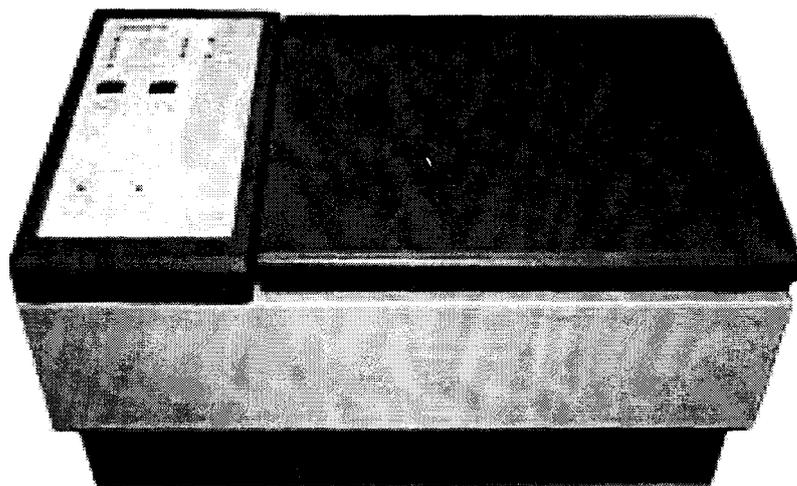


TurboVap[®] 96



Zymark

Workstation



TurboVap[®] 96 Concentration Workstation
User's Manual

Zymark TurboVap® II, LV, 96 and 500 Workstations Factory Warranty

Zymark warrants your TurboVap Workstation **against** defects in material workmanship for a period of ninety (90) days from the date of shipment.

What is Included

- Service will be provided at Zymark's Repair Depot located at our main headquarters in Hopkinton, MA, USA or any other authorized repair site around the world. After a review of the current product status, a Zymark Technical Support Center Representative will advise the best method of repair.
- No-charge for Zymark Repair Depot Services when determined **necessary** by a Zymark Technical Support Specialist.
- No-charge for replacement parts including sensors.
- Unlimited access to Zymark's Technical Support Center during the warranty period, which provides troubleshooting, repair instruction, replacement part information, and **shipment**.
- When Zymark Repair Depot service is required, the customer will ship their damaged TurboVap to the Zymark Repair Depot, or the nearest authorized facility. (see Repair Authorization for further details.) The customer will use their own preferred method of shipment and prepay shipping charges. Upon receipt, within ten (10) business days, our trained technicians will diagnose, repair, and **run** quality performance tests to verify the TurboVap is operating correctly. Zymark will then pay for the equivalent return shipment method to the customer.
- A completed Zymark Service Report provides thorough documentation of all maintenance and service work performed by the Zymark Service Engineer at the Repair Depot. (*Exception:* Documentation is not provided when Zymark provides service via telephone, fax or modern.)
- Limited-Life parts are covered for thirty (30) days. See description of Limited-Life Parts below.

Any defects covered by this warranty shall be corrected by replacing or repairing the affected item, at Zymark's option. Parts replaced during the warranty period will be covered for the remaining term of the original warranty, or for thirty (30) days from time of replacement, whichever is longer. Such replacement parts may, at Zymark's option, be new or remanufactured. All parts removed from warranted equipment become the property of Zymark Corporation.

Zymark reserves the right to satisfy its warranty obligations in full by refunding the purchase price or replacing the unit.

Customer Responsibilities

- The TurboVap must be used under normal installation and application conditions as described in the User's Manual.
- The TurboVap must be maintained as described in the User's Manual.
- Prior to **returning** the product the Zymark Repair Depot, the customer will decontaminate the equipment by identifying and removing pathogens, hazardous materials, and radioactive materials. See Hazardous Limitation Statement for further details.
- If the customer maintains a change **control/validation** log book as a permanent record, then he/she is responsible for entering all service documentation into this log.
- Customers must perform the appropriate level of revalidation required as a result of the maintenance or service provided.

Exclusions

Any alteration of the TurboVap covered under this warranty, that is not performed by Zymark Corporation or an approved Zymark vendor, will void this warranty.

- This warranty is intended to cover the TurboVap. Equipment purchased from other vendors is not covered by this warranty.
- This warranty applies only to the original TurboVap users and delivery location. It is not transferable to other users or locations without pre-approval from Zymark.
- Product that has been subject to misuse, accident, negligence or improper transportation, handling, installation, storage, use, maintenance, or application is not covered under this warranty.

-
- Limited-Life parts are covered for thirty (30) days after installation. These parts are available from Zymark Corporation and are designed for replacement by the customer. See description of **Limited-Life Parts** below.
- Damage to Limited-Life parts caused by insufficient maintenance or cleaning practices, or abnormal applications are not covered under this contract. If these situations are diagnosed, charges are incurred for parts and service rate **structure** for labor and travel.
 1. Application and chemistry support are not included.

Limited-Life Parts

Limited-Life Parts are any parts that are exposed to **solvents**, reagents, or samples. Such parts include, but are not limited to, valves, seals and fittings. These parts are warranted to be functional at the time of installation and are covered for thirty (30) days after installation. **Limited-Life Parts** are available from **Zymark** at current list prices and are designed for replacement by the customer.

Repair Authorization

In servicing situations requiring the return of equipment to Zymark, the TurboVap must be **returned** to Hopkinton, MA, USA, or a facility designated by Zymark. The customer shall prepay charges for equipment **returned** to Zymark, with Zymark paying for equivalent **return** shipment to the customer. A **Returned Material Authorization (RMA)** must be obtained for any TurboVap being returned to Zymark. Contact the Zymark Technical Support Center by telephone at (508) 435-9761 or via the Internet at **techsupport@zymark.com** or by fax at (508) 435-0950 before returning any TurboVap to Zymark. Additionally, customers are required to complete a Zymark Chemical Questionnaire prior to the issuance of an RMA. A TurboVap returned to Zymark must first be decontaminated to meet Zymark and United States Department of Transportation procedures and standards. These procedures provide for the safety of Zymark receiving and repair personnel.

Hazardous Limitation Statement

At no time will Zymark personnel perform service on unsafe equipment, perform service in unsafe environments, or decontaminate equipment to make it safe.

Zymark is not licensed to accept products that have been exposed to radioactive materials.

Prior to the performance of any service work, Zymark personnel will evaluate the condition of the equipment and the environment in which the equipment is located.

After evaluation and discussion with the customer, Zymark commits to the following:

- When the environment and the TurboVap are **determined** to be free of chemical, radioactive and **bio-hazardous** materials by Zymark personnel, servicing will be performed.
- When the environment and the TurboVap are determined to be hazardous by Zymark personnel, Zymark reserves the right to refuse servicing the TurboVap. One of two situations will then occur:
- The customer will decontaminate the TurboVap **and/or** the environment in which the equipment is located to the satisfaction of Zymark personnel, prior to Zymark servicing.
- The customer decides not to decontaminate the TurboVap and/or the environment, and takes responsibility to service the TurboVap themselves through **on-site**, verbal instruction from Zymark personnel.

Parts Availability and On-Going Support

Zymark provides support for its products for a period of five (5) years after a product is no longer available for purchase.

No Other Warranties

ZYMARK SPECIFICALLY DISCLAIMS ANY AND ALL OTHER PROMISES, REPRESENTATIONS, AND WARRANTIES, EXPRESSED OR IMPLIED. THIS INCLUDES, BUT IS NOT LIMITED TO, THE PRODUCT'S CONDITION, ITS CONFORMITY TO ANY DESCRIPTION OR REPRESENTATION, THE EXISTENCE OF ANY LATENT OR PATENT DEFECTS, **IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE**. IN NO EVENT WILL ZYMARK BE LIABLE FOR ANY LOSS OF PROFIT OR ANY OTHER COMMERCIAL DAMAGES, INCLUDING, BUT NOT **LIMITED TO**, SPECIAL, **INCIDENTAL**, CONSEQUENTIAL, OR OTHER. IN NO EVENT SHALL ZYMARK'S LIABILITY EXCEED THE PURCHASE PRICE FOR THE PRODUCT.

Introduction

Overview

Congratulations on your purchase of the TurboVap 96 Concentration Workstation. This workstation is a microprocessor-controlled instrument for simultaneous, automated concentration of multiple samples with unattended Operation, convenience, and speed. It can accommodate one or two 96-well microplates or deepwell plates. This workstation demonstrates Zymark's commitment to improving laboratory **efficiency** by:

- A **microprocessor-controlled** concentration environment allowing changes to gas time, plate temperature, and input gas flow rate during the setup procedure.
- Dual 96-well positions for separate or simultaneous concentration using different test conditions and cycle times.
- Two inert gas regulators that allow you to control the flow rate to each position.
- Precision placement of gas **nozzles** to provide a patented gas vortex shearing technique to concentrate samples quickly.
- Automatic shut off of the gas flow and pause of evaporation time when **you** open the cover during a concentration. When the cover is closed, the concentration for each position continues automatically.
- Unattended Operation and shut off of gas flow with a beeper signal when the concentration time has elapsed.
- Microprocessor monitoring of over temperature and **low** flow rate of **input** gas.
- Manual Start/Stop of **either** position at any time.

We are confident the TurboVap 96 Concentration Workstation will be a welcome addition to your laboratory.

Audience

This manual is for the operator of the TurboVap 96 Concentration Workstation for use in a laboratory environment.

Product Information

Keep your product information readily available should you have to contact Zymark Corporation for any reason. Record the product information below.

Model: _____ *TurboVap 96 Concentration Workstation*

Serial Number: _____
(found on the back of the workstation)

Your Customer ID Code: _____
(found on your shipping documents)

Technical Support

If you have questions about the TurboVap 96 Concentration Workstation that are not fully answered by this user's manual, please contact the Zymark Technical Support Center. You can contact the Zymark Technical Support Center using any of the following:

Phone: (508) 435-9761

Fax: (508) 435-0950

[E-mail: techsupport@zymark.com](mailto:techsupport@zymark.com)

The Center hours of operation are Monday through Friday from 8:00 a.m. to 8:00 p.m. EST.

You can also visit our World Wide Web site on the Internet at www.zymark.com. The Center provides expert services including product troubleshooting, repair instruction, service and installation scheduling, and replacement part information.

For support in Europe, contact Zymark LTD, Runcorn, UK +44-1928-711448 or fax +44-1928-791228. For more information, contact your local Zymark representative.

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Contents

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.

FCC (USA)

This equipment has been tested and found to comply with the limits for a Class A device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial **environment**. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the user manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference; in which case, the user will be required to correct the interference at his own expense.

Canada DOC

This apparatus does not exceed the Class A limits for noise emissions set out in the radio interference regulations of the Canadian Department of Communications.



This device **complies** with all CE rules and requirements. See the Declaration of Conformity for details.

NOTE



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

Product Safety

The workstation has been designed with safety as a foremost consideration. It is equipped with a nonarcing fan, solid state electronics, and provisions for vapor removal. The fans are **brushless** motor fans and will not ignite vapors; however, the workstation is not classified as "Explosion Proof," and its use is at the discretion and risk of the Operator or laboratory supervisor/manager.

The power switch **on** the workstation is the same kind 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.

WARNING

A

*The power switch is an arcing source and **could** ignite explosive vapors if present.*

Customer's Responsibility

It is the customer's responsibility to develop a concentration method, install an inert gas input, and install a venting hose to the back of the workstation to maintain proper ventilation. The venting hose is supplied.

Statement of Proper Use

Use of this product is only for the manner described in this manual. The TurboVap 96 workstation is NOT designed for *in vitro* testing or for use with highly corrosive samples. When used other than specified, the safety protections may be impaired.

WARNING



*To reduce the risk of electric shock, do not disassemble the unit: There are no user **serviceable** parts inside. Refer repairs to qualified service personnel.*

Table of Symbols

These symbols are **intended** to draw your attention to particularly important information and alert you to the presence of hazards as indicated. Some of these symbols may not appear in this manual or on the product this manual describes:

	DANGER: An imminently hazardous situation, which if not avoided , will result in death or serious injury.								
	WARNING: A potentially hazardous situation, which if not avoided , could result in death or serious injury.								
	NOTE: A cautionary statement; an operating tip or maintenance suggestion, which may result in instrument damage if not followed.								
	Hazardous voltage; risk of shock injury.								
	Risk of body parts, hair, jewelry, or clothing getting caught in a moving part.								
	Risk of puncture injury .								
	Risk of eye injury: Wear safety glasses.								
	Risk of fire.								
	Risk of poison.								
	Risk of explosion.								
	Hazardous fumes.								
	Hot surface; risk of burns.								
	Ground symbol.								
	CE compliance mark.								
	Signifies that the unit has passed safety tests for grounding, high voltage spikes, and voltage leakage.								
	Input.								
	Output.								
Equipment labels are color-coded:	<table border="0"> <tr> <td>Yellow</td> <td>Caution, risk of danger</td> <td>Red</td> <td>Stop</td> </tr> <tr> <td>Blue</td> <td>Mandatory action</td> <td>Green</td> <td>Safe condition or information</td> </tr> </table>	Yellow	Caution, risk of danger	Red	Stop	Blue	Mandatory action	Green	Safe condition or information
Yellow	Caution, risk of danger	Red	Stop						
Blue	Mandatory action	Green	Safe condition or information						
	Helpful hint; additional information								

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Unpacking and Site Preparation

Unpacking Instructions

Unpack the **shipping** container and verify that all the parts are present. If anything is damaged or missing, contact Zymark Corporation.

Parts Listing

The TurboVap 96 Concentration Workstation comes with the **following** parts:

- Concentration Workstation
- Power Cord
- **Venting** Hose 12.5 ft (3.8 m)
- 3/8 in. (9.5 mm) ID Gas tubing
- Bag of two 3/8 in. (9.5 mm) Barb Fittings (1/8 in. NPT and 1/4 in. NPT)
- **Coupling** Insert
- Two hose clamps
- User's Manual
- Microplate Adapters (2)

Items Required But Not Included

- Inert gas supply (example: nitrogen) with two-stage regulator

Record the Serial Number

Record the serial number of the workstation and your customer **ID** code **on** page vii of this manual. These numbers can be found **on** the Sales Order slip. This information is required whenever you call the **Zymark** Customer Support Center.

Site Preparation

Before **installing** the TurboVap 96 Concentration Workstation, you must have an appropriate location with available gas and **electrical** sources and adequate ventilation as specified by these site preparation requirements.

Space

Minimum bench space needed for the Concentration workstation and any accessories:

Height: 12 inches (30.5 cm)

Width: 23.5 inches (59.7 cm)

Depth: 12.5 inches (31.8 cm)

Open Cover: 21 inches (53.3 cm)

Work Area

Flat, level, stable surface

Indoor use only within 12.5 ft (3.8 m) of proper ventilation apparatus

Power

	100/120 VAC Model	220/240 VAC Model
Input Voltage	105-132 VAC	198-264 VAC
Maximum Power	620 VA	620 VA
Line Frequency	50/60 Hz	50/60 Hz
Fuse	1.25 x 0.25 in., 6 A, Fast Acting, 250V	5 x 20 mm, 3 A, Fast Acting, 250V
Ground	The 3-prong power cord plug supplies the ground.	

Gas Supply

You must use clean, dry, regulated nitrogen or other suitable gas. Use the supplied 3/8 in. (9.5 mm) ID gas tubing for connection of the gas supply. A carbon trap is also recommended.

Use of compressed air could contribute to the oxidation of some phenolic compounds and reduce sample recoveries.

WARNING



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

Compressed Gas Supply Inlet Pressure

Minimum	Recommended	Maximum
30 psi (2.1 bars)	60-70 psi (4.1 - 4.8 bars)	80 psi (5.52 bars)

1 bar = 100 kilopascals.

Devices added to the inlet supply line, such as moisture traps or filters, must not drop the pressure under 30 psi (2.1 bars) measured at the TurboVap 96 inlet fitting.

CAUTION



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

Exhaust Duct

The exhaust duct requires a 2-inch (5.1-cm) diameter venting hose (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.

Installing the Workstation

Use the following procedure to install the TurboVap 96 workstation.

Connect the Gas Supply

WARNING



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

Connect your gas supply as follows:

- 1 Make sure that the gas supply turned off.
- 2 Determine if an in-line carbon trap is necessary.
- 3 Slip one of the supplied clamps over each end of the 3/8-in. (9.5 mm) tubing supplied.
- 4 Connect one end of the **tubing** to your gas supply, and tighten the **clamp** to secure the tubing onto the barbed fittings.
- 5 Connect the other end to the barbed fitting **on the Coupling Insert** and tighten its **clamp**.
- 6 Snap the Coupling Insert (O-ring end) into the Quick-disconnect Gas Inlet **on the back of the Concentration workstation**.
- 7 Turn **on** the gas supply.

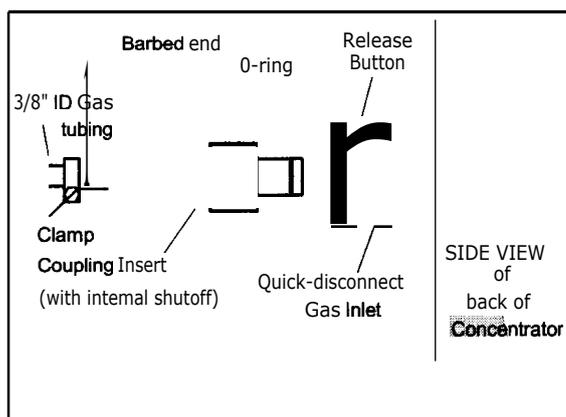


Figure 1. Connecting the Gas Supply

CAUTION



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

Install the Venting Hose

If the Concentration Workstation is *not* placed under a hood, install the venting hose using the **following** procedure.

- 1 Slide one end of the **venting** hose over the exhaust port.

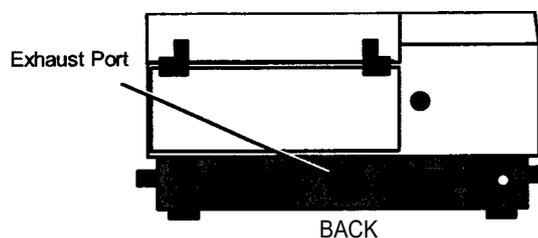


Figure 2. Installing the Venting Hose

- 2 Route the hose to a suitable outside-vented location. Ensure that the ventilation system is operating whenever the TurboVap 96 workstation is in use.

WARNING



Health hazard. Gas fumes exiting this instrument can contaminate the air you breathe. Maintain proper ventilation.

- 3 Use only a venting hose with appropriate length and diameter specifications to avoid excessive pressure **drop**. A venting hose with these specifications is supplied.

Maximum Hose Length

12.5 ft. (3.8 m)

Internal Diameter

2 in. (5 cm) I.D.

Connect Power

Follow these steps:

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

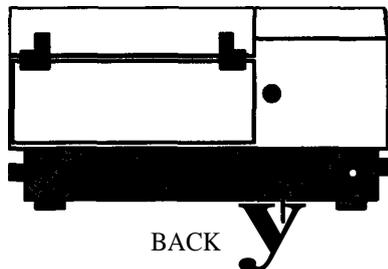


Figure 3. Installing the Power Cord

- 2 Connect the 3-pronged end of the power cord into an appropriate power source.

WARNING



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

- 3 Turn ON the power switch located **on** the lower left side of the unit.

When the workstation is first turned on, the internal air temperature will heat up to the previously set plate temperature if it was set to below 37°C; or it will heat up to 37°C if it is set above this value.

Diagnostics and Initialization

When power to the TurboVap 96 Concentration Workstation is turned on, both the Value and Units display show 1\$, and all LEDs are turned **on** for 1.5 seconds. If you press the Select button while in this state, the workstation goes into diagnostics mode, displaying the current **firmware** revision. Then, the initialization process continues.

After initialization, the workstation lights the Position 1 — Gas Time LED and displays the Gas Time previously set for Position 1.

Operation of the Workstation

Introduction

The TurboVap 96 Concentration Workstation is a microprocessor-controlled concentrator that provides automated sample evaporation. The workstation uses a patented gas vortex shearing action to maintain high evaporation rates under mild thermal conditions.

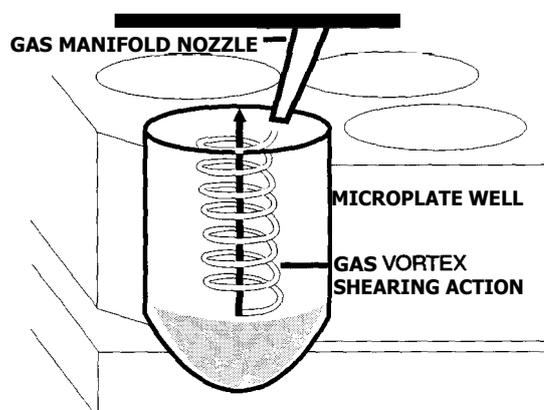


Figure 4. Gas Manifold Nozzle in Microplate Well

Microplates and Deepwell Plates

Either one or two 96-sample microplates or **deepwell** plates can be used. Deepwell plates are placed directly on the surface of the locator plate for Position 1 (left position) and Position 2 (right position). Microplates must use an adapter (supplied) to bring the top of the microplate to the same level as the top of a **deepwell** plate.

Helical Gas Flow

When you close the cover, 96 gas nozzles in the manifold align into each well of the microplate or deepwell plate. A stream of inert gas directed into each well creates a "helical flow." This helical flow, shown by the helix around the arrow in the illustration, sets up a vortexing action that provides for sample homogeneity and continuous rinsing of the well wall. You control the gas flow rate individually for Position 1 and Position 2.

Heating Process

Below the surface of the locating plate for Position 1 and 2 are two heater assemblies that direct hot air through holes directed toward each well in the microplate. The combination of the forced hot air and the circulating gas quickly evaporates the solvent in each well.

Vapor Removal Process

An exhaust blower pulls air from the front of the workstation across the microplates, removing the solvent vapors. The blower then forces the vapors through the exhaust port at the back of the workstation. From the exhaust port, you route the venting hose to a suitable outside ventilation system.

Features

The features of the concentration workstation are described in the table below.

Feature	Description
Automated	Microprocessor control provides control of gas time and plate temperature, unattended shutoff, cycle readouts, and detection of over temperature and low flow rates.
Patented Technology	The patented "gas vortex shearing action" speeds concentration and provides a homogenous environment for the samples.
Cover Sensor	When you open the cover during a concentration, a sensor shuts off the gas so you are protected from gas vapors.
Adjustable	For each of the two positions, you set: <ul style="list-style-type: none"> • Evaporation time from 1 to 99 minutes. For unlimited evaporation time, use a 0 setting. • Plate temperature from 20° (ambient) to 80°C. • Gas flow rate from 5 to 99 standard cubic feet/hour (SCFH). <p>You can start or stop each position at any time independent of the other position.</p>
Mild Conditions	The heaters airflow provides sufficient warming without harming the sample .
Instant On Heat	When you turn the workstation on, the heaters heat up to the set Plate Temperature or to 37°C if it is set above 37°C, ready for your next concentration.
Requires No Exhaust Hood	The manifold cover and exhaust system permit the unit to be placed on a bench rather than taking up valuable hood space.
Multiple Samples	Each sample position provides 96 gas manifold nozzles that extend into the wells of the microplates or deepwell plates to supply gas for concentration. Using both position 1 and 2 allows up to 192 samples to be processed simultaneously.
Convenience	You are able to start a run of samples and leave the instrument unattended. When the concentration has finished, the gas flow shuts off automatically, the temperature drops to 37° C, and the workstation sounds a beeper every 30 seconds until you remove the samples or press the Start • Stop buttons.

Workstation Controls and Ports

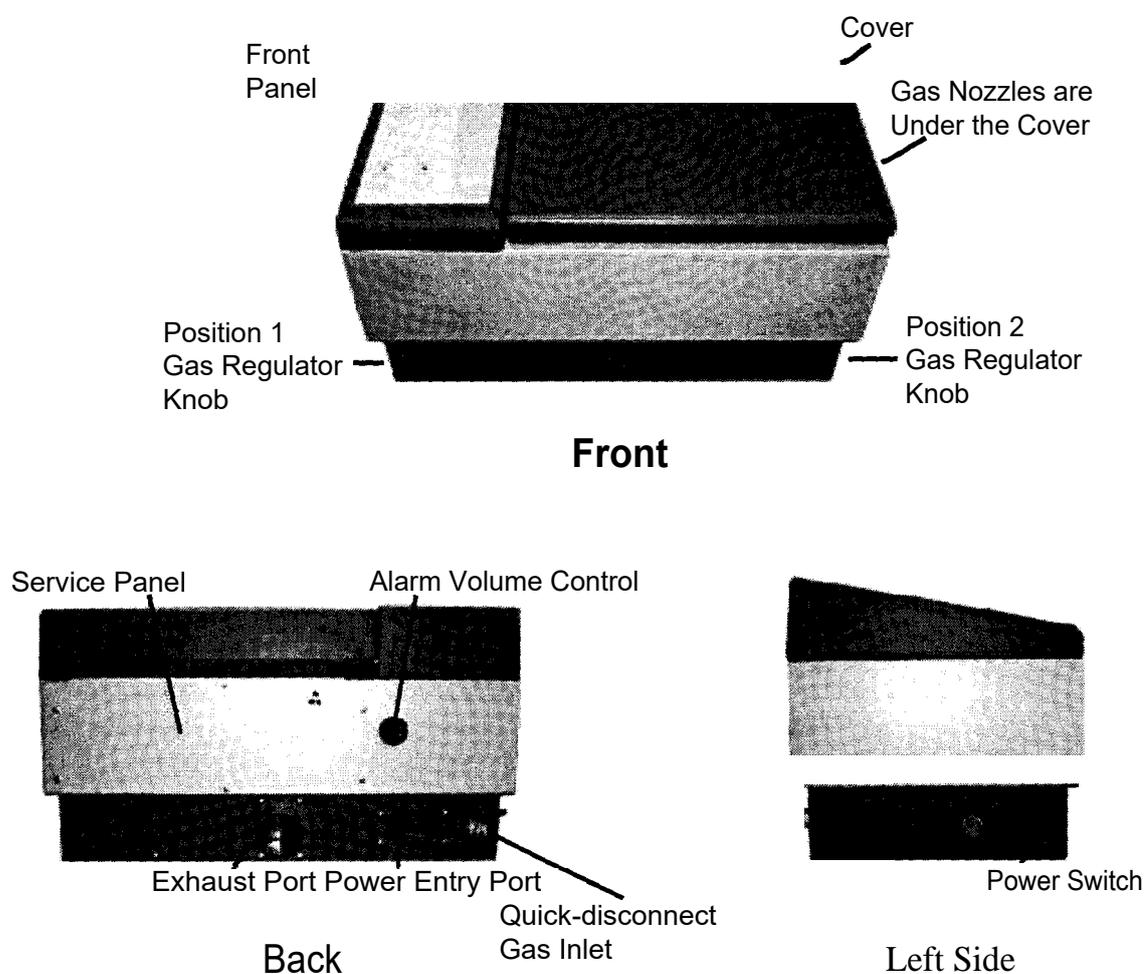


Figure 5. TurboVap 96 Concentration Workstation

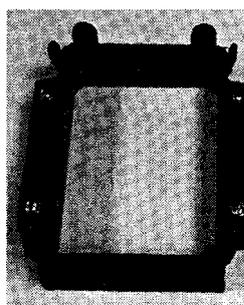


Figure 6. Microplate Adapter

Workstation Control and Port Functions

Item	Description
Front Panel	Controls the setup and Operation of the Concentration Workstation.
Cover	Holds the gas manifolds that direct the stream of gas into the sample wells of each microplate to create the gas vortex shearing action.
Microplates and deepwell plates	Hold the samples for concentration.
Microplate adapters	Used under a microplate to bring the top of the microplate up to the same level as a deepwell plate. When the cover is closed, the manifold nozzles will then fit inside each microplate well.
Heater assembly	Warms the samples during concentration to aid in the evaporation process.
Gas Regulator Knobs	Set the flow rate for all 96 gas manifold nozzles. The left gas regulator knob controls the flow rate to Position 1; the right knob, to Position 2. Knobs must be pulled out prior to making adjustments and pushed back in after the adjustments are made.
Quick-disconnect Gas Inlet	Connects the gas supply to the workstation. The fitting has an internal shutoff that allows you to disconnect the workstation from the gas supply without shutting off the gas supply itself .
Exhaust port	Allows you to connect a hose to channel the solvent vapors to a suitable outside vent location.
Power entry port	Connects the power cord and houses the fuse(s).
Power Switch	Use the switch to turn the unit power an and off .
Service Panel	Used by service personnel to access the exhaust blower and the sensor/interconnect module.
Alarm Volume Control	Adjusts the loudness of the beeper.

Front Panel Diagram

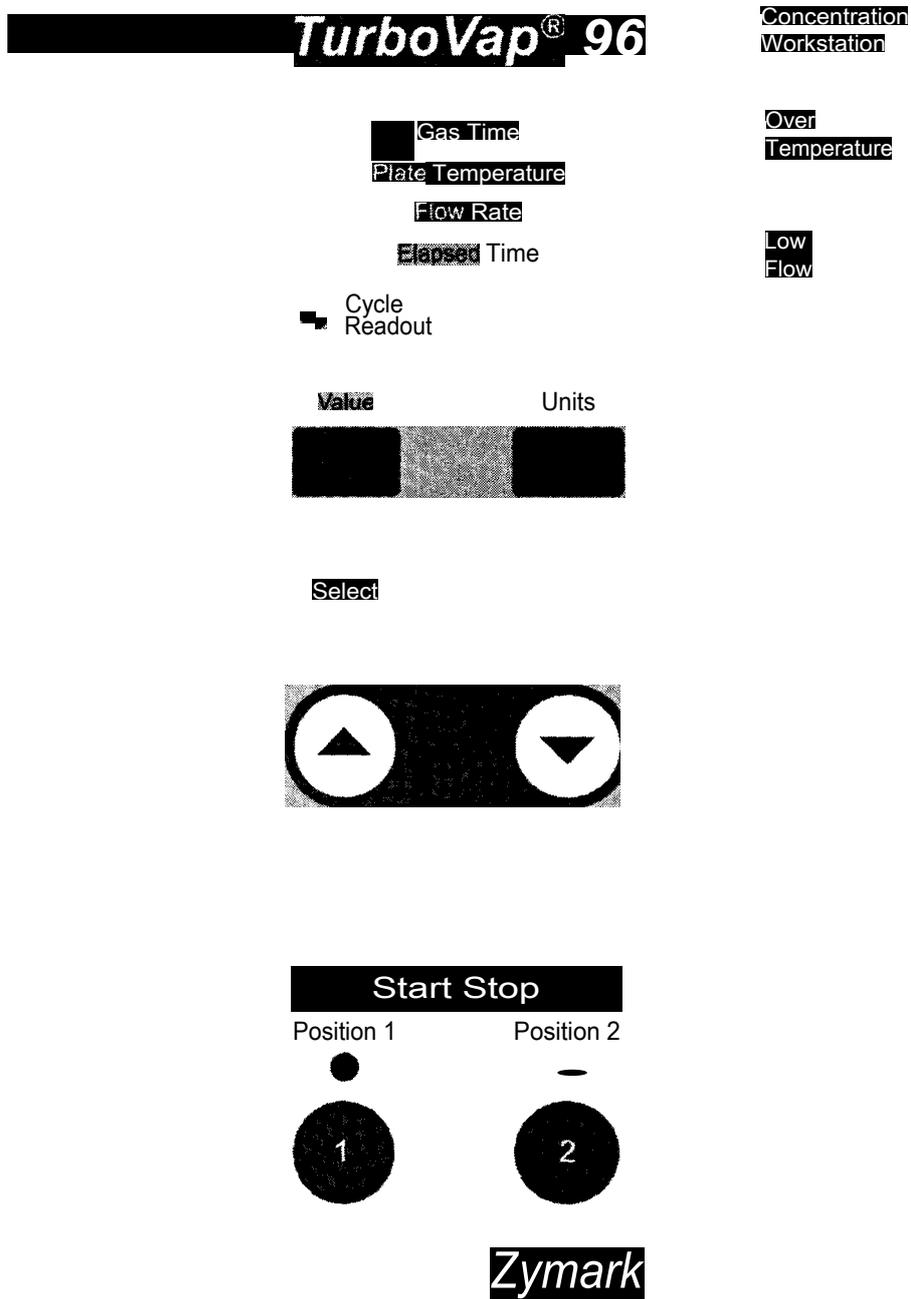


Figure 7, TurboVap 96 Front Panel

Front Panel Display Selections and Functions

Selection	Function
Gas Time	Gas time is the evaporation time, the length of time that the gas flow will be on, ranging in value from 1 to 99 minutes; however, a setting of 0 will allow the gas time (evaporation time) to continue until you manually shut it off .
Plate Temperature	This setting defines the temperature of the airflow under the plate being evaporated. Specify an integer value in degrees C, ranging from 20° (ambient) to 80°C.
Flow Rate	The flow rate is a hardware adjustable reading; it is not a software adjustable parameter. The regulators on both sides of the workstation adjust the flow rate for Position 1 and Position 2. This display ranges from 5 to 99 standard cubic feet per hour (SCFH). This flow rate is the total gas flow for all 96 nozzles in one position, not per nozzle.
Elapsed Time	The elapsed time is a status value, showing the amount of time in minutes that have passed since the start of evaporation; "--" means not started. Range: 0 to 99 minutes. If the Gas Time is set to 'infinite' mode, after 99 minutes the elapsed time displays
Cycle Readout	Cycle Readout displays all of the parameters, one at a time, for any position that is running. If both positions are not running, the display will show the set values for both positions. The plate temperature display shows the present temperature when evaporation is in process for that position; otherwise, it shows the set value.
Select Button	Pressing the Select button causes the display readout to advance to the next display parameter. If you press the Select button after turning on the workstation, it goes into diagnostics mode, displaying the current firmware revision.
Set Button	This button sets the present displayed value as the value to be used, saving that value to memory. The Set button is only used to set the values for gas time and plate temperature. The Set button has no effect on the other settings or values.
A and Y Buttons	These buttons increment or decrement the value in the display. These buttons are only used to set the values for gas time and plate temperature.
Start • Stop	These buttons are used to start evaporation or to stop evaporation once sample evaporation is in process. When on, the Position LED will be green.

Other Front Panel Functions

Feature	Function
Over Temp LED	This LED turns on (red) when the present temperature of one of the positions is 10°C greater than the value set in memory for the plate temperature. When the temperature drops below this value, this LED goes out. This LED may indicate a heater runaway caused by a defective relay or temperature sensor.
Low Flow LED	This LED indicates a low flow situation: Either the gas is running out, or the flow regulator was not adjusted prior to running the evaporation. If the flow rate drops below 5 SCFH when the evaporation is in process, the Low Flow LED lights and the alarm beeps continuously.

Establishing Your Concentration

Overview

You must determine what front panel settings will best concentrate your sample before operation. The settings to decide upon for each position are:

- Gas time (evaporation time)
- Plate temperature
- Flow rate

*To establish a flow rate that will not cause **splashing**, test various **flow rates** with clean solvent.*

Diagnostics and Initialization

When power to the TurboVap 96 Concentration Workstation is **turned on**, both the Value and Units display show **88**, and all LEDs are **turned on** for 1.5 seconds. If you press the Select button while in this state, the workstation goes into diagnostics mode, displaying the current firmware revision. Then, the **initialization** process is completed.

After initialization, the workstation lights the Position 1— Gas Time LED and displays the Gas Time previously set for Position 1.

Position 1 - Gas Time (Evaporation Time)

The green light shows the parameter that is currently being displayed, and the **blinking** display shows the set number of minutes the evaporation will run. Set the Gas Time as follows:

- 1 Press the up and down arrow buttons (**A V**) to **increment** or decrement the displayed Value. The gas time can be set from 1 to 99 **minutes** and has a one-second resolution. Setting this value to 0 will allow an **infinite** gas time (evaporation time).

NOTE



*If you set an 'infinite' gas time using a 0 setting, you must manually stop the gas flow by using the **Start • Stop** button.*

- 2 When the desired gas time is displayed, press the Set button.

The new Value will blink and will be stored in the battery backed-up memory. If the Select button is pressed before pressing the Set button, the original value is reset, and the display steps to Position 1 — Plate Temperature.

Position 1 Plate Temperature

Set the Plate Temperature as **follows**:

- 1 Press the Select button to light the Position 1 — Plate Temp LED. The display blinks the previous set Position 1 temperature.
- 2 Press the ▲ and ▼ buttons to **increment** or decrement the displayed Value. The Plate Temperature can be set from 20°C (ambient) to 80°C. (The Units display shows °C.) The plate temperature is maintained within this setting $\pm 5^\circ\text{C}$.
- 3 Press the Set button to save the new value in **memory**.

NOTES



- *The cooling effect of both the gas flow and the resulting evaporation of a solvent will keep the **internal** temperature **below** that of the set **plate** temperature.*
- *The temperature of each well during the evaporation process will be **below** that of the **plate** temperature. Once the liquid in the well evaporates and the gas flow stops, the well temperature will rise.*

The new Value will blink and will be stored in memory. If the Select button is pressed before the Set button is pressed, the original plate temperature will be reset, and the display steps to Position 1 — Flow Rate. During evaporation, the display will show the present temperature of the position, not the set temperature.

Position 1 Flow Rate

This flow rate is the total flow for the 96 nozzle manifolds in Position 1; it is not a per nozzle flow rate. This value is not a software configurable parameter. Instead, a gas regulator knob **on** the left side of the workstation controls the flow rate.

- 1 Press the Select button to light the Position 1— Flow Rate LED. The value displayed shows "--" if the gas is shut off, the cover is open, or the left gas regulator knob is closed.
- 2 Close the cover and press the Position 1 **Start • Stop** button to light the Position 1 LED.
- 3 Make sure the source input gas is on.
- 4 **Pull the left Gas Regulator Knob out.** The Gas Regulator Knob increments the flow rate. The flow rate can be set from 5 to 99 SCFH. Once adjustments are **made, push the Gas Regulator Knob back in.**

*Turn the Gas Regulator Knob **slowly**, because the **flow** sensors are **very sensitive** and may have some delay before equilibrating.*

The Units display shows **Fh** for Standard Cubic Feet per Hour (SCFH). (The Set button and the up and down buttons have no effect **on** this setting.)

- 5 Press the Position 1 **Start • Stop** button to turn it off.

If the **Select** button is pressed, the Position 1 — Elapsed Time LED lights, and Position 1 elapsed time is displayed.

Position 2 Gas Time (Evaporation Time)

Setting the Position 2 — Gas Time is similar to setting Position 1:

- 1 Press the Select button to light the Position 2 — Gas Time LED.
- 2 Press the **A** and **V** buttons to display the desired Value.
- 3 Press the Set button.

The new Value will blink and will be stored in memory. If the Select button is pressed before pressing the Set button, the original value is reset, and the display steps to Position 2 — Plate Temperature.

Position 2 Plate Temperature

Setting the Plate Temperature for Position 2 functions the same as Position 1 Plate Temperature.

- 1 Press the Select button to light the Position 2 — Plate Temp LED. The display blinks the previous set Position 2 temperature.
- 2 Press the **A** and **V** buttons to display the desired Value.
- 3 Press the Set button.

If the Select button is pressed before the **Set** button is pressed, the original plate temperature will be reset, and the display steps to the Position 2 — Flow Rate.

Position 2 - Flow Rate

This flow rate is the total flow for the 96 nozzle manifolds in Position 2. Setting the flow rate for Position 2 functions the same as Position 1 Flow Rate; however, the Position 2 Flow Rate is **controlled** by the gas regulator knob on the right side of the workstation.

- 1 Press the **Select** button to light the Position 2 — Flow Rate LED.
- 2 With the cover closed, press the Position 2 **Start • Stop** button to light the Position 2 LED.
- 3 **Pull the right Gas Regulator Knob out.** Turn the knob to increment the flow rate. Once adjustments are made, **push the Gas Regulator Knob back in.**
- 4 Press the Position 2 **Start • Stop** button to turn it off.

The Set button and the up and down buttons have no effect **on** this setting. If the Select button is pressed, the Position 2 — Elapsed Time LED lights, and Position 2 elapsed time is displayed.

Considerations when Selecting Plate Temperature

The two workstation heater assemblies operate over a wide temperature range of 20°C (ambient) to 80° ±5°C. This **eliminates** "bot" Spots and improves sample recovery for more volatile compounds.

When selecting the **Plate Temperature**, consider the following:

- Faster evaporation occurs as the plate temperature is increased; however, highly volatile analytes can be lost if allowed to sit for extended periods of time in a **hot** environment.
- You can use a Plate Temperature above the boiling point of your solvent, because the gas Flow Rate creates a cooling effect over the solvent.

NOTES



- *The cooling effect of both the gas flow and the **resulting** evaporation of a solvent will keep the internal temperature below that of the set plate temperature.*
- *The temperature of each well during the evaporation process will be below that of the plate temperature. Once the liquid in the well evaporates and the gas flow stops, the well temperature will rise.*

When the workstation is turned on, the plate temperature **warms** up to wait for the next evaporation process. If the cover is opened after the evaporation process begins, the following chart shows how the temperature changes.

State of Workstation	Cover	Plate Temp Setting is < 37°C	Plate Temp Setting is > 37°C
		System runs at ...	System runs at ...
Turned on and initialized.	Either open or closed	Set temperature	37°C
Evaporation has started.	Closed	Set temperature	Set temperature
Evaporation has started.	Opened	Set temperature	37°C
Gas flow time is complete.	Either open or closed	Set temperature	37°C

Considerations When Setting the Gas Flow Rate

When selecting the gas **Flow Rate**, consider that:

- A higher flow rate causes a faster evaporation rate.
- An excessively high flow rate can cause the loss of analyte due to **splashing**. For the best **results**, use the highest gas pressure possible without causing **splashing**.
- As the **sample** volume decreases during concentration, increasing the flow rate will reduce the overall concentration time.
- For proper operation, the pressure to the workstation should be at least 30 psi (2.07 bars). To avoid damage, the supply inlet pressure must not exceed 80 psi (5.52 bars); 60 — 70 psi (4.1 — 4.8 bars) is recommended.

CAUTION



To avoid injury to yourself or damage to the instrument, **DO NOT** exceed 80 psi maximum supply pressure.

Starting the Concentration Process

After you have set your desired **Gas Time**, **Plate Temperature**, and Flow Rate for Position 1 and/or Position 2, you are ready to start the **concentration** process.

- 1 Place the deepwell plates or microplates with adapters in Position 1 and Position 2 if desired.

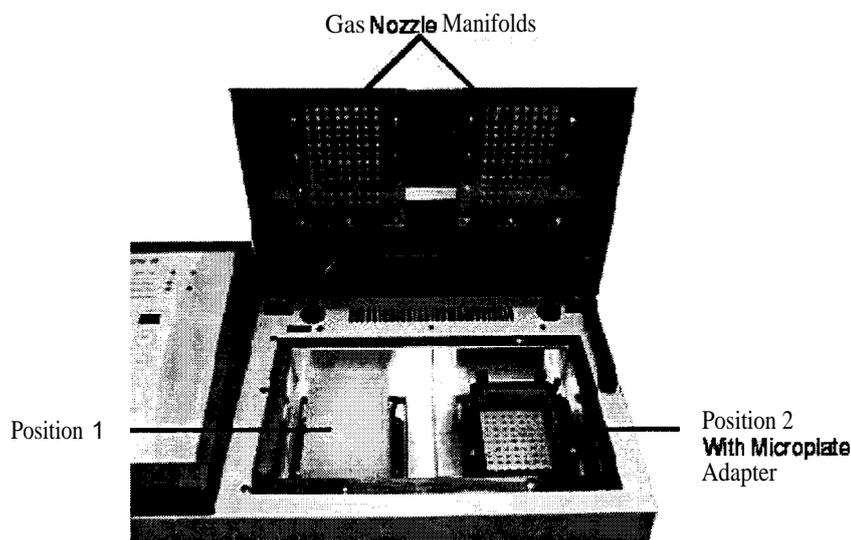


Figure 8. Inserting Microplates into the Workstation

- 2 Close the top cover.
- 3 If **using** Position 1, press the Position 1 **Start • Stop** button. If using Position 2, press the Position 2 **Start • Stop** button.
- 4 If desired, you can adjust either Gas Regulator Knob during the concentration process. **Be sure to pull the knob out before making any adjustments to the setting.**

The Gas Time and Plate Temperature values cannot be adjusted once the concentration process has started.

Pausing the Concentration Process

Cover Sensor — The gas flow and the evaporation time will continue as long as the cover is closed. When the cover is opened, an alarm will beep for 1 second. The evaporation timer and the gas flow will pause and will not turn **on** while the cover is in the up position.

When the cover is closed, the evaporation will continue.

Restarting the Concentration Process

If the evaporation has started, pressing the **Start • Stop** button stops the evaporation process and sounds an alarm beep for 1 second. Pressing this button again resets the timer to **zero** and restarts the evaporation process.

Completing the Concentration Process

When the evaporation process is complete, the Position LED will blink, and the alarm will beep every 30 seconds until the Position Start • Stop button is pressed or the cover is opened. If the cover is then closed, the position is turned off.

NOTES



- *The plate temperature will maintain the set Plate Temperature if it was set to below 37°C; or it will go to 37°C if it is set above this value.*
- *If you set an 'infinite' gas time using a 0 setting, you must manually stop the concentration process by using the **Start • Stop** button.*

Elapsed Time

The displayed Value will blink "- -" when the position has been stopped or is not started.

If evaporation has started, the displayed value will show the number of minutes passed since the start of the evaporation. The total elapsed time is determined by the Gas Time setting, with the same range from 1 to 99 minutes. If the Gas Time is set to 'infinite' mode, after 99 minutes the elapsed time displays

The Set button and the up and down buttons have no effect **on** this selection.

If the **Select** button is pressed the Cycle Readout LED will be lit and the Display All Function firmware program begins.

Cycle Readout

When the Cycle Readout LED is lit, the Display All Function **firmware** program is running. This program displays the current conditions for each of the parameter settings in the following sequence:

- Position 1 - Gas Time,
- Position 1 - Plate Temp
- Position 1 - Flow Rate
- Position 1 - Elapsed Time
- Position 2 - Gas Time
- Position 2 - Plate Temp
- Position 2 - Flow Rate
- Position 2 - Elapsed Time

After displaying the Position 2 — Elapsed Time, the program cycles back to Position 1 - Gas Time.

NOTES



- If evaporation is in process, the present plate temperature will be displayed for the position that is running, not the set Plate Temperature.
- If the current temperature is +/- 10°C from the set Plate Temperature, the displayed temperature will blink.
- If only one position is started, the cycle displays the conditions for only that position. If both positions are started or stopped, all the conditions are displayed.

If the Select button is pressed while the Cycle Readout LED is on, the display will then show the previously set Gas Time for Position 2, and the Position 2 — Gas Time LED will light. (The up, down, and set buttons have no effect when the Cycle Readout LED is on.)

Maintenance

Troubleshooting Procedures

Concentration Process Problem

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

Condition	Probable Cause	Solution
Concentration rate is too slow.	Low plate temperature Gas flow rate is set too low, or wrong gas regulator knob is on.	Increase the Plate Temperature. Increase the Flow Rate for the correct Position.
Concentration rate is too fast.	High plate temperature Gas flow rate is set too high.	Decrease the Plate Temperature. Decrease the Flow Rate.
No concentration at only one microplate well.	Plugged nozzle	Contact Zymark.
Sample is splashing .	Gas flow rate is set too high.	Decrease the flow rate.
Low recovery of sample	Sample left too long after completion of concentration. Sample splashing	At the end of concentration, remove the sample promptly. Decrease the gas Flow Rate.

Front Panel Display Problem

Locate the description of the condition, cause, and solution in the table below.

Condition	Probable Cause	Solution
Plate Temperature blinks during Cycle Readout mode.	Present temperature is $\pm 10^{\circ}\text{C}$ from the set temperature.	Normal operation
Over Temp LED is on.	Present temperature of one of the positions has been reset 10°C lower than the previous setting . Heater runaway caused by defective relay or temperature sensor.	Allow some time for the heater to reach the new temperature, and the LED will go out. Contact Zymark.
Message "hi" is displayed in Cycle Readout mode.	Plate temperature sensor detects a temperature greater than 90°C , or the temperature sensor has failed. Fan is inoperative for this position.	Contact Zymark. Contact Zymark.
Message "10" is displayed in Cycle Readout mode.	The temperature sensor has failed.	Contact Zymark.
Low Flow LED is on, and the alarm continues to beep.	The gas flow regulator for the correct position has not been turned on. The flow rate is set below 5, or has dropped below 5 SCFH, and the gas is running out. Problem with flow sensor.	Turn on the gas flow regulator and restart the position using the Start • Stop button. Check the input gas supply. Contact Zymark.
Elapsed Time displays "--" in Cycle Readout mode.	The position has been stopped or is not started.	Restart the position.
Elapsed Time displays	Gas Time is set to 'infinite' mode.	This is the normal display after 99 minutes.
LED out on front panel.	Faulty LED	Contact Zymark.
Value or Units display does not work.	Faulty display chip	Contact Zymark.

Workstation Not Operational

Locate the description of the condition in the table below.

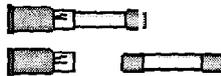
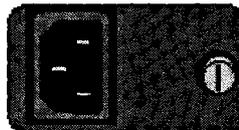
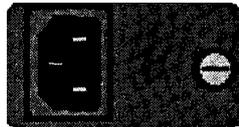
Condition	Probable Cause	Solution
Unit is inoperative.	Power is off , or the power cord is loose.	Check that the power switch is on and that the power cord is seated.
	Faulty fuse	Replace the fuse .
	Faulty control board	Contact Zymark.
Flow Rate is not operational or not correct.	Bad sensor PCB.	Contact Zymark.

Replacing the Fuses

WARNING



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



Use the following procedure:

- 1 Remove the power cord.
- 2 Turn the **fuse** holder from horizontal to vertical.
- 3 Remove the **fuse**.
- 4 Replace the **fuse** with the correct rating.

Figure 9. Replacing the Fuses

	<u>1001120 VAC Model</u>	<u>200/220 VAC Model</u>
Fuse	1.25 in. x 0.25 in, 6 A, Fast Acting, 250V	Two 5 x 20 mm, 3 A, Fast Acting, 250V

Specifications

Capacity

The workstation uses either one or two 96-well microplates or deepwell plates.

Physical Specifications

Height	12 inches (30.5 cm)
Width	23.5 inches (59.7 cm)
Depth	12.5 inches (31.8 cm)
Height with cover open	21 inches (53.3 cm)
Weight	50 lbs. (22.7 kg)

Power

	<u>100/120 VAC Model</u>	<u>200/220 VAC Model</u>
Input Voltage	105-132 VAC	198-264 VAC
Maximum Power	620 VA	620 VA
Frequency	50/60 Hz	50/60 Hz
Fuse	1.25 x 0.25 in., 6 A, Fast Acting, 250V	2 ea. 5 x 20mm, 3 A, Fast Acting, 250V

Time Range

1 to 99 minutes with a one-second resolution.

Temperature Control

Internal Temperature	Two heaters, each adjustable 20° (ambient) to 80° ±5°C.	
External Temperature	<u>Minimum</u>	<u>Maximum</u>
	Ambient	40°C (104°F)

Temperature Control (Cont)

State of Workstation	Cover	Plate temp <37°C System runs at ...	Plate temp >37°C System runs at ...
Turned on and initialized.	Either open or closed	Set temperature	37°C
Evaporation has started.	Closed	Set temperature	Set temperature
Evaporation has started.	Opened	Set temperature	37°C
Evaporation gas time is complete.	Either open or closed	Set temperature	37°C

Gas Input

Input Requirement

Use clean, *e*, regulated, compressed nitrogen or other suitable gas. A carbon trap is recommended.

WARNING



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

Gas Supply Fitting

3/8 in. (9.5 mm) outside diameter: Use the gas tubing supplied.

Inlet Pressure

<u>Minimum</u>	<u>Maximum</u>
30 psi (2.1 bars)	80 psi (5.52 bars)

Exhaust Output

Exhaust port

2 in. (5.1 cm) outside diameter. Venting hose is supplied.

Vent hose

2 in. (5.1 cm) inside diameter (supplied)

WARNING



*The exhaust duct **MUST** go to a suitable ventilation system vented outside the laboratory.*

Noise Level

The **workstation** uses an internal exhaust blower. Refer to the *Declaration of Conformity* for noise level test result.

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