



AD-2000
Adsorption Module

User Manual

***Tekmar*-DOHRMANN™**

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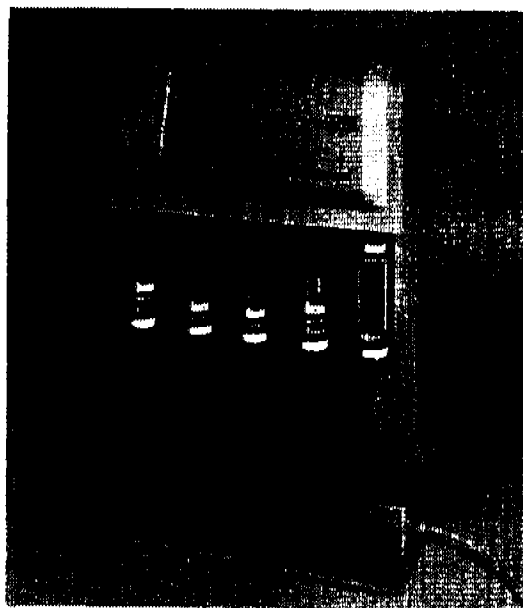
INSTRUMENT OVERVIEW

This chapter acquaints you with the Model AD-2000 Adsorption Module shown below, its purposes, components, controls and indicators, and operation.

BACKGROUND

Measurement of the level of organic halide is an important factor in the assessment of water quality. As a group, organic halides are usually an indication of man-made pollutants. Due to their toxicity, organic halide levels are often regulated in drinking, ground, and waste waters.

This organic halide group parameter is measured by Total Organic Halide (TOX) analysis, also known as Adsorbable Organic Halide analysis (AOX). TOX/AOX analysis involves adsorption of organic halides onto granular activated carbon (GAC), followed by combustion and microcoulometric detection. The two commonly used methods for adsorbing the organic halides onto GAC are by using microcolumns, or by using a flask and filter apparatus. The AD-2000 module is designed for GAC adsorption using microcolumns.



Model AD-2000 Adsorption Module

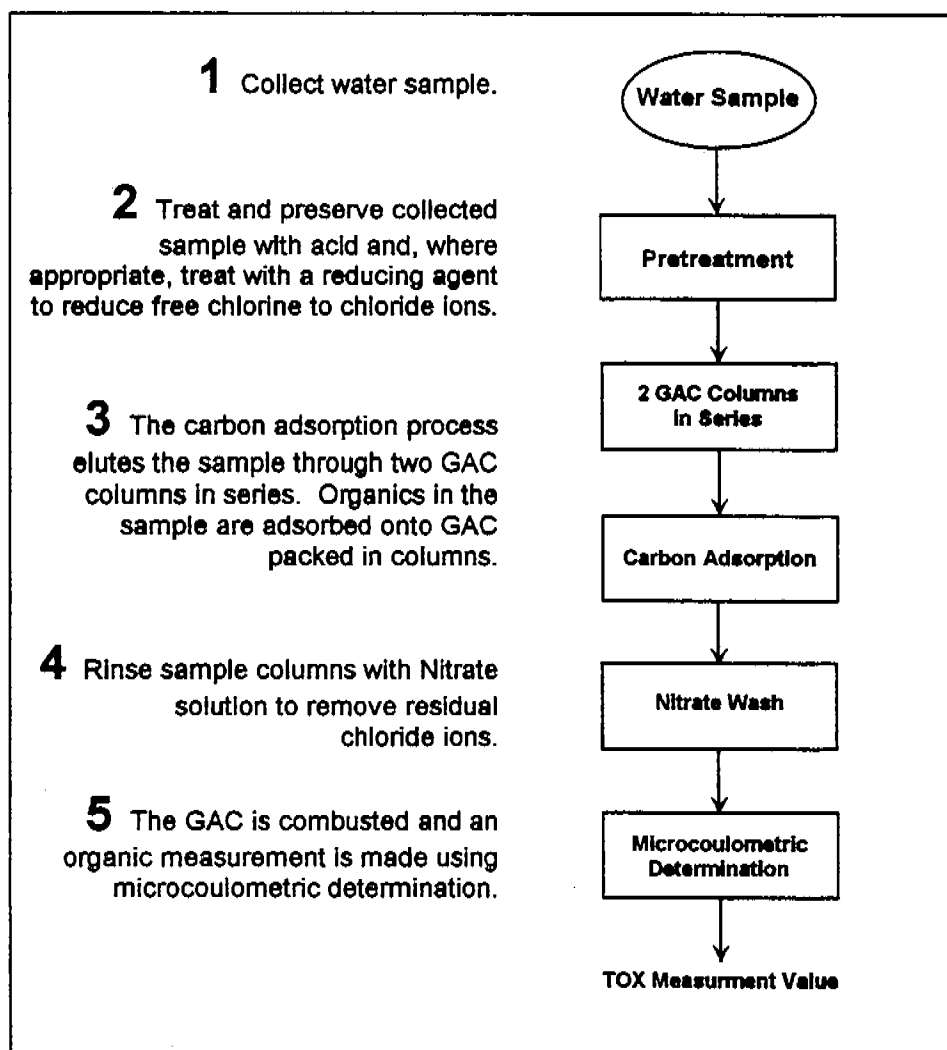
OVERVIEW

A water sample is collected and preserved with acid. Before adsorption, the sample is treated with a reducing agent to convert any free chlorine to chloride ion. The sample is passed through two columns in series on the AD-2000, where the organic halide is collected on the GAC. (The organics typically will be completely collected onto the first column; the second column serves as a check on adsorption efficiency.) The columns are then rinsed with a nitrate solution to remove any residual chloride ions. The columns are now ready for combustion and microcoulometric determination on the Model DX-2000, DX-20A, or similar instrument.

Sample adsorption can be programmed with the same or unique processing parameters on each of the four Sample Channels while the Nitrate Channel is setup independently.

THE TOX MEASUREMENT PROCESS

The TOX measurement process can be summarized in the following steps:



OVERVIEW OF OPERATIONS

The primary function of the Adsorption Module is to process water samples through GAC columns for measurement of Total Organic Halide (TOX).

The Adsorption Module first passes the water sample through the GAC column and subsequently performs a Nitrate Wash of the GAC column.

To perform these tasks, you can use the default run parameters for the Sample Adsorption and Nitrate Wash or you can revise the run parameters using the setup function of the instrument.

The available instrument functions and associated function keys are described below.

NOTE: The channels must only be operated with liquids. Operation with no liquid will damage the O-rings and plungers.

Task	Function	Keys
Runs (Analysis)	Sample Adsorption	1 - 4 then Start/Stop
	Nitrate Wash	5 then Start/Stop
Run Setups	Sample Channel Priming and Adsorption Parameters	1 - 4 then Sample
	Nitrate Wash Parameters	Nitrate then Sample
Maintenance Setups and Runs	Setup and Run Sample Channel Rinsing	1 - 4 then Rinse
	Setup Nitrate Channel Drain, Rinse and Fill Parameters	Nitrate then Rinse
	Run Nitrate Channel Drain, Rinse, and Fill Procedure	Nitrate Rinse then Start/Stop
	Instrument Tests/Diagnostics	Test
Using Help	Display Help Messages	Help

SPECIFICATIONS

Specifications	Characteristics
Sample Processing:	
Sample Adsorption	Sample Volumes of 10, 25, 50 or 100 mL Sample Adsorption Rates of 0.5, 1, 2, 3, or 5 mL/min* Fill rates of 33 mL/min (slow) or 66 mL/min (fast) Channel Priming: Yes or No (If Yes, 5 or 10 mL)
Nitrate Wash	Sample Volumes of 1, 2, 3, 4, 5, 10, 15, 20, 25, or 50 mL Flow Rates of 0.5, 1, 2, or 3 mL/min
Sample Elution Pressure	50 psig max.
Weight	42.5 lbs. (19 kg)
Dimensions	26" (66 cm) high 17" (43 cm) wide 12.5" (32 cm) deep
Operating Power	80 W, 90-130 Vac, 50/60 Hz 80 W, 180-260 Vac, 50/60 Hz

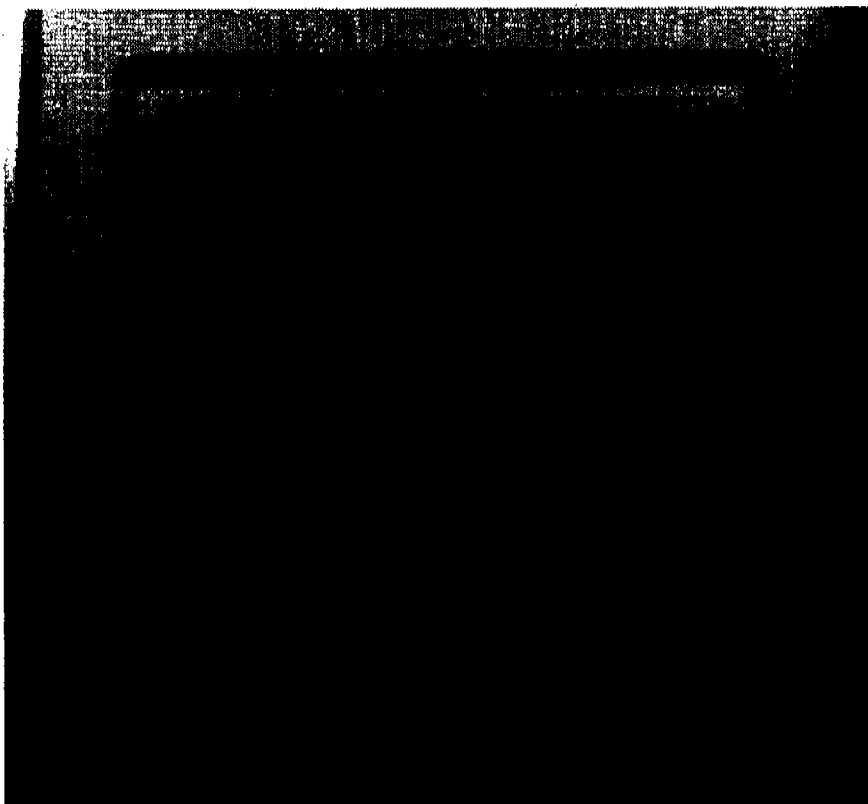
*NOTE: The rate of 5 mL/min may only be used with 3mm ID GAC columns. If 2 mm ID columns are used, motor errors may occur.

CONTROL PANEL KEYS AND LEDS

The control panel is used to direct Adsorption Module operations, such as performing a sample adsorption or setting up adsorption parameters.

The control panel (shown below) is comprised of a two line by 16 character LED display and 16 keys. Nine of the 16 keys include LEDs to indicate the status of the function associated with the key.

The control panel keys are used to select processing parameters and to select processes (i.e., sample adsorption). The control panel layout groups the keys into Channel keys and Action keys. These two groups of keys are illustrated and described below.



Control Panel (Keypad and Display)

Channel Selection Keys

1 through 4

These keys are used to select sample channels 1 through 4 for setup and processing of samples.

LED:

The LED (red) is lit when the channel is selected. To cancel a channel selection, press another Channel key. The Channel LED will flash when the instrument is prompting you for an input.

Nitrate

Use this key to select the Nitrate Channel (NO₃) for setup and performing a nitrate wash of the sample in a GAC column.

LED:

See **1 through 4**

Action Keys

This group of keys can be divided into two categories which are Run/Parameter Control and Function Select.



Run/Parameter Control Keys

Start/Stop

Use this key to start and stop instrument processes and runs such as instrument initialization, nitrate wash, sample adsorption, and channel rinsing.

LED:

The LED (red) is lit whenever the key is pressed and the selected channel plunger is moving and the channel status is being displayed on the display panel.



 OR 

These keys are used to scroll through the available parameters of a parameter selection screen that is displayed during setup.

Example:

In response to the parameter selection screen for nitrate wash volume :

Wash Volume: 2mL

you can press  OR  to scroll forward or backward through the available selections of 1, 2, 3, 4, 5, 10, 15, 20, 25, and 50 mL, and the summary screen.

Run/Parameter Control Keys (Continued)

Next

Use this key to start a setup process and then to step through parameter selection screens for the selected setup. The **Next** key is also used to step through menu selections of the Test function.

Example:

If you press **Nitrate** and then **Sample**, the following Nitrate Wash setup prompt is displayed:

Run: Press START Menu: Press NEXT

Press **Next** and the instrument displays the parameter summary screen:

2 mL Wash Volume 3.00 mL/min

Repeatedly press **Next** to step through the available setup parameter screens.

OK

When you are required to take an action before the next step in a run, the instrument interrupts the run and prompts you for the action. The **OK** key is used to continue the run after the required action has been taken.

Example:

During a sample adsorption run, the instrument pauses and the screen displays:

Connect Columns (Then Press OK)

After you connect the GAC columns, press **OK** to continue the run.

Yes and No

These keys are used to enter **Yes** or **No** in response to an instrument prompt and to stop or continue a run (sample, rinse, or drain).

Example:

In response to the Nitrate Channel setup prompt:

Drain Channel (Yes/No)?

You can press **Yes** or **No** to enter the selected setup parameter which will either drain or not drain the channel prior to performing a sample adsorption or after interrupting and aborting a run.

Function Select Keys

Help

Use this key to display a Help message for the displayed screen. Press the key once to display the Help message. If a message is not available, the screen displays:

Help Unavailable
Press OK

To exit and return to the normal display, press the **Help** key a second time, or press the **OK**.

Test

Use this key to select the Homing Motor diagnostic test function which is used to calibrate the home (bottom) position of the selected channel.

When testing is complete, press this key again to return the instrument to the original step in the test mode. (All other test routines are for service use only!)

LED:

The LED (red) is lit when the Test function is selected.

Rinse

Use this key along with a Channel Selection key to select a rinse function which includes:

- Nitrate channel rinse, drain, and fill setup
- Channel 1-4 rinse setup

LED:

The LED (red) is lit during a Rinse function run.

Sample

Use this key along with a Channel Selection key to select a sample function which includes:

- Nitrate Wash setup
- Channel 1-4 Sample Adsorption Setup

LED:

The LED (red) is lit during a Sample function setup or run.

CONTROL PANEL DISPLAY

The Control Panel Display is a two-line by 16-character LCD display which is used to present:

- status messages
- help messages
- setup parameter summary messages
- setup parameter messages
- run status
- prompts for operator action

INSTRUMENT CONTROLS AND INDICATORS

In addition to the Control Panel keys and display, the instrument has the controls and indicators shown and described below.

Channel Status LEDs

1 through 4

The LED (red) is lit (see below) when the Sample Channel plunger is moving, and flashes along with the LED for the Channel select key if an operator input is needed.

Example:

During a sample adsorption the screen displays:

Connect Columns
(Then Press OK)

At this point the Channel Status LED will flash until the columns are connected and the **OK** key is pressed.

Channel Status LEDs (Continued)

NO₃

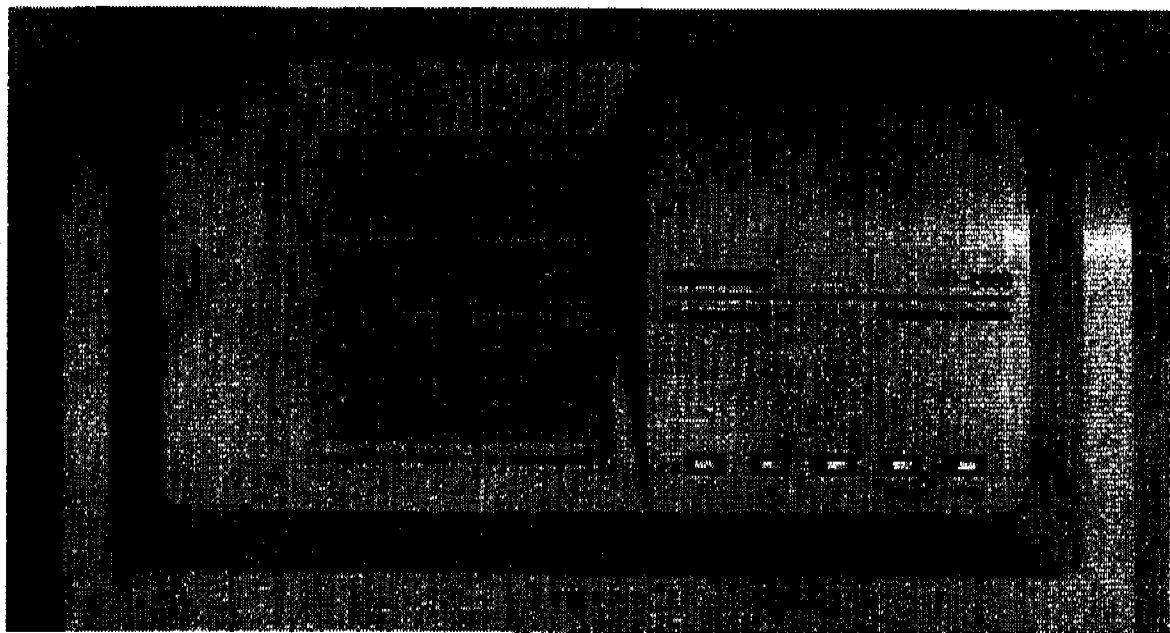
The LED (red) is lit (see below) when the Nitrate Channel plunger is moving, and flashes along with the LED for the Nitrate Channel select key if an operator input is needed.

Example:

During the fill cycle of a Nitrate Channel drain, rinse, and fill run the screen displays:

Ready to Fill
w/Nitrate, (OK)

At this point the Nitrate Channel status LED will flash until the Nitrate source is connected to the channel and the **OK** key is pressed.



Channel Status LEDs

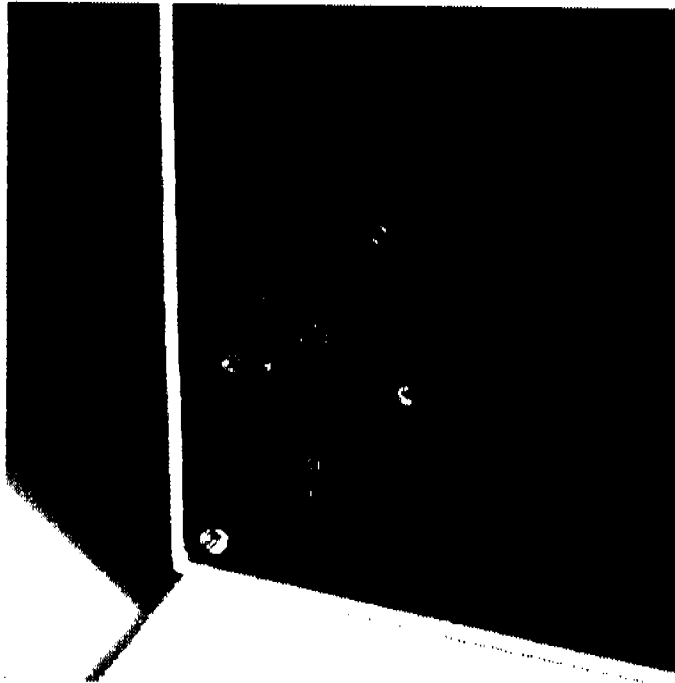
Power Switch and Fuse



The power switch is on when the I section of the switch is pressed and off when the 0 section is pressed (see below).

100V-120V

The fuse cover indicates the operating voltage range of the instrument; 100 to 120 VAC or 200 to 240 VAC.



Rear Panel Power Switch and Fuse



UNDERSTANDING INSTRUMENT OPERATION

This chapter describes the functions provided by the Adsorption Module and how it performs these functions. The steps you must take and those that the instrument follows to process a sample are depicted in flow charts and the associated operator and instrument actions are described.

OVERVIEW

The primary function of the Adsorption Module is to process water samples through GAC columns for measurement of Total Organic Halide (TOX). The functions of the module can be divided into two main categories: Operation and Maintenance.

- Operation functions deal with setup and run of Sample Adsorptions and Nitrate Washes.
- Maintenance functions deal with maintenance of the Nitrate and Sample Channels. Nitrate Channel maintenance consists of draining and rinsing as necessary and filling with sufficient Nitrate solution to perform the required Nitrate Washes. Each Nitrate Wash cycle requires 1 to 50 mL of solution. Sample Channel maintenance consists of rinsing the channel periodically.

This chapter describes the Adsorption Module functions below and graphically depicts the operator and instrument actions required to accomplish these functions in the flow diagrams that follow.

NOTE: The channels must only be operated with liquids. Operation with no liquid will damage the O-rings and plungers.

Functions (See Flowchart)	Description
Sample Adsorption Operation	Sample Channel 1-4 Setup and Adsorption (Run)
Nitrate Wash Operation	Nitrate Channel Setup and Nitrate Wash
Sample Channel Rinse Maintenance	Sample Channel 1-4 Rinse Setup and Rinsing
Nitrate Channel Maintenance	Nitrate Channel Drain, Rinse and Fill Setup and Maintenance

SAMPLE ADSORPTION OPERATION

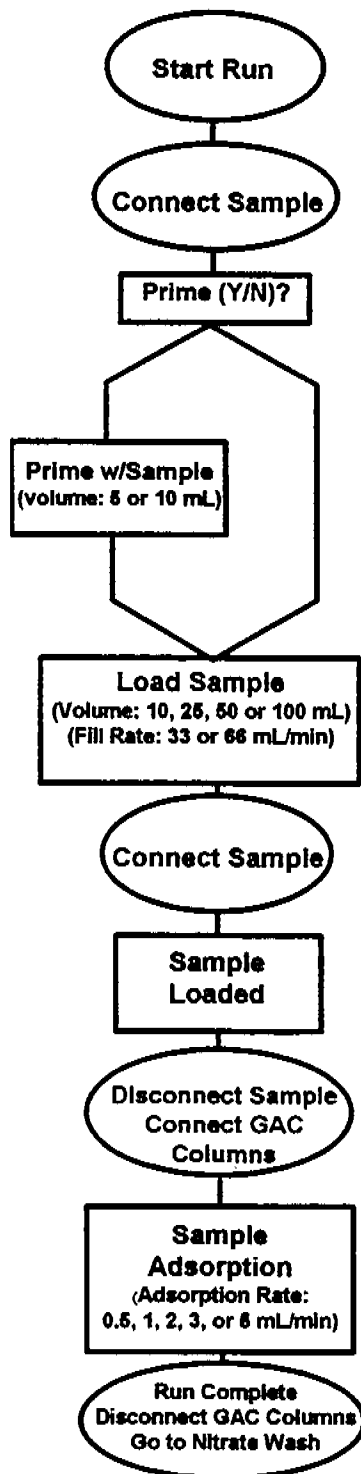
Setup

You start setup by pressing the desired channel, **1 - 4**, and then pressing the **Sample** key at the Ready prompt.

After starting the setup, the instrument displays a run parameter summary screen.

You can accept the displayed setup or revise it.

To revise the setup, you will select new run parameters in the parameter entry screens as you step through setup. Selectable parameters are shown in parentheses in the run flow diagram to the right.



You start the run by pressing the desired channel, **1 - 4**, and then the **Start/Stop** key at the Ready prompt.

The instrument operates interactively by advancing to the next step and pausing until you connect the sample and press the **OK** key. If the channel already contains fluid (plunger not at home position), the system will prompt you to drain the channel first.

Based on your selection during setup, the instrument either begins loading the sample or primes the channel. Priming consists of aspirating and then expelling the selected volume of sample.

At this point the instrument pauses and prompts you to connect the sample. Connect the sample and press the **OK** key. The instrument then loads the sample using the volume and fill rate selected during setup.

After the sample is loaded, the instrument pauses while you disconnect the sample and connect the GAC columns. After pressing the **OK** key, the instrument begins Sample Adsorption.

Sample Adsorption is performed at the rate specified during setup. The channel pushes the sample through the GAC columns with up to 50 psig.

At completion, the instrument relieves channel pressure, then prompts that the run is complete. You can begin the Nitrate Wash, then disconnect the GAC columns.

NITRATE WASH OPERATION

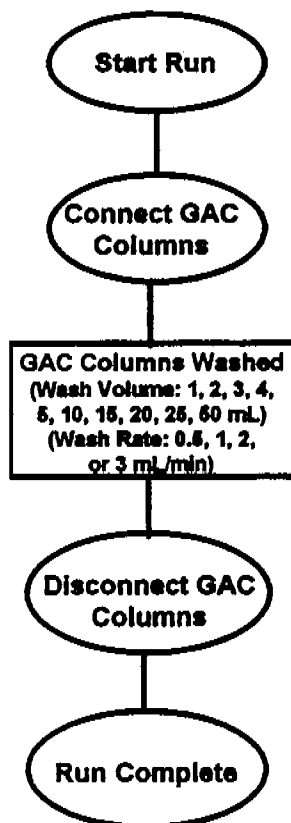
Setup

You start setup by pressing the **Nitrate** and then the **Sample** key at the Ready prompt.

After starting setup the instrument displays a run parameter summary screen.

You can accept the displayed setup or revise it.

To revise the setup, you will select new run parameters in the parameter entry screens as you step through setup. Selectable parameters are shown in parentheses in the run flow diagram to the right.



You start the run by pressing the **Nitrate** channel and then the **Start/Stop** key at the Ready prompt.

The instrument operates interactively by advancing to the next step and pausing until you connect the GAC columns and press the **OK** key. If the channel already contains fluid (plunger not at home position), the system will prompt you to drain the channel first.

At this point, the instrument washes the sample using the volume and wash rate selected during setup.

At completion, the instrument relieves channel pressure, then prompts that the run is complete. Disconnect the GAC columns and perform analysis on samples using the DX-2000.

SAMPLE CHANNEL RINSE MAINTENANCE

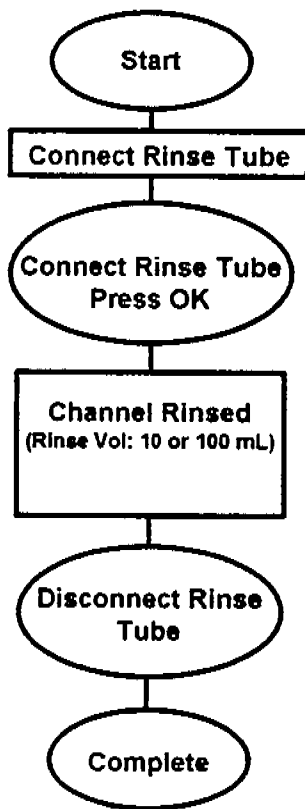
Setup

You start setup by pressing **1 - 4** and then the **Rinse** key at the Ready prompt.

After starting setup, the instrument displays a run parameter summary screen.

You can accept the displayed setup or revise it.

To revise the setup, you will select new run parameters in the parameter entry screens as you step through setup. Selectable parameters are shown in parentheses in the run flow diagram to the right.



You start the run by pressing **1 - 4**, the **Rinse** key, then the **Start/Stop** key at the Ready prompt.

The instrument operates interactively by advancing to the next step and pausing until you connect the Rinse tube and solution. Press the **OK** key.

Based on your selection during setup, the instrument rinses the channel with the selected rinse volume.

At completion, the instrument prompts that the run is complete. Disconnect the rinse tube from the Sample Channel.

NITRATE CHANNEL DRAIN, RINSE AND FILL MAINTENANCE

Setup

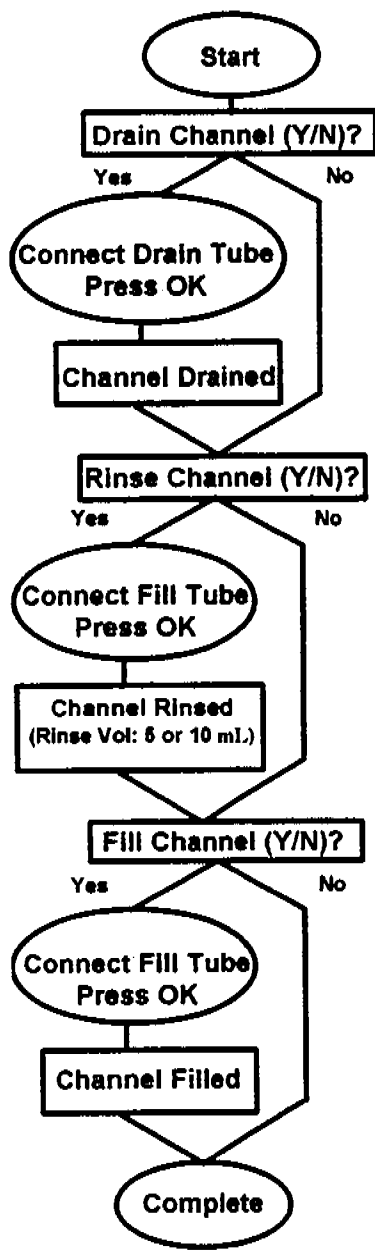
You start setup by pressing the *Nitrate* and then the *Rinse* key at the Ready prompt.

After starting the setup, you can step through a series of three query screens; Drain, Rinse and Fill Channel.

You can accept the displayed setup or revise it.

To revise the setup, you will select new "Yes" or "No" in response to the Query screen prompts.

Selectable parameters in relation to the Drain, Rinse and Fill functions are shown in parentheses in the run flow diagram to the right.



You start the cycle by pressing the *Nitrate* channel, the *Rinse* key, and then the *Start/Stop* key at the Ready prompt.

Use the drain cycle to remove old Nitrate solution from the channel. If a drain cycle was selected in setup, the instrument will prompt you for a drain tube connection. After pressing the *OK* key, the channel is drained.

Use the rinse cycle to clean and flush the channel. If a rinse cycle was selected in setup, the instrument will prompt you for a fill tube connection. After pressing the *OK* key, the channel is rinsed with the selected volume.

Use the fill cycle to add Nitrate solution to the channel. If the fill cycle was selected in setup, the instrument will prompt you for a fill tube connection (if not prompted in the rinse cycle). After pressing the *OK* key, the channel is filled.

At completion, the instrument prompts that the action is complete. Disconnect the tubing from channel.



SOFTWARE DESCRIPTION

This chapter describes the system software, its functions, and screens. Review this section before you begin preparing and processing samples.

OVERVIEW

The Adsorption Module software controls all instrument functions. Its principle functions are to process samples, to accept operator inputs from the keypad, display processing parameters, and prompt you for parameter and function selections. The software operates interactively with you to display system status, sample and rinse setup and process parameters.

SCREEN DESCRIPTIONS

The following paragraphs depict and describe the screens associated with instrument functions that can be selected using the keypad. These functions are:

- Sample Adsorption Setup (Channels 1-4)
- Rinse Setup (Channels 1-4)
- Nitrate Wash Setup (Nitrate Channel)
- Rinse Setup (Nitrate Channel Maintenance)
- Homing Motor Calibration

There are three types of screens used to interface the above functions. These are:

- parameter summary
- parameter selection
- query

The "parameter summary" screen summarizes all of the processing parameters so that it is not necessary to step through the parameter selection screens to determine processing parameters. The "parameter selection" screens display the individual parameters that can be set to other values. The "query" screen allows you to select a function when prompted by pressing a *Yes* or *No* key.

NOTE

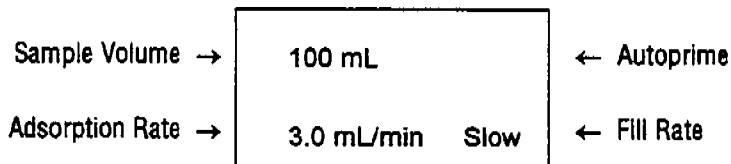


The sample screens shown in the following descriptions depict factory set default values that are present after initial power on. The values displayed on your instrument will vary as you change the setup.

SAMPLE ADSORPTION SETUP SCREENS (CHANNELS 1-4)

You will use six screens when setting up a sample adsorption into a GAC column: the "parameter summary" screen and five "parameter selection" screens. Using the parameter selection screens, you can set sample volume, adsorption rate, sample fill rate, sample priming and sample priming volume. The Autoprime area of the parameter summary screen is blank when the system default (priming off) is selected.

Parameter Summary Screen



Parameter Selection Screens

The ... screen displays	currently set values.	Selections include ...
Sample Volume	Sample Volume: 100 mL	10, 25, 50, and 100 mL
Adsorption Rate	Adsorption rate: 3.0 mL/min	0.5, 1, 2, 3, and 5 mL/min*
Sample Fill Rate	Fill rate: Fast: 66 mL/min	Fast: 66 mL/min Slow: 33 mL/min

*NOTE: The rate of 5 mL/min may only be used with 3 mm ID GAC columns. If 2 mm ID columns are used, motor errors may occur.

Parameter Selection Screens (Continued)

Sample Prime Query	Prime w/Sample (Yes/No)? No	Yes (turns priming on) No (turns priming off)
Priming Volume	Prime Volume: 10 mL	5 and 10 mL

RINSE SETUP SCREENS (CHANNELS 1-4)

There is one "parameter selection" screen associated with setting up a sample channel for rinsing. Using this screen you can set the rinse volume.

Parameter Selection Screen

The ... screen displays	currently set values.	Selections include ...
Rinse Volume	Volume: 100 mL	10 and 100 mL

NITRATE WASH SETUP SCREENS (NITRATE CHANNEL)

There are three screens associated with setting up the Nitrate channel for a Nitrate wash of the GAC column: the "parameter summary" screen and two "parameter selection" screens. Using the parameter selection screens, you can set the Nitrate wash volume and flow rate.

Parameter Summary Screen

Nitrate Wash Volume →	2mL Wash Volume
Flow Rate →	3.0 mL/min

Parameter Selection Screens

The ... screen displays	currently set values.	Selections Include ...
Nitrate Wash Volume	Wash Volume: 2 mL	1, 2, 3, 4, 5, 10, 15, 20, 25, and 50 mL
Wash Rate	Wash rate 3.00 mL/min	0.5, 1, 2, and 3 mL/min

RINSE SETUP SCREENS (NITRATE CHANNEL MAINTENANCE)

There are four screens associated with setting up this channel for rinsing: three "query" screens and one "parameter selection" screen. Using these screens you can select drain, rinse and fill cycles and set the volume of fluid to be used in the rinse cycle.

Cycle and Parameter Selection Screens

The ... screen displays	currently set values.	Selections include ...
Drain Channel Query	Drain Channel (Yes/No)?	Yes and No
Rinse Channel Query	Rinse Channel (Yes/No)?	Yes and No
Rinse Volume	Rinse Volume 10mL	5 and 10 mL
Fill Channel Query	Fill Channel (Yes/No)? Yes	Yes and No

TEST SCREENS

Test functions are selected using query screens (Yes/No screens) that list the diagnostic tests for the instrument. Unless directed by a factory representative, you will only use the diagnostics for the screens shown below. You will use:

- the Homing Motor diagnostic as a calibration tool to set and calibrate the home position at the bottom of the channel.
- the "Select speed" parameter selection screen is used to set the travel speed of the channel motor during calibration.

QUERY AND PARAMETER SELECTION SCREENS

The ... screen displays	currently set values.	Selections include ...
Homing Motor Query	Homing Motor (Yes/No)?	Yes and No
Select Speed	Select speed 172 steps/sec	1, 3, 5, 8, 13, 86, and 172 steps/sec

HELP SCREENS

Help messages are available for most screens. Pressing the *Help* key displays a help message related to the screen displayed when the key was pressed. Examples are provided in chapters of this manual that describe how to operate and maintain the instrument.

DAILY PROCEDURES

This chapter tells you the steps necessary to turn the instrument on and off and the daily steps necessary to prepare the instrument for use.

OVERVIEW

Listed below are actions you may need to perform daily to prepare the instrument for use. These actions are shown in a typical order of progression by step number. However, once power is turned on and the instrument initialized, the parameter check procedures (Steps 2 and 3) can be performed in any sequence. The instrument is factory set with default values that most users would follow. These default values are displayed in the screens used as examples in the parameter check procedures.

<u>Step</u>	<u>Action</u>
1	Power On and Instrument Initialization
2	Check Nitrate Wash Parameters
3	Check Sample Adsorption Parameters
4	Daily Maintenance
5	Power Off

WARNING! All persons near the instrument should wear a laboratory coat, eye protection, and protective gloves. Follow established laboratory procedures when using and maintaining the instrument. Failure to observe this warning can expose you and those around you to injury.

OPERATING NOTES

Help Messages

① When you see this symbol next to a screen, look for the associated Help message screen at the end of the step. The Help message is displayed by pressing the **Help** key. The number inside the circle correlates the displayed screen to the Help message screen. To exit the Help mode, press the **Help** key again, or press the **OK** key.

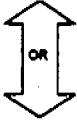
Exiting Check/Setup Procedures

At any point in Steps 2 and 3 of this chapter you can exit the procedure by pressing the Channel key again. All setup values will be accepted even if you have not reviewed them. If you press **Start/Stop**, the check/setup will terminate and the associated run will start.

Operation With Liquids

The channels must only be operated with liquids. Operation with no liquid will damage the O-rings and plungers.

STEP 1 - POWER ON AND INSTRUMENT INITIALIZATION

Step	Task	Press ...	Action/Response	Press ...	Action/Response
A	Turn on power	l on power switch at rear of instrument.	Single beep, all LEDs light momentarily, and the screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Dohrmann AD-2000 Press Start</div>		
B	Initialize the instrument	Start/Stop	Screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">System Power up Select a Channel</div>	1 - 5 to select the desired Channel.	Based on instrument status when power was turned off, the instrument will respond in one of two ways. If the state of the Channel <u>was Ready</u> when power was turned off, the instrument exits initialization and goes to the Ready state. (Go to Step D.)  If the state of the Channel <u>was not Ready</u> when power was turned off, go to Step C.

STEP 1 - POWER ON AND INSTRUMENT INITIALIZATION (CONTINUED)

Step	Task	Press ...	Action/Response	Press ...	Action/Response
C	Continue previous run or drain Channel and go to the Ready state.		the screen displays: <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">Continue Prev. Run (Yes/No)?</div>	Yes	The screen displays: <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">Press START to continue</div> When you press Start/Stop , the instrument starts operating at the point where power was turned off. Be sure that the fill or drain connections are still in place for any runs that were in progress before pressing Start/Stop .
				No	The screen displays: <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">Drain Channel (Yes/No)?</div> If you press Yes , the screen displays: <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">Connect Drain Tube, Press OK</div> Connect drain tube to the selected Channel and press OK . If you selected Channel 5, all the Nitrate solution will be drained. The instrument drains the Channel and goes to the Ready state. The screen displays: <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">** READY **</div> Go to step D.
				or	If you press No the instrument goes directly to the Ready state. (Go to step D.)

Step	Task	Press ...	Action/Response	Press ...	Action/Response
D	Exit Initialization and Start Adsorption or	Start/Stop	to accept all existing setups and start a sample adsorption for the selected Channel. Go to Step 1 of Chapter 5.		
	Review and Revise Sample Adsorption Setup or	Sample	to review and revise, if desired, the sample adsorption run parameters for the selected Channel (Go to Step 3).		
	Review and Revise Channel Rinse Parameters	Rinse	to review and revise, if desired, the selected Channel rinsing parameters. Go to Sample Channel Rinsing in Monthly Maintenance of Chapter 6.		

STEP 2 - CHECK NITRATE WASH PARAMETERS

Step	Task	Press ...	Action/Response	Press ...	Action/Response
A	Review Nitrate Wash Setup	At the Ready prompt, press Nitrate then Sample	Screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Run: Press START menu: Press NEXT</div>	Next	Screen displays a summary of the Nitrate Wash parameters: <div style="border: 1px solid black; padding: 2px; display: inline-block;">2 mL Wash Volume 3.00 mL/min</div> Either accept or revise setup following Step A.
		Accept existing setup	Start/Stop to accept displayed setup and go to the Run state.		
	or				
	Revise Setup	Next	to revise setup starting at Step B.		
B	Set Sample Volume		Screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Wash Volume: 2mL</div>	<input type="button" value="▼"/> OR <input type="button" value="▲"/>	to step sample volume through selections of 1, 2, 3, 4, 5, 10, 20, 25, and 50 mL. Press Next when the desired volume is displayed and go to Step C.
				Next	to accept the displayed volume and go to Step C.

Step	Task	Press ...	Action/Response	Press ...	Action/Response
C	Set Wash Rate		Screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Wash rate 3.00 mL/min</div>	▼ OR ▲	to toggle between 1 and 3 mL/min. Go to Step D when the desired wash rate is displayed.
D	Repeat Setup	Next	to accept displayed wash rate and go to the start of setup (Step A).		
	or				
	Accept Setup and Exit	Start	to accept displayed wash rate and go to the Ready state.		

STEP 3 - CHECK SAMPLE CHANNEL ADSORPTION PARAMETERS

Step	Task	Press ...	Action/Response	Press ...	Action/Response
A	Review Adsorption Parameters	1 - 4 at the Ready prompt.	Screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Run: Press START Menu: Press NEXT</div>	Next	Screen displays parameter summary: <div style="border: 1px solid black; padding: 2px; display: inline-block;">100 mL 3.0 mL/min Slow</div>
		Then press Sample			Either accept or revise setup following Step A.
	Accept existing setup	Start/Stop	to accept displayed setup and go to the Run state.		
	or				
	Revise Setup	Next	to revise setup starting at Step B.		
B	Set Sample Volume		Screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Sample Volume: 100 mL</div>	<input type="button" value="▼"/> OR <input type="button" value="▲"/>	to step volume between 10, 25, 50 and 100 mL.
C	Set Sample Adsorption Rate	Next	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Adsorption rate: 3.0 mL/min</div>	<input type="button" value="▼"/> OR <input type="button" value="▲"/>	to step adsorption rate between 0.5, 1.0, 2.0, 3.0 and 5.0 mL/min.
D	Set Fill Rate	Next	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Fill rate: Fast: 66.0mL/min</div>	<input type="button" value="▼"/> OR <input type="button" value="▲"/>	to step fill rate between Fast 66 mL/min and Slow 33 mL/min.

Step	Task	Press ...	Action/Response	Press ...	Action/Response
E	Set Channel Priming	Next	The screen displays: <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;"> Prime w/Sample (Yes/No)? No </div>	Yes	The screen displays: <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;"> Prime Volume: 10 mL </div> <p>Press <input type="button" value="▼"/> OR <input type="button" value="▲"/> to toggle between available volumes of 5 and 10 mL. When the desired volume is displayed, go to Step F.</p>
				or	No
F	Repeat Setup	Next	to repeat setup starting at Step A.		
	Accept Setup and Exit	Channel key	Instrument goes to the Ready state.		

STEP 4 - MAINTENANCE

Refer to Chapter 6 and perform the Daily Maintenance procedures:

- Check Nitrate Channel Solution Level
- Check Waste Tray Level

STEP 5 - POWER OFF

Daily Power Off

It is not necessary to turn the instrument off each day. If the instrument is turned off when a run is in progress (for example, while performing a sample adsorption), you will be prompted to continue the run when power is turned on.

To avoid interrupting a run, check that no runs are in progress before turning off power.

Turn off power by pressing the power switch at the rear of the instrument.

Extended Power Off

If you plan on leaving the instrument unattended or off for a long period of time, you may also want to drain and rinse all Channels.

After rinsing and draining all Channels, remove all fill or drain lines and empty and clean the waste tray (see Chapter 6).

OPERATING THE INSTRUMENT

This chapter tells you how to collect and pretreat samples, how to operate the four Sample Channels (1-4) for sample adsorption, and how to operate the Nitrate Channel for a Nitrate Wash of the sample. Instructions for setting up the Sample Channels for sample adsorption and the Nitrate Channel for a Nitrate Wash are presented in Chapter 3, Daily Procedures. Instructions for preparing the Nitrate Channel (rinsing, draining and filling) are provided in Chapter 6, Maintenance.

OVERVIEW

The table below lists operations or actions you can perform. These actions are shown in the required order of progression by step number except that Interrupting a Run, Step 5, can be performed at any time while a Sample Adsorption or Nitrate Wash run is in progress.

<u>Step</u>	<u>Action</u>
1	Collect and Pretreat Samples
2	Perform a Sample Adsorption
3	Perform a Nitrate Wash
4	GAC Column Handling
5	Interrupt a Run

Read the safety instructions presented in Appendix D prior to performing any operation on the instrument.

Help Messages

① When you see this symbol next to a screen, look for the associated Help message screen at the end of the step. The Help message is displayed by pressing the **Help** key. The number inside the circle correlates the displayed screen to the Help message screen. To exit the Help mode, press the **Help** key again, or press the **OK** key.

WARNING! All persons near the instrument should wear a laboratory coat, eye protection, and protective gloves. Follow established laboratory procedures when using and maintaining the instrument. Failure to observe this warning can expose you and those around you to injury.

STEP 1 - COLLECT AND PRETREAT SAMPLES

Glassware Cleaning and Storage

Glassware and lids must be thoroughly cleaned before use and as soon as possible after use, as follows:

1. Wash with detergent and hot water.
2. Clean the glassware. Standard methods include:
 - a) ALCONOX and a Sonicator
 - b) Nochromix
3. Rinse with tap water, then distilled water, and drain dry.
4. Allow the glassware to cool, then seal and store the glassware and lids in a clean environment to prevent any accumulation of dust or other contaminants.

Sample Collection

Sample collected should be stored in amber glass bottles (glassware) with a recommended 250 ml capacity. Before collection, the glassware must be cleaned in the manner described above. The bottles must have Teflon-lined caps; foil may be substituted to seal the bottle if the sample is not corrosive.

Sample Pre-treatment

To preserve the sample, you must reduce residual chlorine (Cl_2 or ClO_2) in the sample to chloride and adjust the sample pH to a level of < 2 . Proceed as follows:

1. Reduce free chlorine to chloride by adding 1 mL/liter of 1M Sodium Sulfite Solution (see Appendix B) when the sample is collected.

WARNING! Observe all applicable safety precautions when handling acids. If contact with skin should occur, flush areas of skin contact amply with water for 15 minutes. Refer to your MSDS or lab policies for more information.

2. To reduce the pH, add about 1 mL of reagent grade nitric acid (HNO_3) to the sample.

Sample Storage

Once the sample is pre-treated, it should be stored in cleaned glassware. The sample should be stored at 4°C and protected against loss of volatiles by eliminating headspace in the container.

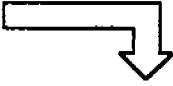
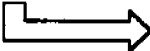
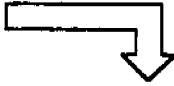

STEP 2 - PERFORM A SAMPLE ADSORPTION

Step	Task	Press ...	Action/Response	Press ...	Action/Response
A	Select Channel	1 - 4 to select the desired Channel at the Ready prompt. Then press Start/Stop	If the plunger is not in its home position, the instrument prompts:	No	Instrument continues with sample adsorption. See Step B.
			Drain Channel First (Yes/No)?	Yes	The screen displays: <div style="border: 1px solid black; padding: 5px; text-align: center;">Connect Drain Tube, Press OK</div>
	Drain Channel (if applicable)	In response to the Drain Channel prompt, if you pressed Yes	Connect Drain Tubing to the selected channel, then	OK	The screen displays: <div style="border: 1px solid black; padding: 5px; text-align: center;">Draining Channel Volume: x mL</div> Where x is the volume remaining in the cylinder. When complete, the screen displays: <div style="border: 1px solid black; padding: 5px; text-align: center;">Remove Drain Tube, Press OK</div>
			Disconnect Drain Tubing	OK	The screen displays: <div style="border: 1px solid black; padding: 5px; text-align: center;">Run Setup (Yes/No)?</div> Press No to revise Sample Adsorption setup. Go to Chapter 4. Press Yes to continue Sample Adsorption. Go to Step B.

STEP 2 - PERFORM A SAMPLE ADSORPTION (CONTINUED)

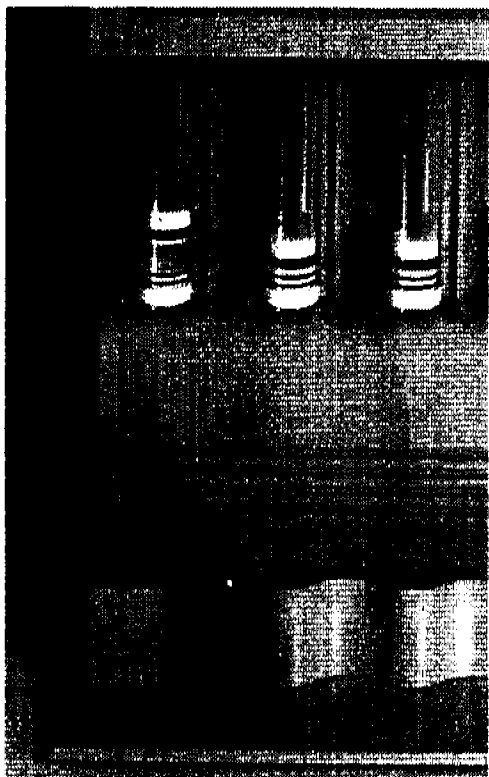
Step	Task	Press ...	Action/Response	Press ...	Action/Response
B	Sample Adsorption Started	Start/Stop	<p>The instrument starts the sample adsorption run and the screen displays:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Connect Sample (Then Press OK)</p> </div> <p>Connect a fill tube to the selected Channel. Place the tube in a bottle of the water to be sampled with the tube at the bottom of the bottle. Ensure that the water sample volume is slightly greater than the volume to be sampled.</p>		<p>NOTE: To avoid aspirating air into the Channel, ensure that the fill tube is at the bottom of the sample bottle and that the bottle contains the selected sample volume plus about 10%.</p>

STEP 2 - PERFORM A SAMPLE ADSORPTION (CONTINUED)

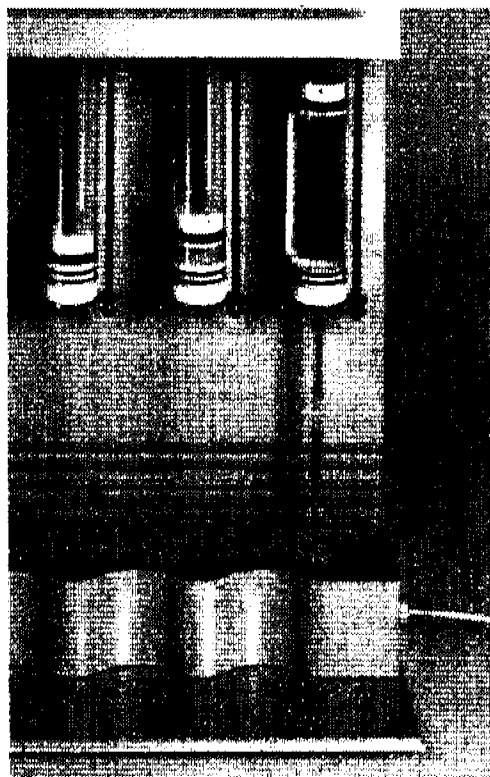
Step	Task	Press ...	Action/Response	Press ...	Action/Response
C	Channel Priming and Sample Loading	OK	 Priming <hr/> If Prime w/Sample <u>was</u> selected during setup the screen displays: <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 5px auto;"> Prime w/Sample Loading: 9 mL </div> and counts up to the selected volume (5 or 10 mL), while loading. It then displays the rinsing volume and counts down to 1 mL while rinsing: <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 5px auto;"> Prime w/Sample Rinsing: 9 mL </div> <hr/> 	or	 Loading <hr/> If Prime w/Sample <u>was not</u> selected during setup  the screen displays: <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 5px auto;"> Loading Sample Volume: 1 mL </div> and counts up to the selected volume while loading. When complete, go to Step D.

STEP 2 - PERFORM A SAMPLE ADSORPTION (CONTINUED)

Step	Task	Press ...	Action/Response	Press ...	Action/Response
D	Perform Sample Adsorption <u>NOTE:</u> You can use prepackaged GAC columns or you can package them yourself. Refer to Appendix F for GAC handling and packing.		The screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Connect Columns (Then Press OK)</div> Disconnect the fill tube and sample bottle and connect two GAC columns in series with an adapter between them to the applicable Channel. Be sure to punch holes in both ends of the GAC columns before installing them.	OK	The screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Remaining Sample Volume: 99 mL</div> and counts down from the selected volume while pushing the sample through the GAC columns. When adsorption is complete, the screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Please Wait For Pressure Release</div> In about 30 seconds a beep will be heard. The screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Run Complete Press OK</div>
E	Exit Run	OK	The instrument returns to the Ready mode. Go to Step 3.		



Sample Loading Connection



GAC Column Connection

STEP 3 - PERFORM A SAMPLE NITRATE WASH

Step	Task	Press ...	Action/Response	Press ...	Action/Response
A	Start Nitrate Wash	<i>Nitrate</i> then <i>OK</i>	<p>The screen displays:</p> <div style="border: 1px solid black; padding: 2px; display: inline-block;">Connect Columns (Then Press OK)</div> <p>If not already done, remove GAC columns from the Sample Channel and connect them to the Nitrate Channel.</p> <hr/> <p>NOTE: When removing the columns from the Sample Channel and connecting them to the Nitrate Channel, do not reverse the top and bottom connection of columns to the instrument.</p> <hr/>	<i>OK</i>	<p>The screen displays:</p> <div style="border: 1px solid black; padding: 2px; display: inline-block;">Remaining Wash Volume: 2 mL</div> <p>and counts down to 1 mL from the selected volume while pushing the Nitrate through the GAC columns.</p> <p>When the Nitrate Wash is complete, the screen displays:</p> <div style="border: 1px solid black; padding: 2px; display: inline-block;">Please Wait For Pressure Release</div> <p>In about 30 seconds a beep will be heard. The screen displays:</p> <div style="border: 1px solid black; padding: 2px; display: inline-block;">Run Complete Press OK</div>
B	Exit the Run	<i>OK</i>	The instrument returns to the Ready mode. Remove columns and go to Step 4.		

STEP 3 - PERFORM A SAMPLE NITRATE WASH (CONTINUED)

If there is not enough Nitrate wash in the channel to complete the wash requested, the screen will display

Insufficient NO₃
Solution, (OK)

Fill the Nitrate wash channel with additional solution.

Step	Task	Press ...	Action/Response	Press ...	Action/Response
A	Stop Sampling	Start/Stop	The screen displays: <div style="border: 1px solid black; padding: 5px; margin: 5px auto; width: 150px;">Sampling Stopped Go On (Yes/No)?</div>	No	The screen displays: <div style="border: 1px solid black; padding: 5px; margin: 5px auto; width: 150px;">Drain Channel (Yes/No)?</div>
				No	The screen returns to: <div style="border: 1px solid black; padding: 5px; margin: 5px auto; width: 150px;">** READY **</div>

Fill Nitrate channel as described in Nitrate Channel Preparation (Page 6-4) and continue with wash of GAC columns.

STEP 4 - GAC COLUMN HANDLING

After performing a sample adsorption and nitrate wash, the GAC columns can be used immediately for sample analysis or stored. Use the following guidelines:

- **Identify the Columns.** For sample analysis of the GAC columns on the DX-2000, it is important to know which GAC packing is from the top column and which packing is from the bottom column; therefore, keep track of top and bottom columns.
- **GAC Storage.** GAC analysis does not need to follow immediately. The columns may be stored temporarily with the GAC packing in place. However, it is best to analyze them on the same day. Do not let them dry out. Packed columns, processed or unprocessed, should be wrapped in clean aluminum foil or kept in a sealed container of suitable size for any length of time to avoid TOX adsorption from ambient air.
- **GAC Handling.** Minimize handling of the processed GAC. Gloves should be worn so that salt from your hands does not contaminate the sample.

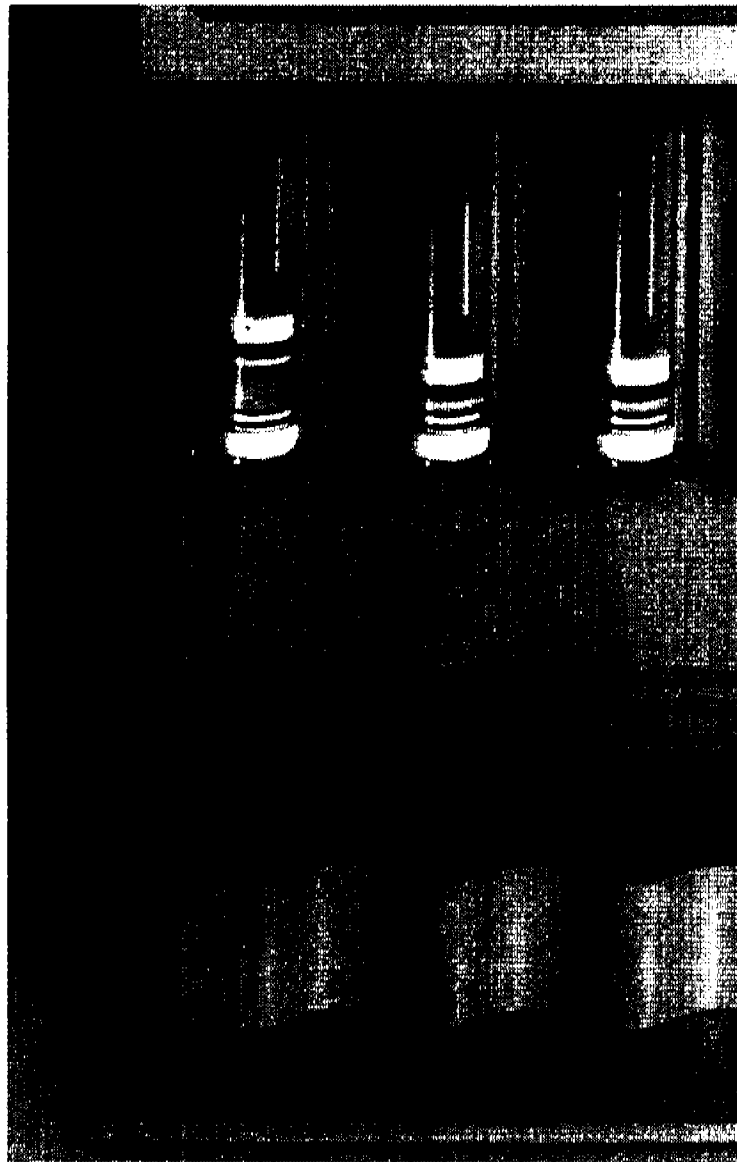
STEP 5 - INTERRUPTING A RUN

You can interrupt or terminate the run at any time. Use this procedure to stop the run and then take the necessary actions.

Step	Task	Press ...	Action/Response	Press ...	Action/Response
A	Interrupting a Run	Start/Stop	The instrument stops the run and the screen displays: <u>During Filling or Sampling</u> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">Sampling Stopped Go on (Yes/No)?</div> <u>During Rinsing</u> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">Rinsing Stopped Go on (Yes/No)?</div> <u>During Draining</u> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">Draining Stopped Go on (Yes/No)?</div>	N/A	Go to Step B to Continue a Run or to Step C to end the run.
<p>NOTE: If an interruption occurs during an adsorption process, the plunger is backed up 200 steps to relieve pressure in the column.</p>					

STEP 5 - INTERRUPTING A RUN (CONTINUED)

Step	Task	Press ...	Action/Response	Press ...	Action/Response
B	Continuing a Run	Yes	The screen displays: <div style="border: 1px solid black; padding: 5px; display: inline-block;">Press START to continue</div>	Start/Stop	The interrupted run (sample, rinse, or drain) is restarted from the point of interruption.
C	Stop the Run and Start Over	No	The screen displays: <div style="border: 1px solid black; padding: 5px; display: inline-block;">Drain Channel (Yes/No)?</div>	Yes	The screen displays: <div style="border: 1px solid black; padding: 5px; display: inline-block;">Connect Drain Tube, Press OK</div> Connect the drain tube and press OK . The system drains the Channel and returns to the Ready state.
				No	The instrument returns to the Ready state.



Drain Tube Connection



MAINTENANCE

This chapter tells you how to maintain your instrument by performing scheduled and unscheduled maintenance.

OVERVIEW

Maintenance procedures include rinsing, cleaning, Nitrate Channel preparation, checking and replacing instrument parts, and making adjustments.

Scheduled maintenance is a critical part of keeping the instrument functioning properly. Performing these procedures as scheduled will enhance instrument reliability and performance. Each procedure in this chapter can be performed individually. When several procedures are performed as group (for example, weekly maintenance) some steps may be redundant and repeats can be ignored.

Read the safety instructions presented in Appendix D prior to performing any maintenance on the instrument.

WARNING! All persons near the instrument should wear a laboratory coat, eye protection, and protective gloves. Follow established laboratory procedures when using and maintaining the instrument. Failure to observe this warning can expose you and those around you to injury.

NOTE: The channels must only be operated with liquids. Operation with no liquid will damage the O-rings and plungers.

MAINTENANCE SCHEDULE

Schedule	Actions
Daily	Check Nitrate Channel Solution Level
	Check Waste Tray Level
Weekly	Clean Instrument Exterior
	Clean Instrument Work Area
	Perform Nitrate Channel Preparation
Monthly	Check Channel O-Rings
	Check Channel Cylinders for Cracks or Scratches
	Rinse Sample Channels (1-4)

DAILY MAINTENANCE

Each day the procedures in this section should be performed.

Check Nitrate Channel Solution Level

Observe the level of solution in the Nitrate Channel. Each Nitrate Wash cycle requires 2 mL of solution and the channel holds up to 100 mL. If additional fluid is required, go to Nitrate Channel Preparation in Weekly Maintenance and fill the Channel.

Empty the Waste Tray

The waste tray contains a fitting and tube which can be used to drain instrument waste from the tray into a waste bottle or drain. Perform the following:

- If the waste tray fitting and tube are not being used, check and empty the waste tray as necessary before use.

or

- If the drain is being used with a bottle, check and empty the bottle as necessary before use.

WEEKLY MAINTENANCE

Once each week the procedures in this section should be performed.

Clean the Instrument Exterior

1. Gather the following items:

<u>Item</u>	<u>Quantity</u>
Lint-free wipes or towels	As required
Soapy water (non-abrasive)	As required

2. Stop any instrument runs in process. Press the *Start/Stop* key for each active Channel.
3. Clean the instrument exterior. Using wipes or towels moistened with soapy water wipe down all instrument exterior surfaces. Do not use an excessive amount of cleaning solution. Using wipes or towels moistened with water, wipe down all instrument exterior surfaces to remove soap residue.
4. Clean the waste tray. Remove the waste tray from the instrument and clean it in soapy water. Dry the tray with wipes or towels and return it to the instrument.
5. Turn on instrument power and resume normal operation. Turn on instrument power at the rear of the instrument by pressing I on the power switch and resume normal operation by pressing the *Start/Stop* switch and following screen prompts.

Clean the Instrument Work Area

1. Gather the following items:

<u>Item</u>	<u>Quantity</u>
Paper towels	As required
Soapy water (non-abrasive)	As required

2. Clean the work area. Remove any unnecessary items from the working area of the instrument. Using paper towels and soapy water, clean and dry the working surfaces around the instrument.

Perform Nitrate Channel Preparation

The Nitrate Channel is used to run a Nitrate Wash on the water sample after sample adsorption into the GAC column. Using Steps 1 and 2, you have the option of independently turning on and off the drain, rinse, and fill steps and then running the setup to prepare the Nitrate Channel.

This procedure can be used in a number of ways to perform maintenance tasks on the Nitrate Channel. You can :

- drain and rinse the Channel for long duration storage
- fill the Channel to add additional solution
- drain, rinse, and fill the Channel to replace existing solution.

Once you start the run using Step 2, the instrument will perform the tasks selected in setup (Step 1). Even though all tasks may not have been selected in setup, Step 2 describes all steps the instrument would go through as if all tasks were selected. Since you will be prompted for only those tasks selected, you can ignore those tasks in Step 2 that were not selected in setup.

Help Messages

① When you see this symbol next to a screen, look for the associated Help message screen at the end of the procedure. The Help message is displayed by pressing the *Help* key. The number inside the circle correlates the displayed screen to the Help message screen. To exit the Help mode, press the *Help* key again, or press the *OK* key.

Step 1 - Setup Procedure for Nitrate Channel Preparation

Step	Task	Press ...	Action/Response	Press ...	Action/Response
A	Start Setup	<i>Nitrate</i> at the Ready prompt. Then press <i>Rinse</i> .	Screen displays: <div style="border: 1px solid black; padding: 5px; display: inline-block;">Rinse Channel: OK Clean Glass: YES</div>	<i>OK</i>	The screen displays: <div style="border: 1px solid black; padding: 5px; display: inline-block;">Run: Press START Menu: Press NEXT</div>
				<i>Start/Stop</i>	to go to Step 2 and start the Nitrate Channel Preparation cycle.
				<i>Next</i>	to go to Step B and review or revise the setup.
<p>NOTE: Press the <i>Channel</i> key at anytime to exit setup and go to the Ready state.</p>					

Step 1 - Setup Procedure for Nitrate Channel Preparation(Continued)

Step	Task	Press ...	Action/Response	Press ...	Action/Response
B	Drain Setup		Screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Drain Channel (Yes/No)?</div> ①	Next or Yes or No	to accept the displayed setup and go to Step C. to change to the desired setup and go to Step C.
C	Fill Setup		Screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Fill Channel (Yes/No)?</div> ③	Next or Yes or No	to accept the displayed setup and go to Step D. to change to the desired setup and go to Step D.
D	Rinse Setup		Screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Rinse Channel (Yes/No)?</div> ④	Next or No or Yes	to accept the displayed setup. NOTE: If the setup choice is Yes, the instrument advances to Step E. If the setup choice is No, the instrument advances to Step F. to change to the desired setup and go to the Run/Menu screen in Step A. Press Next (see Note above). to change to the desired rate and go to the Run/Menu screen of Step A.

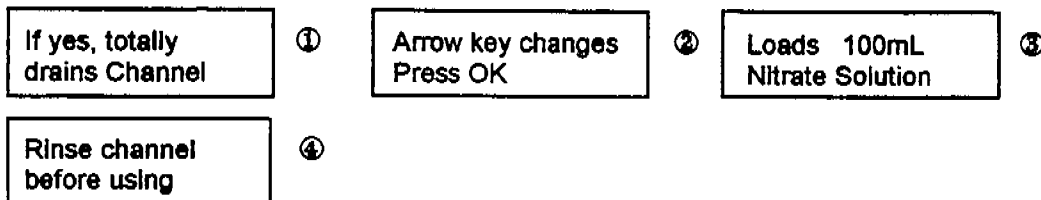
Step 1 - Setup Procedure for Nitrate Channel Preparation (Continued)

Step	Task	Press ...	Action/Response	Press ...	Action/Response
E	Rinse Volume		The screen displays the rinse volume: <div style="border: 1px solid black; padding: 5px; display: inline-block;">Rinse Volume: 10mL</div> ②	▼ OR ▲	to toggle between a volume of 5 and 10 mL.
				then press Next	to accept the displayed rinse volume and go to the Run/Menu screen of Step A.
F	Exit Setup	Nitrate Channel Select key again.	Instrument goes to the Ready state and the screen displays: <div style="border: 1px solid black; padding: 5px; display: inline-block;">** READY **</div>		



NOTE

At any point you can exit the setup procedure by pressing the Channel key again. All setup values and selections will be accepted even if you have not reviewed them. If you press **Start/Stop**, the setup will terminate and the run will start (see Step 2).



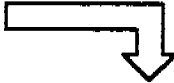

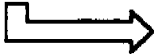
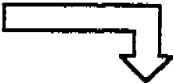
Step 2 - Run Procedure for Nitrate Channel Preparation

Step	Task	Press ...	Action/Response	Press ...	Action/Response
A	Review Setup		If necessary, go to Step 1 and review Nitrate Channel Drain, Fill, and Rinse setups. Otherwise, go to Step B and run the Nitrate Channel Setup.		
B	Start Nitrate Channel Preparation Run	Nitrate Rinse then Start/Stop	The instrument advances to the first selected task (drain, fill, or rinse). Go to Step C, D, or E accordingly.		
C	Drain Channel		<p>The screen displays</p> <div style="border: 1px solid black; padding: 5px; display: inline-block;"> Connect Drain Tube, Press OK </div> <p>Connect drain tube to the Nitrate Channel and ensure that the end of the drain tube is either in the waste tray or in a beaker with sufficient volume to hold the channel contents (110 mL maximum).</p>	OK	<p>the screen displays:</p> <div style="border: 1px solid black; padding: 5px; display: inline-block;"> Draining Channel Volume: 3mL </div> <p>and counts down as the Channel is drained. When draining is complete, the instrument advances to the next selected task:</p> <ul style="list-style-type: none"> • rinse (Step D) • fill (Step E) • exit (Step F)

Step 2 - Run Procedure for Nitrate Channel Preparation (Continued)

Step	Task	Press ...	Action/Response	Press ...	Action/Response
D	Rinse Channel		<p>The screen displays:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;">Connect Nitrate For Rinse, (OK)</div> <p><u>For Rinse Only:</u></p> <p>Connect fill tube with bottle containing desired rinse solution and rinse volume selected in setup, to the Nitrate Channel.</p> <p><u>For Rinse and Fill:</u></p> <p>Connect fill tube with bottle containing sufficient Nitrate Wash solution to fill the Nitrate Channel (110 mL maximum fill capacity). See Appendix B for Nitrate Wash solution preparation.</p>	OK	<p>The screen displays:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;">Rinse w/5 mL NO₃ Loading: 2mL</div> <p>and counts up to the selected rinse volume as Nitrate Wash is loaded. After loading, the screen displays:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;">Please Move Pick-up Tube, (OK)</div> <p>User moves pick-up tube to drainage container or discharge, rinsing liquid into same container press <i>OK</i>. The screen displays:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;">Rinse w/5 mL NO₃ Rinsing: 2mL</div> <p>and counts down until the loaded rinse volume is drained.</p> <p>Go to Step E.</p>

Step 2 - Run Procedure for Nitrate Channel Preparation (Continued)

Step	Task	Press ...	Action/Response	Press ...	Action/Response
E	Fill Channel		 <u>If a Rinse cycle was selected:</u>  	or	 <u>If a Rinse cycle was not selected:</u> The screen displays: <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px 0;"> Ready to Fill w/Nitrate, (OK) </div> Connect fill tube with bottle containing sufficient Nitrate Wash solution to fill the Nitrate Channel (110 mL maximum fill capacity). Each Nitrate Wash cycle requires 2 mL of solution. (See Appendix B for Nitrate Wash solution preparation.) Press OK <hr/> the screen displays: <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px 0;"> Filling Channel Volume: 4 mL </div> and counts up to 100 mL as Nitrate is loaded. When filling is complete, a beep will be heard. Go to Step F.

Step 2 - Run Procedure for Nitrate Channel Preparation (Continued)

Step	Task	Press ...	Action/Response	Press ...	Action/Response
F	Exit Run		The screen displays: <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">Run Complete Press OK</div>	OK	The instrument returns to the Ready mode. Remove any tubes and go to the next desired action.

Channel is ready to start (OK)

 ①

Channel is ready to start (OK)

 ②
MONTHLY MAINTENANCE

Once each month the procedures in this section should be performed.

Check the O-Rings for each Channel

1. **Check O-rings on the Channel base.** Check that there is no fluid seeping past the O-rings, and that there is no discoloration or buildup of sample fluids. If defective, go to Step 3.
2. **Check O-ring on Channel Plunger.** Check that there is no fluid seeping past the O-ring as the plunger pushes sample water through the GAC columns. If defective, go to Step 3.
3. **Replace O-rings and Adjust Channel.** Replace defective O-rings (see Replacement Procedures) and perform the Channel Home Position Adjustment.

Check the Channel Cylinders for Cracks and Scratches

1. **Check each cylinder for cracks and scratches.** Check that the glass cylinder of each Channel is free of cracks or scratches. If defective, go to Step 2.
2. **Replace Cylinder and Adjust Channel.** Replace defective cylinder (see Replacement Procedures) and perform the Channel Home Position Adjustment.

Rinsing Sample Channels (1-4)

Step	Task	Press ...	Action/Response	Press ...	Action/Response
A	Review Rinsing Setup	At the Ready prompt, press 1 - 4 then <i>Rinse</i>	Screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Rinse Channel: OK Clean Glass: YES</div>	OK	The screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Run: Press START Menu: Press NEXT</div>
	Accept Setup and Start Rinse	Start/Stop or	to accept displayed setup and start rinse. Go to Step D.		
	Revise Rinse Setup	Next	to revise setup starting at Step B.		
B	Set Rinsing Volume		Screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Rinsing Volume: 100mL</div>	<input type="button" value="▼"/> OR <input type="button" value="▲"/> or	to toggle volume between 10 and 100 mL. Press Next when the desired volume is displayed and go to Step C.

Rinsing Sample Channels (1-4) (Continued)

Step	Task	Press ...	Action/Response	Press ...	Action/Response
C	Repeat Setup or	Next	Go to Step A.		
	Start run	Start/Stop	Screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Connect Rinse Tube, Press OK</div> Connect rinse tube then	OK	The instrument rinses the cylinder and displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Rinse Cycle: Loading: xxmL</div> where xx is the rinse cycle and volume. After loading is complete, <div style="border: 1px solid black; padding: 2px; display: inline-block;">Please Move Pick-up Tube (OK)</div> user diverts the discharge liquid designation to allow the liquid to go into the save containers. Press OK . <div style="border: 1px solid black; padding: 2px; display: inline-block;">Rinse Cycle Unloading: xxmL</div> Drains out the liquid. When done, go to step D.
D	Exit Run		The screen displays: <div style="border: 1px solid black; padding: 2px; display: inline-block;">Run Complete Press OK</div>	OK	The instrument returns to the Ready mode. Remove any tubes and go to the next desired action.

CHANNEL HOMING CALIBRATION

This procedure should be performed whenever a Channel cylinder or its O-rings are replaced. To perform the Channel Homing Calibration, you will use the "Homing motor diagnostic" function of the Test mode. Proceed as follows:

Step	Task	Press ...	Action/Response	Press ...	Action/Response
A	Access Homing Motor Diagnostic	Test	The screen displays <div style="border: 1px solid black; padding: 5px; display: inline-block;"> Menu: Press NEXT Exit: Press TEXT </div> ①	Next	Step the instrument through the available diagnostic screens. Stop when the screen displays: <div style="border: 1px solid black; padding: 5px; display: inline-block;"> Homing Motor (Yes/No)? </div>
				Test	To exit the test function, if desired.
B	Setup Adjustment	Yes	The screen displays <div style="border: 1px solid black; padding: 5px; display: inline-block;"> Select a channel Press NEXT </div>	1 - 4 or Nitrate	The screen displays <div style="border: 1px solid black; padding: 5px; display: inline-block;"> Select speed 172 steps/sec </div> Press <input type="button" value="▼"/> OR <input type="button" value="▲"/> to step through available speeds of 1, 3, 5, 8, 13, 86, or 172 steps/sec. Stop at the desired speed and go to Step C.
				<p>NOTE: There are 15,900 motor steps from the top to the bottom of the column. Pick an appropriate speed to move the plunger from its current position to the bottom of the column.</p>	

CHANNEL HOMING CALIBRATION (CONTINUED)

Step	Task	Press ...	Action/Response	Press ...	Action/Response
<p>NOTE: If there is fluid in the column, it will be drained as you move the plunger to the bottom of the column. Be sure the waste tray is in place and connect a drain tube to the selected Channel before moving the plunger.</p>					
C	Move Plunger to Bottom of Column	Next	The screen displays	Start/Stop	the screen displays:
			START to move Next for setup		UP/DOWN to move OK when finished
					<p>Press and hold the ▼key to move the plunger to the bottom of the column. When a clicking sound is heard, the plunger has reached the bottom of the column. Release the ▼key.</p> <p>Go to Step D.</p>
				Next	<p>to go to Step B (Setup) and reset motor speed if you selected an inappropriate speed or want to change the selected Channel.</p>

CHANNEL HOMING CALIBRATION (CONTINUED)

Step	Task	Press ...	Action/Response	Press ...	Action/Response
D	Calibrate the Homing Position	OK	The screen displays: <div style="border: 1px solid black; padding: 5px; display: inline-block;">START: calibrate OK: exit</div>	Start/Stop	the instrument calibrates the home position (20 steps from the column bottom) while the screen displays: <div style="border: 1px solid black; padding: 5px; display: inline-block;">Calibrating Please Wait</div> After the plunger reaches home position the screen displays: <div style="border: 1px solid black; padding: 5px; display: inline-block;">Done calibrating OK: exit, NXT: more</div> Go to Step E.
				OK	to exit without calibrating the Channel. Go to Step E.
<p>NOTE: If the plunger is unable to detect the home position, the screen will display:</p> <div style="border: 1px solid black; padding: 5px; display: inline-block; margin: 10px auto;">Can't Calibrate Sensor Unblocked</div> <p>Press OK and return to Step C. If the message persists, contact Dohrmann Technical Service.</p>					
E	Repeat or Exit Calibration	Next	Repeat the calibration for another Channel starting at Step B.		
		OK	Instrument exits calibration and the screen displays: <div style="border: 1px solid black; padding: 5px; display: inline-block;">Homing Motor (Yes/No)?</div>	Test	Instrument exits Test function and returns to the Ready state.

REPLACEMENT PROCEDURES

Use these procedures to replace the instrument fuses, the Channel O-rings, and glass cylinders.

Fuse Replacement

1. Turn off the instrument and disconnect the power cord.
2. Using a small flat-blade screwdriver, pop the fuse holder from the Power Entry Module.
3. Pull the fuse(s) from the fuse holder and replace the fuse(s) with the same current and voltage rating.
4. Insert the fuse holder into the Power Entry Module with the two arrows facing each other and press the holder until it firmly seats into the module.
5. Reconnect the power cord.

O-Ring Replacement

This procedure can be used for all channels. Proceed as follows:

1. Gather the following items:

Item	Quantity
Paper towels	As required
O-Rings	2 - base O-rings P/N 100-509 1 - plunger O-ring P/N 899-739



2. **Drain the Channel.** If the channel contains fluid, ensure that the waste tray is in position, then drain the channel. This step must be performed to access the procedure for setting the channel plunger to its top position even if the channel does not contain fluid.

Step	Task	Press ...	Action/Response
A	Access Drain Function	At the Ready prompt, press 1 - 4 or Nitrate then Rinse	Screen displays: <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">Rinse Channel: OK Clean Glass: YES</div>
		Yes	The screen displays: <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">Connect Drain Tube, Press OK</div>
B	Drain the Channel	Yes	The screen displays: <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">Draining Channel Volume: x mL</div> <p>where x is volume to be drained. At end of cycle the screen displays:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">Remove Drain Tube, Press OK</div> <p>Remove the drain tube and go to Step 3.</p>

3. Replace the O-rings.

Step	Task	Press ...	Action/Response
A	Set plunger to top of channel.	OK	<p>The screen displays:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;">Plunger Moving Please Wait</div> <p>while the plunger moves to the top of the cylinder (about 1-2 minutes).</p> <p>The screen displays:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;">Remove Glass For Cleaning, (OK)</div>
B	Disassemble the Column	N/A	<p>a. Remove the two thumbnuts at the base of the column and lift the column support plate from the instrument.</p> <hr/> <p>CAUTION! When removing and installing the glass cylinder, be sure that you only rock the cylinder from side to side or front and back gently and slightly. Excessive or jerking motion can cause the glass to crack or break. Do not twist the cylinder.</p> <hr/> <p>b. Grasp the column firmly with both hands. While pulling it down and out of its upper mounting, gently rock it from side to side and back and forth to assist in removal.</p>
C	Replace the O-rings		<p>Remove old O-rings. Take care not to damage the plunger surface. Use a push pin to pull the O-ring away from the plunger groove and then pull the O-ring off. Install new O-rings on the plunger by sliding the O-ring onto the part until it seats in the O-ring groove.</p>

3. Replace the O-rings (Continued).

Step	Task	Press ...	Action/Response
D	Reassemble the Column	OK	<p>The screen displays:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px 0;"> <p>Re-Install Clean Glass, Press OK</p> </div> <p>a. Wet the column surface with deionized water then, push the column over the plunger using chamfer end onto its upper mounting. To assist in installing the cylinder, gently rock it from side to side and back and forth. When the plunger is almost seated, press OK. The screen displays:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px 0;"> <p>Plunger Moving Please Wait</p> </div> <p>while the plunger is moved upward about 1/2". The screen then displays:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px 0;"> <p>UP/DOWN to move OK when finished</p> </div> <p>b. Press the  OR  key to move the plunger down or up to aid in pushing the cylinder over the plunger</p> <p>c. Press the plunger base in place.</p> <p>d. Hold the column support plate in place and secure it to the column rods using two thumbnuts. Thumbnuts should be hand-tightened only.</p>

3. Replace the O-rings (Continued).

Step	Task	Press ...	Action/Response
E	Calibrate the Home Position	OK	<p>The screen displays:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> START: calibrate OK: exit </div> <p>If the plunger is unable to detect the home position, the screen will display:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> Can't Calibrate Sensor Unblocked </div> <p>Press OK, go back to step C.</p>
		Start/Stop	<p>The screen displays:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> Calibrating Please Wait </div> <p>When calibration is complete, the instrument returns to the Ready state.</p>

4. **Check Channel Operation.** Repeatedly fill and drain the channel with liquid to check that the channel functions properly.
5. Perform Channel Homing Calibration, page 6-14.

Column Cylinder Replacement

When replacing the column cylinder, replacement of the O-rings should be performed as a preventative measure. Repeat the O-ring replacement procedure and replace the glass column (P/N 890-115) in Step 3.

TROUBLESHOOTING

This chapter tells you how to troubleshoot your instrument for general instrument failures, instrument error messages, and for sample data or processing errors.

OVERVIEW

General instrument and error message failures are observable instrument failures and troubleshooting is based on the associated failure symptoms. Data or processing errors do not show up until the sample in the GAC columns is processed for TOX using the Dohrmann DX-2000 TOX System Analyzer or similar equipment. The types are described below:

- **General Instrument Failures.** These errors are typically a result of instrument failure and troubleshooting by the operator is limited.
- **Error Message Failure.** A built-in test capability of the instrument monitors syringe motors and sensors for each channel. Failure of the instrument to detect sensor operation or motor position will result in an error message.
- **Data Errors.** These errors occur when the test results of the sample adsorbed into the GAC columns indicate an adsorption error.

To troubleshoot failures, observe the instrument or data failure symptoms(s), go to the appropriate section in this chapter, and take the recommended action.

NOTE: These troubleshooting procedures are intended for use by operating personnel. When directed to do so or when unable to correct an instrument failure, call Dohrmann Technical Service for assistance.

CAUTION! Service. Only authorized personnel should perform troubleshooting and service procedures on internal components of this instrument. Service by unauthorized personnel may void the instrument warranty.

Read the safety instructions presented in Appendix D prior to performing any maintenance on the instrument.

WARNING! *All persons near the instrument should wear a laboratory coat, eye protection, and protective gloves. Follow established laboratory procedures when using and maintaining the instrument. Failure to observe this warning can expose you and those around you to injury.*

GENERAL INSTRUMENT FAILURES

To troubleshoot a general instrument failure, proceed as follows:

1. Observe the failure symptom(s) of the instrument.
2. Locate the symptom(s) in the listing provided below, and take the recommended action.
3. After correcting the failure, check that the instrument is error free and its status is "READY" as displayed on the screen.
4. If the failure cannot be corrected, contact Dohrmann Technical Service at (800) 538-7708

No Response After Power Is Turned On

Probable Cause

- Facility power off.
- Instrument fuse(s) blown.

Recommended Action

- Check for facility power at the wall outlet.
- Check fuse(s) at the rear of the instrument:
 1. Refer to the Fuse Replacement procedure in Chapter 6, Maintenance.
 2. Remove and check the fuses. Replace as necessary.
 3. If a fuse blows again, call Dohrmann Technical Service at (800) 538-7708.

CAUTION! Use replacement fuses with the required current rating and specification. Improper fuses or short-circuiting the fuse holder may cause fire or damage to the instrument.

Display Screens Not Visible, Alarm Tone Missing, or Control Panel Keys Do Not Respond

Probable Cause

Instrument failure.

Recommended Action

Call Dohrmann Technical Service at (800) 538-7708.

INSTRUMENT ERROR MESSAGES

If a channel motor or sensor error occurs during operation, an error message is displayed on the screen. There are two error messages.

1. When the screen displays one of the two following error messages, note the error message:

Motor error Channel x

Sensor Channel x

Where x = Channel Number (1-5)

2. Perform one of the following:

- a. A "Motor error" indicates a mechanical failure of the motor or excessive back pressure so that the motor stalled. When this error occurs, the instrument automatically moves the plunger back 200 steps to relieve column pressure. Proceed as follows:

- (1) Press **OK**, then the screen displays:

Complete Sample
(Yes/No)?

- < Press **No**, then the screen displays:

Connect Drain
Tube, Press OK

- (2) Disconnect any connections to the channel and connect the drain tube, then press **OK**.

Press **Yes**. The screen displays:

Completing
Sample

The plunger begins to move until the home sensor is blocked and the sample will be completed. If, after stepping the equivalent of 100 mL and the sensor is still not blocked, the same error is declared. The user can repeat the error recovery.

- (3) The screen displays the message below while attempting to find the home position. If home is found, the error will clear itself and the instrument returns to the Ready state. If the error repeats, the error message is displayed again. If a clanking sound is heard, the motor is stalled. Press **Start/Stop**.

Press STOP
if Motor Stalls

- (4) If a motor error occurs, review the Probable Causes and Recommended actions below. If the failure persists, contact Dohrmann Technical Service.

Probable Cause	Recommended Action
<ul style="list-style-type: none"> • GAC cementing in columns 	<ul style="list-style-type: none"> • Your GAC may have adsorbed too much moisture from the air. Use new GAC to pack the columns.
<ul style="list-style-type: none"> • Sample clogging GAC in the column 	<ul style="list-style-type: none"> • Particulates in the sample may be clogging the GAC or optional particulates filter. Centrifuging the sample before GAC adsorption will reduce the clogging problem.
<ul style="list-style-type: none"> • Glass is not aligned vertically with motor mount shaft 	<ul style="list-style-type: none"> • Re-align the glass to be parallel with the supporting steel rods.
<ul style="list-style-type: none"> • Adsorption rate greater than 3 mL/min with 2mm ID columns 	<ul style="list-style-type: none"> • Set adsorption rate at no more than 3 mL/min with 2 mm ID columns.

- b. The "Sensor error" indicates a mechanical failure of the channel home position sensor. Perform the Channel Homing Calibration in Chapter 6. If the failure repeats, contact Dohrmann Technical Service at (800) 538-7708.

DATA ERRORS

If the test results are in error after analyzing the water sample, review the probable causes and take the appropriate recommended actions.

NOTE: Some Probable Causes apply only if you are packing your own GAC columns. Therefore, disregard Probable Causes identified with an asterik if you are using prepackaged GAC columns.

Breakthrough

When more than 10% of the organic halide is retained on the second column, breakthrough has occurred. This can be caused by the following:

Probable Cause

- Channeling
- High organic content
- High inorganic chloride content
- Organic halide is not strongly adsorbed

Recommended Action

- Failure in the first column. Channeling through the GAC is improbable but possible (See Failed O-rings.). Repeat analysis.
- High organic levels will saturate the GAC, interfering with halide adsorption. Dilute or run less sample volume.
- Dilution is probably necessary. Measure inorganic chloride content to verify.
- A few compounds, such as chloroacetone, do not adsorb onto the first GAC column completely. High recoveries on the second column can be expected. Smaller sample volumes and slower adsorption rates will lessen the effects.

Low Recovery

Probable Cause

- Failed O-rings
- Sample Adsorption Rate Too High
- Breakthrough

Recommended Action

- Usually caused by O-rings allowing sample to bypass the column. Check that O-rings are seated properly in the glass cylinder and are not old and flattened.
- Repeat analysis with adsorption rate set to 2.0 mL/min.
- See Probable Causes and Recommended Actions for Breakthrough later in this chapter.

High Recovery

Probable Cause

- Contaminated GAC*

Recommended Action

- GAC strongly adsorbs halides from the air. Keep the GAC supply container tightly closed. You may have to pour a day's portion of the GAC into a second bottle in order to keep the primary source clean. Keep unopened bottles sealed.

NOTE: Due to the high chlorinated solvent levels found in many lab atmospheres, it may be necessary to store and pack GAC columns in other work areas.

Be sure the GAC meets the performance criteria stated in Appendix B, Supplies, Tools, and Solutions Needed.

If the GAC is contaminated, pour off the top portion (0.50 to 1.0 inch or so) of GAC from the bottle or scoop GAC from deeper in the bottle. If this does not help, new GAC should be used.

Alternatively, the GAC may be rinsed before using. To do this, pack the column, then flush with 10 mL of methanol, 2 mL of water and 5 mL of KNO_3 solution. This rinse step will provide lower, more consistent blank values, but must be done to all columns, for samples and blanks alike.

- | | |
|---|---|
| <ul style="list-style-type: none"> • Dirty equipment | <ul style="list-style-type: none"> • Check the condition of the GAC columns, channel cylinders, GAC measuring cup and funnel, and keep as clean as possible. |
| <ul style="list-style-type: none"> • Contaminated reagents and water | <ul style="list-style-type: none"> • Check for contaminated reagents and water. |
| <ul style="list-style-type: none"> • Insufficient Nitrate Wash solution. | <ul style="list-style-type: none"> • Rinse with more nitrate up to about 5 mL. If problem persists, dilute the sample. |

NOTE: Analyzing the sample for inorganic chloride is very useful when inorganic chloride interference is suspected. This is done by injecting a known volume directly into the titration cell.



WARRANTY AND SERVICE INFORMATION

This appendix tells you the instrument Warranty, Repair and Service policy supplied by Dohrmann.

TERMS AND CONDITIONS OF SALE

This Agreement consisting of these terms and conditions and the typed portion of the attendant quotation and acknowledgment is binding upon Rosemount Analytical Inc., hereinafter Seller, and the Customer, hereinafter Buyer, and is the entire Agreement.

- 1. Acceptances:** The sale of goods is expressly conditional on Buyer's acceptance of Seller's terms and conditions as stated herein and on the typed portion of the attendant quotation. Unless otherwise specified in writing, all quoted prices are firm for thirty (30) days from the date of offer provided that Seller's terms and conditions have not been previously accepted by Buyer. Buyer's receipt of goods shipped under this Agreement is acceptance of these terms and conditions.
- 2. Documentation:** With the exception of resale products as defined in Clause 10 below, Seller shall provide Buyer with that data documentation which is specifically identified in the quotation. Additional copies of data documentation or requests for unique data documentation will cause Seller additional expense and will be made available to Buyer at additional costs.
- 3. Other Changes:** Buyer's changes made after Seller's acceptance of the order that affect the specifications or configurations of the goods or otherwise affect the scope of the order shall be submitted in writing by Buyer and shall become binding only if approved in writing by Seller's cognizant contract administrator. All changes and shipping delays resulting from such changes shall be solely determined by Seller and shall be binding upon Buyer.

4. **Termination and Suspension:** Provided that Seller receives adequate written notice from Buyer, Buyer may terminate or suspend performance at Buyer's convenience subject to all reasonable charges, which charges shall be solely determined by Seller.
5. **Tax:** All government charges upon the production, shipment, and sale of goods covered by this Agreement, including, but not limited to, use occupation, export and import taxes, shall be paid by Buyer or in lieu thereof Buyer shall furnish Seller with a tax exemption certificate acceptable to the authority imposing the tax on Seller.
6. **Credit:** Provided that, in Seller's opinion, there is a material adverse change in Buyer's financial condition and/or Buyer has not, within the agreed time, fully paid for goods previously shipped under this and/or another agreement(s) with Seller, Seller reserves the right to revoke Buyer's credit and or suspend performance on this and/or other orders and future shipments.
7. **Inspection:** Buyer may make reasonable inspections of goods at Seller's factory. Seller reserves the right to determine the reasonableness of the request and to select an appropriate time and location for such inspection. All costs of inspection shall be solely determined by Seller and shall be to Buyer's account. No inspection or expediting by Buyer at the facilities of Seller's suppliers is authorized.
8. **Shipment and Risk of Loss:** With the exception of resale products as defined in Clause 10 below, all sales are F.O.B. Seller's Factory. Shipping contracts made by Seller shall be to Buyer's account. All claims for loss or damage after risk of loss has passed to Buyer shall be filed by Buyer with the carrier. Buyer shall be liable to Seller for the full price of the goods irrespective of loss or damage in transit. Seller shall not be required to provide freight cost receipts to Buyer at the time of invoices.
9. **Late Payments:** All discount periods begin on the invoice date and all payments are due 30 days after the invoice date. A service charge of 1.5% shall be charged for each month and portion thereof that payments are received later than 30 days after the invoice date. Buyer and Seller agree that the laws of the State of California govern this Agreement; however, if it is judicially determined that a different law governs this clause of this Agreement, the service charge shall be the maximum amount permitted under such law.

10. **Resale Products:** Resale products are goods that are sold with Seller's goods which are not manufactured by Seller and which are supplied as an accommodation to Buyer. Seller's responsibility for resale products is limited to reasonable commercial effort to arrange for procurement and shipping. Unless otherwise agreed, all prices are F.O.B. resale product manufacturer's factory. Standard documentation shall be only as supplied by the resale product manufacturer.

SELLER MAKES NO WARRANTY FOR RESELL PRODUCTS EITHER EXPRESS OR IMPLIED INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE SOLE WARRANTY SHALL BE THAT OF THE RESELL PRODUCT MANUFACTURER.

Buyer agrees that Seller has no liability for resale products beyond the services within Seller's direct control necessary to reasonably discharge the above stated responsibility and the Seller shall not be liable for delays caused by resale product manufacturer. Buyer future agrees that Buyer's SOLE AND EXCLUSIVE REMEDY for seller's breach of the stated responsibility shall be limited to the difference between the resale product manufacturer's price to Seller and Seller's price to Buyer for resale products in such breach.

11. **Warranty:** Goods manufactured by Seller are warranted to be free from defects in workmanship and material under normal use and service for a period of twelve (12) months from the date of shipment by Seller. Goods or part(s) proven by Seller to be defective in workmanship and or material shall be replaced or repaired free of charge F.O.B. Seller's factory provided that the goods or parts(s) are returned to Seller's designated factory, transportation charges prepaid, within twelve (12) month period of the warranty. This warranty shall be in effect for replacement of repaired goods or part(s) for the remaining portion of the twelve (12) month period of this warranty. A defect in goods or parts(s) of a commercial unit shall not operate to condemn such commercial unit when such goods or part(s) are capable of being renewed, repaired, or replaced. (See Terms and Conditions #18.)

IN CONSIDERATION OF THE HEREIN STATED PURCHASE PRICE OF THE GOODS, SELLER GRANTS ONLY THE ABOVE STATED EXPRESS WARRANTY. NO OTHER WARRANTIES ARE GRANTED INCLUDING, BUT NOT LIMITED TO, EXPRESS AND IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

12. **Limitations of Remedy:** SELLER SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE. THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF WARRANTY SHALL BE LIMITED TO REPAIR OR REPLACEMENT UNDER THE STANDARD WARRANTY CLAUSE. IN NO CASE, REGARDLESS OF THE FORM OF THE CAUSE OF ACTION, SHALL SELLER'S LIABILITY EXCEED THE PRICE TO BUYER OF THE SPECIFIC GOODS MANUFACTURED BY SELLER GIVING RISE TO THE CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL SELLER'S LIABILITY EXTEND TO INCLUDE INCIDENTAL OR CONSEQUENTIAL DAMAGES. CONSEQUENTIAL DAMAGES SHALL INCLUDE, BUT NOT BE LIMITED TO, LOSS OF ANTICIPATED PROFITS, LOSS OF USE, LOSS OF REVENUE, COST OF CAPITAL AND DAMAGE OR LOSS OF OTHER PROPERTY OR EQUIPMENT, IN NO EVENT SHALL SELLER BE LIABLE FOR PROPERTY DAMAGE AND OR THIRD PARTY CLAIMS COVERED BY UMBRELLA INSURANCE AND/OR INDEMNITY COVERAGE PROVIDED TO BUYER, ITS ASSIGNS, AND EACH SUCCESSOR IN INTEREST TO THE GOODS PROVIDED HEREUNDER.

13. **Force Majeurs:** Seller shall not be liable for failure to perform due to labor strikes or acts beyond Seller's direct control.

14. **Patents:** Seller shall defend any suits brought against the Buyer based on a claim that the goods manufactured by Seller constitutes an infringement of a valid patent of the United States, and shall pay any damages and reasonable costs awarded therein against Buyer, provided that Buyer promptly notifies Seller in writing and gives authority, information, and assistance to Seller for the defense of such suit. In the event that only the goods manufactured by Seller are held to be infringing in such suit and their use is enjoyed, Seller shall, at Seller's expense, provide a commercially acceptable alternative, including, but not limited to, procuring for Buyer the right to continue using the goods, replacing them with a non-infringing product or modifying them so they become non-infringing. Buyer agrees that Seller shall not be liable and the Buyer shall fully indemnify Seller if infringement is based upon the use of the goods in connection with goods not manufactured by Seller or in a manner for which the goods were not designed by the Seller or if the goods were designed by the Buyer or were modified by or for the Buyer in a manner to cause them to become infringing.

15. **Software Provisions:** If software is provided under this Agreement, Buyer is granted a non-exclusive, royalty fee license only for Buyer's use of Seller's software provided with the Seller's system. Under this license Buyer may:
 - (a) Use Seller's software with the Seller's system provided,
 - (b) Copy the Seller's software into any machine readable or printed form for back up or modification purposes in support of Buyer's use of the Seller's software on the Seller's system provided,
 - (c) Modify the Seller's software or merge it into another software program for Buyer's use on the Seller's system,
 - (d) Create one additional copy of the software for archival purposes only.

- 16. General Provisions:** (a) Neither party shall have the right to assign its rights or obligations under this Agreement except with the written consent of the other party, provided, however, that a successor in interest by merger, by operation of law, assignment, purchase, or otherwise of the entire business of either party, shall acquire all interests of such party hereunder. Any prohibited assignment shall be null and void. (b) There are no understandings, agreements or representations, expressed or implied, not specified in this Agreement. (c) No action, regardless of form arising out of transactions under this Agreement, may be brought by either party more than two (2) years after the cause of action has accrued. (d) No representative of Seller has any authority to modify these terms and conditions unless the modification is contained in a written instrument assigned by a duly authority representative of Seller. (e) This Agreement is formed and shall be constructed under the laws of the State of California. (f) All stenographic, typographical and clerical errors in quotations and specifications may be corrected at any time by Seller. (g) If goods supplied hereunder are used in a nuclear power generation facility, Buyer fully indemnities Seller pursuant to Seller's Standard Nuclear Liability Form.

Provisions applicable to Rosemount Analytical Inc.:

- 17. Government Contracts:** If this Agreement is entered into to satisfy U.S. Government supply requirements and this is properly documented by Buyer, Seller agrees only to those Federal Acquisition Regulation (FAR) clauses which Buyer specifies in its order and which are required by law to be incorporated into a fixed price supply subcontract. This Agreement shall include no other FAR clause unless specifically agreed to in writing by Seller.
- 18. Consumables:** The following warranty provision in Terms and Conditions #11 shall apply except with respect to Consumables. Consumables which include glass electrodes, membranes, liquid junctions, electrolyte, O-rings, catalytic beads, etc. are warranted to be free from defects in workmanship and material under normal use and service for a period of ninety (90) days from date of shipment by Seller. This warranty shall be in effect for replacement or repaired consumables for the remaining portion of the ninety (90) day warranty.

REPAIR SERVICE POLICY

Post-warranty service is available directly from Dohrmann or its authorized service agent. The following procedures will be followed when returning products to Dohrmann and will be billed using one of the methods stated.

Returning Instruments for Service

- Shipping authorization is to be obtained prior to returning an instrument or part thereof for servicing.
- The shipment must be prepaid and must be preceded or accompanied by a purchase order authorizing estimating and repair expenses to be incurred.

Billing

Billing amount is composed of either a service charge based on an hourly rate plus cost of required parts and shipping, or the replacement price of the returned equipment plus handling and shipping charges.

REPAIR PARTS POLICY

Consumables and tools needed for operation and maintenance are listed and described in Appendix B while recommended spare parts are listed in Appendix C. Prices are available upon request. To ensure minimum downtime, Dohrmann recommends that you obtain the quantities specified in the recommended lists at the time of equipment purchase.

When ordering, please specify the following:

- quantity
- description
- part number

Orders may be placed with authorized representatives or directly with Dohrmann Customer Service at (800) 538-7708.

Appendix B

SUPPLIES, TOOLS, AND SOLUTIONS NEEDED

This appendix lists the consumable items, tools, and solutions you will need to operate and maintain the instrument. Consumable supplies and tools listed in this appendix are based on your using pre-packed GAC columns. If you plan on packing your own columns, refer to Appendix F for additional items that will be required.

OVERVIEW

The supplies and tools needed are available from Dohrmann. For ordering, refer to the Recommended Spare Parts Policy in Appendix A.

It may be advantageous to obtain non-specialty items locally. You are also advised to obtain from local sources chemicals which may be required, since these may be subject to government shipping regulation for hazardous substances. Therefore, Dohrmann does not supply these chemicals in a routine manner.

CONSUMABLE SUPPLIES AND TOOLS

For Pre-packed Glass GAC Columns

<u>Item</u>	<u>Quantity</u>	<u>Dohrmann Part Number</u>
Consumables:		
Pre-packed GAC column, glass, 2mm ID	100/pkg.	080-152

NOTE: The items listed below are part of Operating Kit 080-153 which is supplied with the instrument. Consumables and tools in the kit can be purchased separately.

Tools:		
Plastic luer column coupler	25/pkg	899-907
Ejector tool	1	080-155
Diaphragm hole puncher	1	080-150

090-367
100-510

For Pre-packed Plastic GAC Columns

<u>Item</u>	<u>Quantity</u>	<u>Dohrmann Part Number</u>
Consumables:		
Pre-packed GAC column, plastic, 3mm ID	100/pkg.	080-145
<hr/>		
NOTE: The items listed below are part of Operating Kit 899-900 which can be obtained from Dohrman to support operators using pre-packed plastic GAC columns.		
<hr/>		
Column filters	100/pkg.	080-151
Tools:		
Diaphragm hole puncher	1	080-150
Column couplers	25/pkg.	080-769
Ejector body	1	080-142
Ejector handle	1	080-143
Ejector rods	5/pkg.	080-144

SOLUTIONS TO HAVE ON HAND

The following solutions should be on hand or available for use in operating and maintaining the instrument.

Reagent Water

Reagent water is used in rinsing sample channels, diluting sample and calibration solutions. A supply of several liters of pure distilled or deionized water should be maintained. Purity of the water with respect to organic halides is critical. Periodically analyze the reagent water as a TOX sample. If this water contains more than a few micrograms TOX per liter, this must be taken into consideration when reviewing sample analysis results.

IMPORTANT! Sample water analysis errors can occur from reagent water TOX levels. Be aware of reagent water TOX levels when using for dilution of samples.

5000 PPM Nitrate Wash Solution

This solution is used in the Nitrate Channel for performing a Nitrate Wash of the sample. The nitrate solution desorbs inorganic halides from the GAC.

Solution Preparation. Prepare the nitrate wash solution by dissolving 8.2 grams of reagent grade potassium nitrate (KNO_3) in 1 liter of reagent water.

0.1M Sodium Sulfite Solution

This solution is used for pre-treatment of the water sample to reduce free chlorine to chloride. Consumption is 1 mL of reagent per 0.5 liter sample.

Solution Preparation. Prepare the sodium sulfite (Na_2SO_3) solution as follows:

1. Transfer 12.6 gm of reagent grade sodium sulfite to a 1 liter volumetric flask.
2. Dilute to volume with oxygen-free reagent water. Oxygen-free reagent water can be attained by bubbling inert gas (for example, Helium) through the water prior to mixing the solution.

Concentrated Nitric Acid (HNO_3)

This solution is used for pre-treatment of the water sample to reduce acidification of the sample. About 1 mL of reagent grade HNO_3 is required per 0.5 liter sample.

WARNING! *Observe all applicable safety precautions when handling acids. If contact with skin should occur, flush areas of skin contact amply with water for at least 15 minutes and refer to your lab policies and the MSDS for more information.*



**Appendix
C**

REPLACEABLE PARTS LIST

This appendix provides a list of replaceable parts. Refer to Appendix A, Service Information for parts ordering.

<u>Item</u>	<u>Quantity (ea.)</u>	<u>Dohrmann Part Number</u>
Syringe Plunger O-ring	5/pkg	899-739
Syringe Base O-rings	2	100-509
Channel column, glass	1	890-115
Fuse, 3A 250V (100-120 VAC operation)	2	070-400
Fuse, 1.6A 250V (200-240 VAC operation)	2	070-401

To order parts, call (800) 538-7708; ask for Customer Service.



Appendix
D

SAFETY SUMMARY

This appendix summarizes information which must be followed to ensure a safe operating environment and to prevent damaging the instrument.

CONVENTIONS USED

This manual uses the following conventions to provide technical and safety information.

WARNING! *An instruction that, if not followed, can result in a condition hazardous to the operator.*

CAUTION: An instruction that, if not followed, can result in a condition that could damage the instrument..

IMPORTANT! *An instruction that, if not followed, can result in sample analysis errors.*

NOTE: Background information provided to clarify a particular step or procedure.

SUMMARY OF WARNINGS

When operated in a safe environment, according to the instructions in this manual, there are no known hazards associated with the Adsorption Module. However, operators should be aware of situations which could result in serious injury. These situations are as follows:

WARNING! Protective Clothing. All persons near the instrument should wear a laboratory coat, eye protection, and protective gloves. Follow established laboratory procedures when using and maintaining the instrument. Failure to observe this warning can expose you and those around you to injury.

WARNING! Power Rating. Ensure that the instrument is connected to a power receptacle that provides voltage and current within the specified rating for the instrument. Use of an incompatible power receptacle may produce electrical shock and fire hazards.

WARNING! Electrical Grounding. Never use a two-prong plug adapter to connect primary power to the instrument. Use of a two-prong adapter disconnects the utility ground, creating a severe shock hazard. Always connect the instrument power cord directly to a three-prong receptacle with a functional ground.

WARNING! Observe all applicable safety precautions when handling acids. If contact with skin should occur, flush areas of skin contact amply with water for 15 minutes. Refer to your MSDS or lab policies for more information.

SUMMARY OF CAUTIONS

The following precautions are provided to help you avoid damaging the instrument.

CAUTION! Installation. The instrument must be installed following the instructions provided in Appendix E of this Manual.

CAUTION! Service. Only authorized personnel should perform troubleshooting and service procedures on internal components of this instrument. Service by unauthorized personnel may void the instrument warranty.

CAUTION! When removing and installing the glass cylinder be sure that you only twist the cylinder. Do not pull it from side to side as this may cause the glass to crack or break.

Appendix E

INSTALLATION AND SETUP

This appendix tells you how to install the instrument and how to set it up for operation.

OVERVIEW

The Adsorption Module is designed for use in a laboratory environment and is easily installed and made ready for use on a bench-top. Included in this appendix are requirements for installation location and instructions for initial power on.

UNPACKING THE INSTRUMENT

Upon receipt of the instrument, you should unpack it and inspect for damage or shortages. Proceed as follows:

1. **Set carton upright.** Ensure that the shipping carton is oriented so that the carton is in an upright position.
2. **Remove and inspect contents.** Open the carton and remove all contents. Visually check that all items are free of damage.
3. **Check contents.** Check that the following items are present:

<u>Item</u>	<u>Quantity</u>	<u>Part Number</u>
Adsorption Module Assembly	1	890-161
Operating Kit Consisting of:	1	899-556
Power Cord	1	011-002
GAC Columns	1	080-152

Operating Kit, GAC Columns	1	080-153
Consisting of:		
Plastic luer column couplers	5/pkg	899-907
Ejector Tool	1	080-155
Diaphragm Hole Puncher		080-150
Plug, 1/8 - NPT	1	080-770
Fitting 1/8 NPFT	1 ea	080-771
Tygon Tubing	72"	154-405
Waste Tray	1 ea	890-087
Sample Pick-Up Assembly	1 ea	899-099
	5/pkg	890-745
O-Ring Kit	5/pkg.	899-739
Operating Manual	1	915-350
Power Cord	1	011-002

NOTE: Claims for loss or shipping damage should be promptly filed with the carrier. Shortages should be reported directly to Dohrmann.

BENCH TOP INSTALLATION

Set the instrument on a laboratory bench suitable for the instrument weight as specified in Chapter 1. A suitable working area should be provided on the sides and front of the instrument.

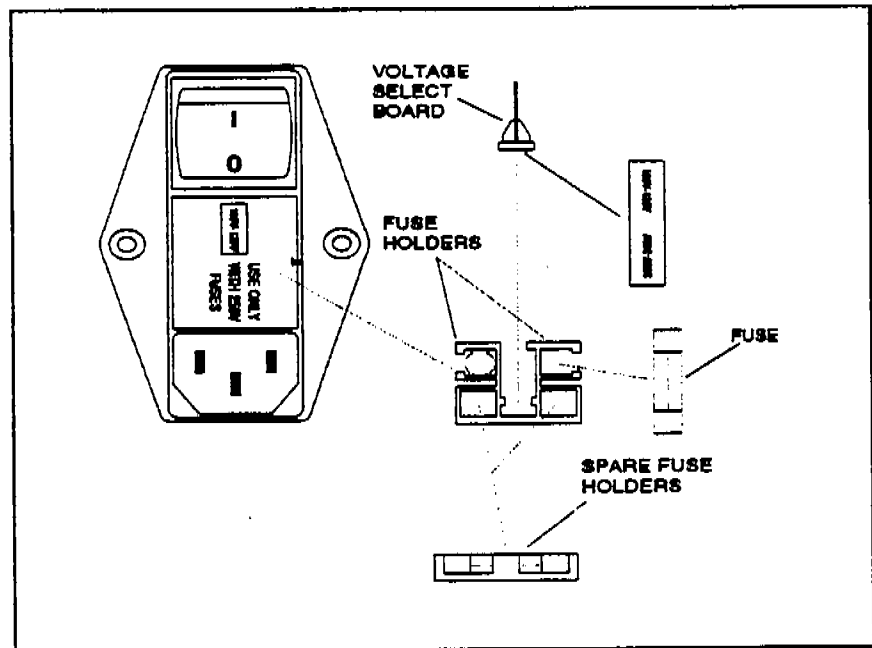
CONNECT OPERATING POWER

Use this procedure to initially connect operating power to the instrument.

1. **Check instrument voltage setting..** At the rear of the instrument, check the operating voltage stated on the power connector (see photo below). The operating voltage will be 100V-120V or 200V-240V. If correct for your laboratory's power go to the next step, otherwise, reset the operating voltage of your instrument as follows:
 - a. Ensure that the power cord is not connected to the instrument.
 - b. Using a small flat-blade screwdriver, pry up the fuse holder on the Power Entry Module.

- c. Lift the fuse holder from the module and slide the Voltage Select Board out of the bottom of the fuse holder. Reverse the board and slide it into the module. The desired operating voltage should be visible through the opening in the fuse holder.
- d. Insert the fuse holder into the Power Entry Module with the two arrows facing each other and press the holder until it firmly seats into the module.

CAUTION
CORRECT FUSE MUST BE USED OR DAMAGE TO PRODUCT WILL RESULT.



Power Entry Module

WARNING! Power Rating. Ensure that the instrument is connected to a power receptacle that provides voltage and current within the specified rating for the instrument. Use of an incompatible power receptacle may produce electrical shock and fire hazards.

WARNING! Electrical Grounding. Never use a two-prong plug adapter to connect primary power to the instrument. Use of a two-prong adapter disconnects the utility ground, creating a severe shock hazard. Always connect the instrument power cord directly to a three-prong receptacle with a functional ground.

2. **Connect operating power.** Connect the instrument power cord to the rear of the instrument and then to a laboratory power receptacle that provides the required operating power:
 - 90 to 130 Vac, 50-60 Hz (100V-120V on the Power Entry Module)
 - or
 - 180 to 260 Vac, 50-60 Hz (200V-240V on the Power Entry Module)

INITIAL POWER ON

Use this procedure to initially turn on operating power after installation.

1. **Turn on power.** Press | on power switch at rear of instrument. You will hear a single beep, all LEDs light momentarily, and the screen displays:

Dohrmann AD-2000
Press START

2. **Initialize the instrument.** Press the *Start/Stop* key. The screen displays.

System Power up
Select a Channel

3. **Select a channel.** Press Sample Channel key *1*. The screen displays.

** READY **

INSTRUMENT DEFAULTS

Use this procedure to review the factory set default values for processing:

1. **Check instrument default settings.** Refer to Chapter 4 for instructions on operating the instrument and check Sample Channels 1 through 4 for the following factory set defaults.

Specifications	Characteristics
Sample Processing:	
Sample Adsorption	Sample Volume of 100 mL Sample Adsorption Rate of 3.00 mL/min Fill rate of 33mL/min Channel Priming: No
Nitrate Wash	Sample Volume of 2 mL Flow Rate of 3 mL/min
Instrument Maintenance	
Sample Channel Rinsing	Rinse Volume of 100 mL
Nitrate Channel Preparation	Drain Channel: Yes Rinse Channel: Yes Rinse Volume of 10 mL Fill Channel: Yes

2. **Reset processing parameters.** Refer to Chapter 4 and reset processing parameters as desired.



GAC COLUMN PREPARATION

If you choose to pack your own GAC columns, additional consumable items, tools, and solutions are needed to operate and maintain the instrument. This appendix lists those items and provides instructions for GAC handling and column preparation.

OVERVIEW

Supplies and tools needed to pack your own GAC columns are available from Dohrmann. For information on how to place an order, refer to the Recommended Spare Parts Policy in Appendix A.

It may be advantageous to obtain non-specialty items locally. You are also advised to obtain from local sources chemicals which may be required, since these may be subject to government shipping regulation for hazardous substances. Therefore, Dohrmann does not supply these chemicals in a routine manner.

GAC HANDLING PRECAUTIONS

Due to the highly absorbent nature of GAC, it can easily be contaminated by improper handling. The precautions in this chapter will help you to prevent contamination and thereby provide better sample analysis.

- Do not open the GAC vial cap until it is ready to use.
- Keep the GAC container closed at all times when not actually dispensing GAC.
- Avoid using the GAC in an atmosphere where solvents, especially chlorinated solvents, might be present because they can be freely absorbed by the GAC. Given the opportunity, GAC will adsorb chlorinated material from the air! It may be useful to pack GAC columns in an office area rather than a laboratory to minimize exposure to chlorinated solvents.
- Transfer enough GAC for one day of operation (about 1.5 grams) into a clean secondary container and recap the original GAC vial to minimize contamination from the atmosphere.
- Packed columns, processed or unprocessed, should be wrapped in clean aluminum foil or kept in a sealed container of suitable size for storage to avoid TOX adsorption from ambient air.
- Minimize handling of the processed GAC. Gloves should be worn so that salt from your hands does not contaminate the sample.

GAC QUALITY AND PROCESSING REQUIREMENTS

If you use GAC purchased from a source other than Dohrmann, you must ensure that it meets the four quality specifications listed below in order to ensure high TOX analysis reliability and repeatability. GAC meeting these specifications is available from Dohrmann (See Consumable Supplies listed below.). Call (800) 538-7708 and ask for Customer Service. The GAC quality and processing requirements are as follows.

Item	Specification	Limit	Processing Requirement
1	Apparent Halide Background (without Nitrate Wash)	Less than 1.0 μg Cl equivalent	Based on combustion of 40 mg of GAC.
2	Apparent Halide Background (after Nitrate Wash)	Not greater than 0.1 μg Cl equivalent over that determined in 1 above.	Based on combustion of 40 mg of GAC after flushing with 2 mL of a 5000 mg/liter nitrate solution.
3	IX Removal Efficiency	Apparent halide background increase of no more than 0.2 μg Cl equivalent over that determined in 2 above.	Contact 40 mg of GAC with 100 mL of deionized water containing 100 mg/liter of chloride ion from NaCl (See Inorganic Chloride Solution below.). Flush the GAC with 2 ml of a 5000 mg/liter Nitrate Wash solution and then combust the GAC.
4	Organic Halide Recovery	90% ($\pm 2\%$) on the first 40 mg portion of GAC contacted and the remaining 10% recovered on the second 40 mg portion of GAC contacted.	Analyze 100 mL of a water sample containing 100 ppb chlorine from 2,4,6-trichlorophenol.

Inorganic Chloride Solution: This solution is made from sodium chloride (NaCl) in water and is prepared as follows:

- a. Prepare a concentrated 10,000 ppm NaCl solution. Place 1.65 grams of NaCl in a 100 mL volumetric flask.
- b. Fill the flask halfway with deionized water.
- c. Agitate well to dissolve salt.
- d. Fill to the 100 mL mark with deionized water.
- e. Dilute 1.0 mL of the concentrated solution to 100 mL with deionized water

IMPORTANT! If you are verifying the suitability of GAC from sources other than Dohrmann Division, requirement 4 must be verified.

CONSUMABLE SUPPLIES

<u>Item</u>	<u>Quantity</u>	<u>Dohrmann Part Number</u>
GAC column, Pyrex glass (empty)	50	899-623
Column O-ring, Viton, 0.114" x 0.070"	25	899-626
Cerafelt pad, 4" x 8"	1 pad	521-030
Granular activated carbon (GAC), 100/200 mesh (See GAC Requirements in this chapter)	30 gm	511-877

TOOLS

Special tools are required for packaging your own GAC columns. Tools required follow:

Item	Quantity	Dohrmann Part Number
GAC measuring spoon	1	521-021
GAC funnel	1	521-022
O-ring, GAC funnel 0.239" x 0.070"	10	511-762
Column packing rod	1	521-032
Cera-blanket cutter	1	521-031
Upper GAC column housing	1	522-139
Lower GAC column housing	1	522-138
Adapter, glass column	5	521-034

GAC COLUMN PREPARATION

The granular activated carbon (GAC) columns can be packed using the following procedure. Be sure to review the Packing Notes prior to packing.

The GAC columns are reusable by washing them with hot soapy water and a pipe cleaner. After washing, rinse the columns with distilled or deionized water.

Packing Notes:

- Do not over-use the Cerafelt pad. The ceramic fibers are brittle and tend to weaken as the pad is handled, reducing thickness and holding power.
- Inspect the cutting tool to be sure the ID of the cutting tip is not too small. If it is, expand by carefully inserting a metallic object with a conical tip.
- If the cutting tool is dull, it can be sharpened using a grinder or emery cloth.
- Discard the occasional column with an ID so large that the Cerafelt will not stay in place.
- Pack a sufficient number of columns for one operating day's expected consumption.
- Store pre-packed columns in a clean container that can be sealed or wrap them individually in aluminum foil to avoid adsorption of contaminants from ambient air.

Proceed as follows to pack the columns:

Step	Task	Action
A	Insert a plug of Cerafelt into one end of the column.	<ol style="list-style-type: none">1. Twist the sharpened end of the cutting tool into a pad of Cerafelt so that a core is cut and a plug of Cerafelt is retained in the cutter. Make sure to cut a plug through the full thickness of the Cerafelt; ideally 5 mm.2. Insert the column packing rod in the Cerafelt cutter.3. While holding the cutting end against the glass column bore, insert the plug through the column between a clean surface and column packing rod. This will expand the thickness of the plug and increase friction, which will hold it in place.
B	Fill the column with GAC.	<ol style="list-style-type: none">1. Obtain a full scoop of GAC using the 40 mg measuring spoon. It is not necessary to weigh the GAC since the spoon delivers the right amount. However, it is important to obtain the same amount ± 2 mg each time a column is filled.2. Push the smaller end of the metal funnel (recessed, with hex nut) onto the open end of the GAC column.3. Pour the GAC into the column through the funnel while occasionally tapping the column to ensure even packing. <u>Do not</u> compress the GAC with the column packing rod. Remove the funnel.
C	Insert a plug of Cerafelt into the open end of the column.	Repeat the procedure given in Step A and insert a plug into the open end of the column.



Glossary

Adsorption	The adhesion of organic halides in water samples to the GAC (Granular Activated Carbon) as the sample is passed through the column.
Breakthrough	When the measured organic halide level on the bottom GAC column is greater than 10%, breakthrough has occurred.
Data Error	A sample measurement error which has resulted from instrument failure or GAC contamination due to handling or packaging. Typical data errors are breakthrough and low and high recovery
Default	A instrument setting that is used in sample processing and instrument maintenance in place of an operator selected value. These values are initially set by the factory.
Error Message	A control panel display message that is shown when the instrument has encountered difficulty with one or more channel sensors or stepper motors.
Keys	Control panel switches used to select instrument functions and select processing parameters. Selections are made by momentarily pressing the key.
High Recovery	The measured results are higher than expected, especially with a calibration standard.
Homing Position	Reference position where the motor step count is zero. Any motor movement up or down will reference this position.
Low Recovery	The measured results are lower than expected, especially with a calibration standard.

AD-2000 ADSORPTION MODULE

Priming	An optional rinse procedure that may be performed at the beginning of a sample processing cycle. If selected, this procedure will draw either 5 or 10 mL of sample into the column and then expel it back into the sample container.
Prompts	A display message that advises you of instrument status or requests and operator action.
Nitrate Wash	A process where nitrate solution is passed through the GAC columns after sample adsorption to remove any residual chloride ions.
Parameter	A value associated with a run such as the fill rate in mL/min when filling a sample channel with fluid.
Rinsing	A procedure that rinses the column with a rinse solution such as clean water or sample. This procedure will draw either 10 or 100 mL of solution into the column and then expel it back into the solution container. The rinse procedure may be automatically set to perform this cycle once.
Run	A series of automated steps performed by the instrument to accomplish a specific function such as a sample adsorption or nitrate wash.

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