test.

If the display shows a zero gas pressure, check the following and take the necessary action.

- the gas source is turned on
- the gas is connected to the concentrator
- the Quick-disconnect Fitting that connects the internal gas tubing to the Control Board is connected
- there are no leaks in the gas tubing

Cell Diagnostics

Any time after the Display Test or other diagnostics have run, even during operation, cell diagnostics can be performed to test the **sensors** and the **valves.** To run the Cell Diagnostics tests:

1. Lift the concentrator's cover and remove any tubes.
2. Turn on the unit, and within four seconds, press the **Select Displayed Condition** button. The **Condition** and **Value** displays show the current software revision, for ex.:**r 1.0**. After 3 seconds, the displays show the current pushwheel settings.
3. Set the gas pressure to 5 psi (described in the Display Test).
4. **Test the Sensor Temperature Rating:** Press the **Cell One** button and keep it depressed for the next step. The **Condition** and **Value** displays show the maximum bath temperature rating for cell one's sensor, for ex.: **60°C.** The light next to the **Cell One** button turns on, and the valve for cell one activates.

5 **Test the Valves:** Use Figure 19 to locate cell one's nozzle and place your finger at the nozzle's opening to confirm gas flow, indicating a functional valve. Gas flows out of cell one's nozzle.

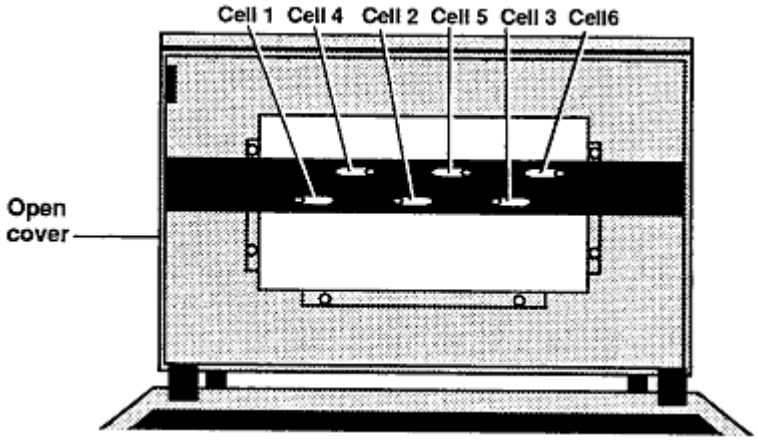


Figure 19. Testing the Valves

6 **Test the Sensors:**

a Release the **Cell One** button. The gas turns off, and the sensor location and optical output is displayed in the **Condition** and **Value** displays.

Note: The sensors must be immersed in the water bath for this test. No bubbles may be present.

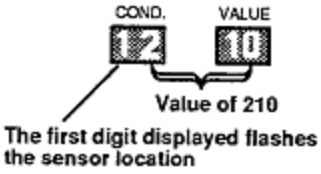


Figure 20. Sensor Test Display

7 Record the sensor output value.

8 Place a clean, empty tube into cell position 1 and record the new display value. With a clean, empty tube in place, the value should be less than 67% of the value recorded in step 6.

9 Repeat steps 4-8 for the remaining cells and valves. The results described for steps 4-8 are duplicated for each cell selected.

10 When all valves and sensors are tested, press **Endpoint Select** to exit the diagnostic. Normal operation resumes.

Faulty Valve

If a valve fails step 5 in the procedure above, order an Air Valve Replacement Kit.

Expected Sensor Optical Output Values

The table below lists the expected sensor values recorded in step 6 when the sensors are in water, without bubbles.

When...	Then...
no tube is in place	value should be between **90** and **410**
empty tube is in place	value should be less than 67% of the value with no tube in place

Note: Then number flashing in the first digit field indicates the sensor position.

Incorrect Sensor Values

The table below describes the possible causes for incorrect sensor values.

When...	Then...	and you should
the sensor temperature rating value seen in step 3 is 95°C instead of the rated value OR the optical output value recorded in step 6 is too high or low	There are bubbles around the sensor optics OR the water level in the bath is below the level of the sensor OR the sensor: • may be improperly connected • has become defective.	• Perform the Bubble Dislodging Procedure (see page 61) and repeat the test. • Check the water bath level and repeat the test if water is added. • Check the sensor connection and repeat the test.
the sensor position flashing in the first field does not match the actual cell position	The sensor is not connected to the correct location on the interconnect board.	Check the sensor connection and repeat the test.

After these conditions are ruled out, replace the sensor.

Specifications

Environmental

Operating Temperature	59° to 95°F (15° to 35°C)
Operating Humidity	0% to 85% relative humidity, non-condensing
Storage Temperature	50° to 122°F (10° to 50°C)
Storage Humidity	0% to 85% relative humidity, non-condensing
Altitude	Up to 2000M
Indoor Use Only	

Power

Input Voltage	100/120VAC +/- 10% 220/240 VAC +/- 10%
Line Frequency	50 - 60 Hz
Fuses	100/120VAC: (1) 10A, T250V (P/N 39164) 220/240 VAC: (2) 5A, T250V (P/N 44412)

Dimensions

Height: 12" (30.5cm)

Width: 21.2" (53.8cm)

Depth: 12" (30.5cm)

Height with cover open: 20 inches (50.8cm)

Weight: 40.5 lbs. (18.47 Kg.) - empty water bath

Time Range: 1 to 99 min. or 0.1 to 9.9 hrs.

***** NOT for in vitro testing *****

Replacement Parts

Description	Part Number
TurboVap II 110V with 200 mL Rack for 1.0 mL stem *recommended unit for 200mL volumes; includes glassware, aux. rack and venting hose*	103187
TurboVap II 220V with 200 mL Rack for 1.0 mL stem *recommended unit for 200mL volumes; includes glassware, aux. rack and venting hose*	103192
TurboVap II 110V with 50 mL Rack for 1.0 mL stem *includes glassware, aux. rack and venting hose*	103189
TurboVap II 220V with 50 mL Rack for 1.0 mL stem *includes glassware, aux. rack and venting hose*	103194
TurboVap II 110V with 200 mL Rack for 0.5 mL stem *includes glassware, aux. rack and venting hose*	103186
TurboVap II 220V with 200 mL Rack for 0.5 mL stem *includes glassware, aux. rack and venting hose*	103190
TurboVap II 110V with 50 mL Rack for 0.5 mL stem *includes glassware, aux. rack and venting hose*	103188
TurboVap II 220V with 50 mL Rack for 0.5 mL stem *includes glassware, aux. rack and venting hose*	103193
Startup Kit	103207

Accessories	Part Number
Auxiliary Rack for 50 mL tubes	42566
Auxiliary Rack 200 mL tubes	42567
Bubble Dislodger	42675
Clear Bath, Water Bath Additive, 8 oz. bottle	44316
Air Regulator & Gauge (200/50)	44526
Rack Adapter kit to convert 0.5- > 1.0mL *to add spacers to rack to accommodate 1.0mL stem*	46462
Plastic Closures, 200 mL (6/bag) — *to cover unused positions*	46463
Plastic Closures, 50 mL (6/bag) — *to cover unused positions*	46464

Glassware	Part Number
Tube, 200 mL with 1.0mL stem (12 ea.)	128133
Tube,50 mL with 1.0mL stem (12 ea.)	128138
Tube, 50 mL with 0.5mL tip (12 ea.)	128135
Tube, 200 mL with 0.5mL stem (12 ea.)	128134

Replacement Kits	Part Number
Sensor Replacement Kit	45713
Rack Gasket Replacement Kit, 50 mL	46379
Rack Gasket Replacement Kit, 200 mL	46380
Control Board Replacement Kit	46382
Electronics Cover (with keypad) Replacement Kit	103205
Air Valve Replacement Kit	46385
Glass Panel Replacement Kit	46386
Bath Replacement Kit	46985
Rack for 200 mL tube — *includes spacers & top plate; sensors not included*	47082
Rack for 50 mL tube — *includes spacers & top plate; sensors not included*	47083

Replacement Parts	Part Number
Fitting, ¼ barb x 1/8 male NPT — *connects gas tubing to gas source. (for ¼ connection see 43145)*	38635
Fitting, ¼ barb x ¼ male NPT — *connects gas tubing to gas source. (for 1/8 connection see 38635)*	43145
2 inch Venting Hose, 12.5 feet	43067
Fitting, coupling, panel mount — *gas inlet coupling on back of unit*	44015
Fitting, coupling, insert — connects *gas tubing to inlet coupling*	44016
Door Sensor Actuator Magnet	44111
Tubing Kit ¼ ID x 3/8 OD Bevaline®, 10 feet	44504

Replacement Parts	Part Number
Top Plate (black) for 200 mL tube (either stem size)	45887
Air Regulator	46337
Bath Siphon	46381
Paint, Dark Grey Touch Up	46392
Top Plate (black) for 50 mL tube (either stem size)	46448
Fan Assembly	46453

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