micromeritics®

Saturn DigiSizer® II 5205

Operator's Manual

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MICROMERITICS INSTRUMENT CORPORATION warrants for one year from the date of shipment each instrument it manufactures to be free from defects in material and workmanship impairing its usefulness under normal use and service conditions except as noted herein.

Our liability under this warranty is limited to repair, servicing and adjustment, free of charge at our plant, of any instrument or defective parts when returned prepaid to us and which our examination discloses to have been defective. The purchaser is responsible for all transportation charges involving the shipment of materials for warranty repairs. Failure of any instrument or product due to operator error, improper installation, unauthorized repair or alteration, failure of utilities, or environmental contamination will not constitute a warranty claim. The materials of construction used in MICROMERITICS instruments and other products were chosen after extensive testing and experience for their reliability and durability. However, these materials cannot be totally guaranteed against wear and/or decomposition by chemical action (corrosion) as a result of normal use.

Repair parts are warranted to be free from defects in material and workmanship for 90 days from the date of shipment.

No instrument or product shall be returned to MICROMERITICS prior to notification of alleged defect and authorization to return the instrument or product. All repairs or replacements are made subject to factory inspection of returned parts.

MICROMERITICS shall be released from all obligations under its warranty in the event repairs or modifications are made by persons other than its own authorized service personnel unless such work is authorized in writing by MICROMERITICS.

The obligations of this warranty will be limited under the following conditions:

1. Certain products sold by MICROMERITICS are the products of reputable manufacturers, sold under their respective brand names or trade names. We, therefore, make no express or implied warranty as to such products. We shall use our best efforts to obtain from the manufacturer, in accordance with his customary practice, the repair or replacement of such of his products that may prove defective in workmanship or materials. Service charges made by such manufacturer are the responsibility of the ultimate purchaser. This states our entire liability in respect to such products, except as an authorized person of MICROMERITICS may otherwise agree to in writing.

2. If an instrument or product is found defective during the warranty period, replacement parts may, at the discretion of MICROMERITICS, be sent to be installed by the purchaser, e.g., printed circuit boards, check valves, seals, etc.

3. Expendable items, e.g., sample tubes, detector source lamps, indicator lamps, fuses, valve plugs (rotor) and stems, seals and O-rings, ferrules, etc., are excluded from this warranty except for manufacturing defects. Such items which perform satisfactorily during the first 45 days after the date of shipment are assumed to be free of manufacturing defects.

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MICROMERITICS shall not be liable for consequential or other type damages resulting from the use of any of its products other than the liability stated above. This warranty is in lieu of all other warranties, express or implied, including, but not limited to, the implied warranties of merchantability or fitness for use.

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1. GENERAL INFORMATION

This manual provides a description of the Saturn DigiSizer system, its menu options, and operating instructions.

To help you operate the Saturn DigiSizer more efficiently:

- read Chapter 2, User Interface, before operating the analyzer and its software
- use the step-by-step instructions in Chapter 3 when performing common operations

Organization of the Manual

The Saturn DigiSizer operator's manual is organized as follows:

Chapter 1 **General Information**

Provides a general description of the Saturn DigiSizer system, its features, and specifications.

Chapter 2 **USER INTERFACE**

Provides basic instrument and software interface.

Chapter 3 **OPERATIONAL PROCEDURES**

Provides step-by-step procedures of common operations for the Saturn DigiSizer.

Chapter 4 **SOFTWARE AND SETUP MODIFICATIONS**

Provides instructions for installing software updates and for modifying setup configurations.

Chapter 5 **FILE MENU**

Provides a description of the commands available from the File menu.

Chapter 6 **UNIT MENU**

Provides a description of the commands available from the Unit menu.

Chapter 7 **REPORTS MENU**

Provides a description of the commands available from the Reports menu.

Chapter 8 **OPTIONS MENU**

Provides a description of the commands available from the Options menu.

Chapter 9 **TROUBLESHOOTING AND MAINTENANCE**

Provides user maintenance and service information.

Chapter 10 **ORDERING INFORMATION**

Provides ordering information for the Saturn DigiSizer system components.

Appendix A **ERROR MESSAGES**

Lists the error messages displayed by the Saturn DigiSizer analysis program; includes cause(s) and action(s) for each.

Appendix B **SAMPLE DISPERSION AND CONCENTRATION**

Provides methods for dispersing samples and adjusting sample concentration.

Appendix C **CHEMICAL AIDS FOR PARTICLE DISPERSION**

Provides a list of dispersants and their active ingredients.

Appendix D **LIQUID DENSITY AND VISCOSITY DATA**

Provides density and viscosity data for common dispersants.

Appendix E **SOURCES OF DISPERSING AIDS**

Provides a list of suppliers for common dispersants.

Appendix F **DATA REDUCTION**

Contains the calculations used for producing reports.

Appendix G **FORMAT OF EXPORTED DATA**

Contains the format and a description of exported data.

Appendix H **ETHERNET CONFIGURATION**

Provides information on configuring an ethernet port and specifying firewall settings.

Appendix I **BACKGROUND QUALITY**

Provides criteria for obtaining and determining an acceptable background.

Appendix J **MASTERTECH INSTALLATION**

Provides instructions for installing the MasterTech autosampler.

Appendix K **LIQUID SAMPLE HANDLER INSTALLATION**

Provides instructions for uninstalling and installing a liquid sample handler.

Index **INDEX**

Provides quick access to a subject matter.

Manual Conventions

This manual uses the icons shown below to identify notes of importance, cautions, and warnings.

Notes contain important information pertinent to the subject matter.

Warnings contain information that help you prevent actions that may cause personal injury.

Cautions contain information that help you prevent actions that may damage the analyzer.

Safety Awareness

Safety precautions and warnings are inserted throughout this manual in appropriate sections. It is important that you read and observe these precautions and warnings in order to prevent personal injury and/or damage to the instrument.

The Saturn DigiSizer uses a laser beam in its analysis process. Direct exposure to a laser beam can be hazardous. Therefore, for your protection, the Saturn DigiSizer contains an interlock safety device which disables laser operation if the analysis compartment is opened during an analysis. Do not, under any circumstances, attempt to override this safety interlock. Doing so may allow exposure to the laser beam at an intensity of up to 7 mW at 658 nm.

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser light exposure.

The Saturn DigiSizer is completely safe to operate. There is no danger of exposure to the laser beam when the Saturn DigiSizer is operated as directed in the operator's manual, and all cautions and warnings are observed.

Equipment Description

Saturn DigiSizer

The Saturn DigiSizer 5205 System consists of up to two particle size analyzers, each with a liquid sample handler, and one multifunction personal computer. You can also install up to two MasterTech 052 Autosamplers allowing automatic analysis of up to 18 samples each.

The Saturn DigiSizer uses a laser in conjunction with a CCD (charge-coupled device) containing over three million detector elements to measure particle size. These detectors are placed so that they can measure the intensity of light scattered by the particles at various angles. Light is scattered by particles in a pattern dependent on their size, shape, refractive index, and wave length of incident light. Based on the Mie theory, the particle size distribution is calculated from the angle distribution of the scattered light intensity collected by the detectors.

Both organic and inorganic particles can be analyzed and measured over a range of 0.06 to 2100 micrometers. The Saturn DigiSizer includes a complete system for circulating the dispersing liquid/sample mixture through the cell and reservoir, as well as to an external waste container.

Liquid Sample Handler

The Saturn DigiSizer requires the use of a sample handler (shown with the DigiSizer in the previous illustration) to transfer the sample to the analyzer for analysis. The sample handler also allows for connection of an ultrasonic probe to assist in sample dispersion.

The sample handler enables automatic sample handling. All you have to do is define analysis conditions (in the sample file), add the sample to the reservoir (containing the dispersing liquid), and start the analysis. Your sample will be automatically monitored and diluted when necessary; and your system rinsed after each analysis (when specified in the sample file).

The Liquid Sample Handler is available in two configurations:

- **Standard unit**: includes a reservoir that holds 500 to 600 mL of dispersed sample. This model is best suited for samples containing coarse particles, or for those of high density.
- **Low-Volume unit**: includes a reservoir that holds 100 to 120 mL of dispersed sample. This model is best suited for analyses where the sample quantity or dispersion liquid is limited, or where the dispersion liquid may be hazardous or difficult to dispose of.

Analysis Program

The Saturn DigiSizer 5205 analysis program is designed to operate in the Windows XP Professional or Windows Vista® Business or Ultimate environment and includes wizards and intuitive screens enabling you to perform system operations quickly and efficiently.

Also included is a report system which allows you to manipulate and customize reports. You can zoom in on portions of the graphs or shift the axes to examine fine details. Scalable graphs can be copied to the clipboard and pasted into other applications. Reports can be customized with your choice of fonts and a company logo added to the report header for an impressive presentation. Refer to **Onscreen Reports**, page **7-20** for additional information.

To make it easier for you to obtain information when needed, an online manual is included on the Help menu. This enables you to access the desired information in just a few mouse clicks. Refer to **Online Manual**, page **2-21** for additional information and navigation methods.

MasterTech 052

The MasterTech 052 is an automatic sampling device that operates in conjunction with the Saturn DigiSizer. The MasterTech allows you to queue as many as 18 predispersed samples to run consecutively and unattended. It allows samples to be redispersed either by stirring only or by stirring and disruption with an ultrasonic probe.

During operation, the beaker tray is loaded with beakers containing predispersed sample. When the Saturn DigiSizer is ready for a sample, the tray rotates until in the correct position for transfer. The sample is stirred for a user-specified length of time just before transfer to the Saturn DigiSizer for analysis. The ultrasonic probe can be activated to assist in redispersion if needed.

After redispersion, the sample is transferred to the reservoir of the analyzer. Then a small amount of analysis fluid is back-flushed to the MasterTech to rinse the stirrer, probe, and tubing. After rinsing is complete, the MasterTech prepares itself for the next sample. The next sample can be redispersed while analysis of the current sample is in progress. Analysis proceeds as if you had filled the reservoir manually with predispersed sample. After analysis of the current sample is complete, the contents of the reservoir are discarded to the waste container and the Saturn DigiSizer is rinsed. The system is now ready to transfer the next sample from the MasterTech.

Refer to **Ordering Information**, page **10-1** for details on placing an order for the MasterTech.

Specifications

The Saturn DigiSizer Analysis System has been designed and tested to meet the specifications provided in Table 1-1.

Table 1-1. Saturn DigiSizer Specifications

Characteristic	Specification
——— SATURN DIGISIZER SYSTEM ———	
Laser	
Type:	Solid-state, Diode
Wavelength:	658 nm
Power output:	6 to 9 mW
Beam type:	Parallel
Beam width (in sample):	16 mm Certified under IEC 825 as a Class 1 laser product
Lens	Focal length, 200 mm (fixed)
Detector	
Number of elements:	3,407,872
Geometry:	Rectangular array with 3328 x 1024 pixels used at 14 different angles to yield the equivalent of over 47 million elements
Alignment:	Automatic
Sample Circuit	
Circulation pump rate:	5 to 19 L/min (Standard sample handler); 2 to 12 L/min (Low-volume sample handler)
Circulation system volume:	590 to 690 mL (Standard sample handler); 100 to 120 mL (Low-volume sample handler)
Materials routinely contacting sample:	Borosilicate glass; stainless steel; Tygon® (fuel grade) tubing; Titanium; Kel-F (CTFE); epoxy; Ertalyte®; Viton® F and Kalrez (Low-volume sample handler only)

Characteristic	Specification
Output	
Measurement range:	0.04 to 2500 µm Equivalent Spherical Diameter (Standard sample handler); 0.06 to 750 µm (Low-volume sample handler)
Measurement time:	Less than five minutes, sample to sample
Size class range:	40 per decade for four decades
Deconvolution	Mie theory and Fraunhofer theory models applied.
Performance	
Accuracy:	0.1 to 1 µm, 10% 1 to 1000 µm, 3%
Resolution:	0.1 to 1 µm, not applicable 1 to 10 µm, can resolve monosized particles separated by 20% in size 10 to 1000 µm, 30% in size
Repeatability:	0.1 to 1 µm, 3% 1 to 1000 µm, 1% (mean diameter for multiple analyses on the same instrument)
Reproducibility:	0.1 to 1 µm, 5% 1 to 100 µm, 2% 100 to 1000 µm, 5% (particle size distribution, instrument to instrument)
Electrical	
Voltage	
Saturn DigiSizer:	100/120, 220/240 VAC
Sample Handler:	85 to 264 VAC
Frequency:	47 to 63 Hz
Power	
Saturn DigiSizer:	150 VA
Sample Handler:	100 VA

Characteristic	Specification
Environment	
Temperature:	Ambient + 10 to 35 ºC, operating; -10 to 55 ºC, storing or shipping
Humidity:	Up to 90% (non-condensing)
Physical	
Saturn DigiSizer:	Height: 50 cm (19.7 in.) Width: 47 cm (18.5 in.) Depth: 65 cm (25.6 in.) Weight: 45 kg (99 lbs)
Sample Handler:	Height: 50 cm (19.7 in.) Width: 27.5 cm (10.8 in.) Depth: 65 cm (25.6 in.) Weight: 26 kg (57 lbs)
——— COMPUTER ———	
Minimum requirements:	Computer capable of running Windows XP Professional or Windows Vista® Business or Ultimate operating system 512 megabytes of main memory 20-gigabytes hard drive CD-ROM drive Ethernet port* (capable of communicating with a 10 base-T or 100-TX card) 1024 x 768 monitor display capability *An additional ethernet port is required if the computer is to be connected to a network.

Characteristic	Specification
	MASTERTECH
Sample Capacity:	18 per tray, continuing indefinitely if tray is replenished
Sample Size:	0.001 to 4 g powder in 60 to 80 mL of liquid
Suspending Liquid:	Any liquid compatible with wetted materials (typical liquids are water, glycols, mineral oils, alcohols, and mineral spirits)
Wetted materials:	Stainless steel, Viton, Tygon, silicone rubber, polypropylene
Voltage:	100/120, 220/240 VAC ± 10%
Power:	250 VA
Frequency:	50/60 Hz
Temperature:	10 to 40 ºC, operating; -10 to 500 ºC, storing or shipping
Humidity:	20 to 80% relative (non-condensing)
Physical:	Height: 71 cm (28 in.) Width: 46 cm (18 in.) Depth: 53 cm (21 in.) Weight: 18 kg (40 lbs)

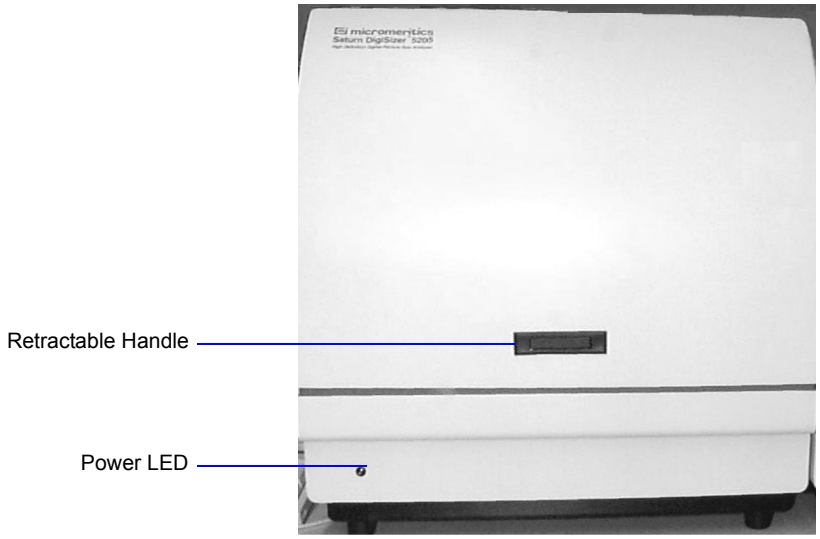
2. USER INTERFACE

Controls, Indicators, and Connectors

This section contains a description of the controls, indicators, and connectors located on the front and rear panels of the Saturn DigiSizer, the liquid sample handler, and the MasterTech 052.

Saturn DigiSizer

Front Panel



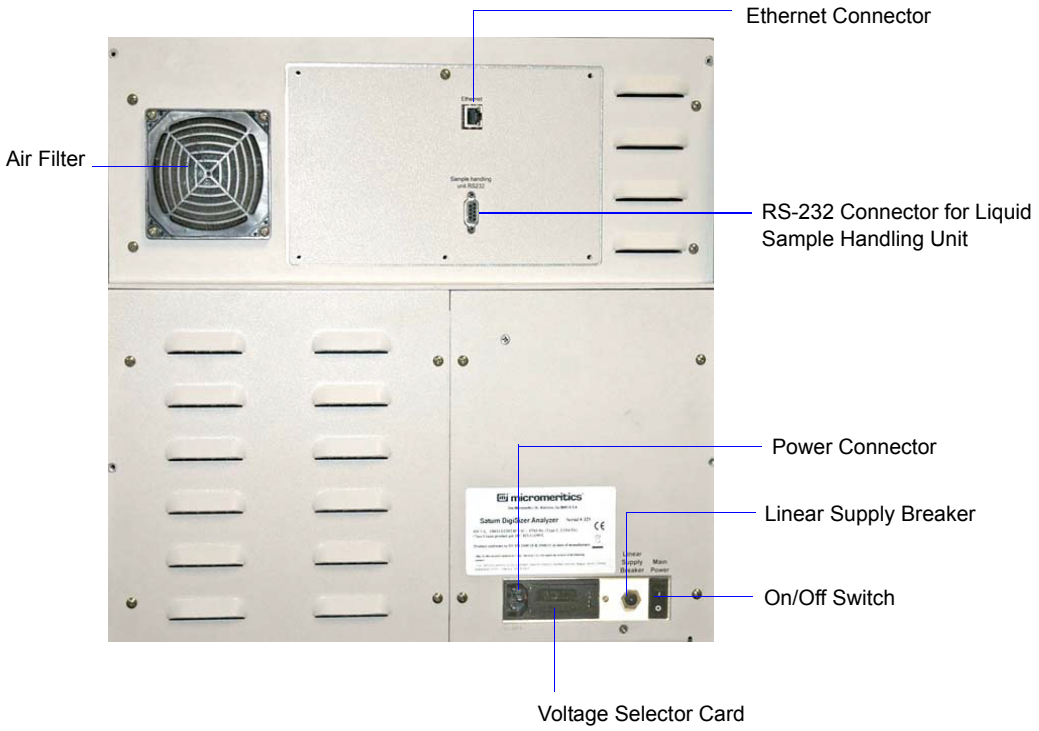
Power LED — Illuminates when the analyzer has been turned on and the analysis program loaded. This LED will flash on and off until the program is completely loaded and ready for operation.

Retractable handle — When pressed on the right side, the handle extends outward so that you can open the front panel.

Side Panel

The side panel of the analyzer contains two plumbing ports; an outlet (upper) and inlet (lower). These ports allow connection of the sample transfer tubing from the liquid sample handler to the sample cell holder.

Rear Panel



Air filter — Minimizes the buildup of dust within the analyzer.

Ethernet connector — Allows communication between the computer and the DigiSizer analyzer.

Liquid Sample Handling Unit RS-232 — Allows communication with the liquid sample handler.

ON/OFF switch — Turns electrical power on and off to the analyzer. The up (|) position turns on the analyzer and the down (O) position turns off the analyzer.

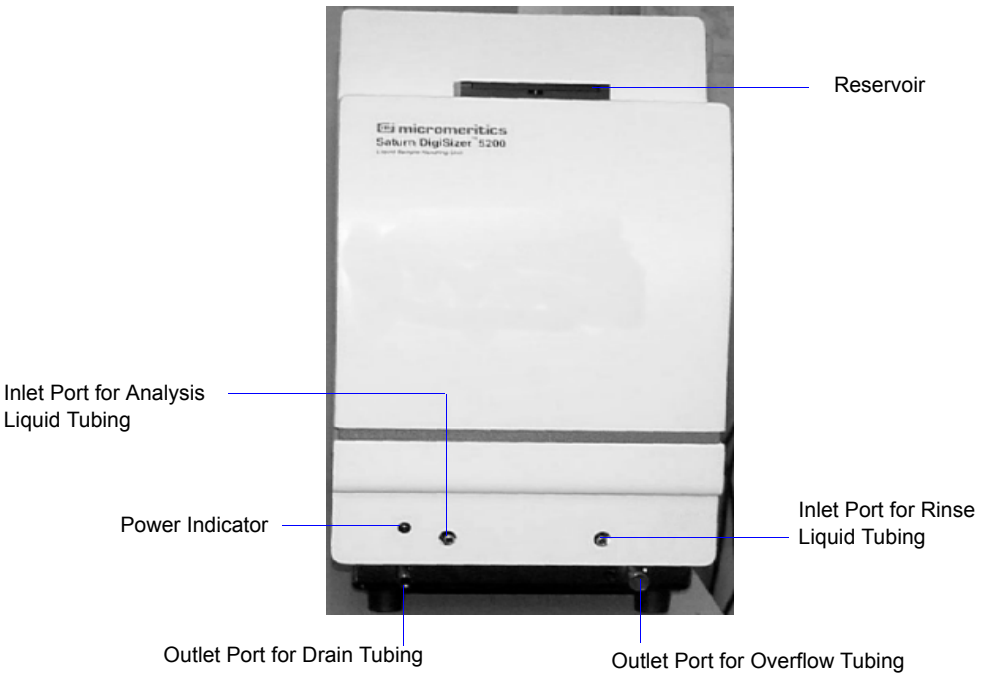
Linear supply breaker	This breaker serves to protect the linear supply that powers the detector. If the breaker trips after resetting, turn off the analyzer and contact your local Micromeritics service representative.
Power connector	Supplies electrical power to the analyzer.
Voltage selector card	Allows you to specify the proper operating voltage.

Liquid Sample Handler

The Liquid Sample Handler is available in two configurations: the Standard unit and the Low-volume unit. The Standard unit is shown for this illustration. The Low-volume unit is similar in appearance; the differences are:

- the size of the reservoir
- the inlet port for the rinse tubing is not used

Front Panel



Reservoir — The compartment into which the sample is placed for transfer to the DigiSizer analyzer for analysis.

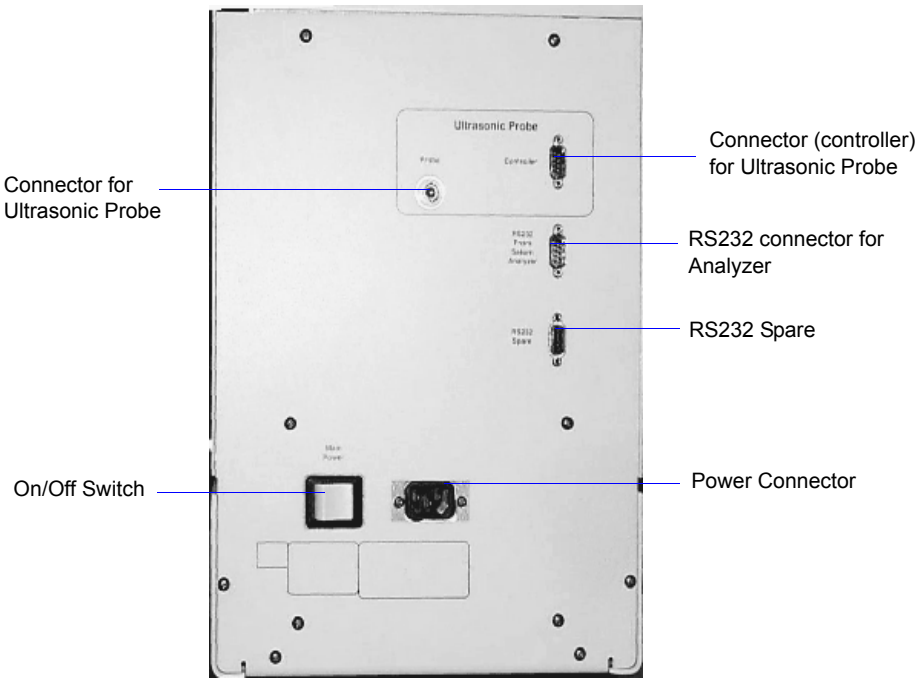
Power indicator — Illuminated when liquid sample handler is turned on.

Ports — For tubing as indicated above.

Side Panel

The side panel of the liquid sample handler contains two plumbing ports; an outlet (lower) and inlet (upper). These ports allow connection of the sample transfer tubing from the liquid sample handler to the analyzer.

Rear Panel



On/Off switch Turns electrical power on and off to the liquid sample handler. The left (|) position turns on the unit and the right (O) position turns off the unit.

Power connector Supplies electrical power to the liquid sample handler.

Controller Allows communication between the ultrasonic probe and the liquid sample handler.

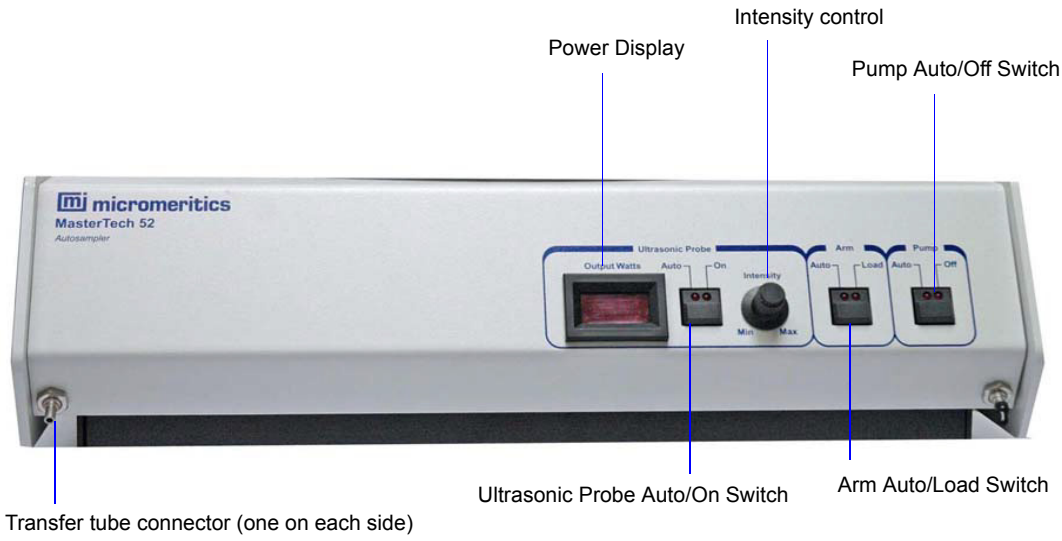
Probe Allows you to connect the ultrasonic probe.

RS232 from analyzer Allows communication between the liquid sample handler and the analyzer.

RS232 spare Used for attaching a MasterTech.

MasterTech 052

Front Panel



ULTRASONIC PROBE AUTO/ON switch

LEDs on the switch indicate the mode of operation.

The **AUTO** position places the probe under automatic control.

The **ON** position turns on the probe. Remove the probe from its holder and place it in the liquid before turning on the probe.

Never turn the probe on unless the tip is submerged in liquid.

After using the probe, press the switch again to place the probe in automatic mode. Then replace it in its holder.

Power Display

Displays the power being generated by the ultrasonic probe.

INTENSITY control

Turn the control clockwise to increase the intensity of the probe, and counterclockwise to decrease the intensity.

ARM AUTO/LOAD switch

The LEDs on the switch indicate the mode of operation.

Do not press the ARM AUTO/LOAD switch while an automatic operation is in progress.

The **AUTO** position places the arm under automatic control.

The **LOAD** position raises the arm when you want to remove or load the tray.

This switch does not function unless the Saturn DigiSizer software is operating.

The MasterTech will not operate if the arm is in the Load position, so be sure to release the **LOAD** switch when you have finished removing or loading the beaker tray.

PUMP AUTO/OFF switch

The LEDs on the switch indicate the mode of operation.

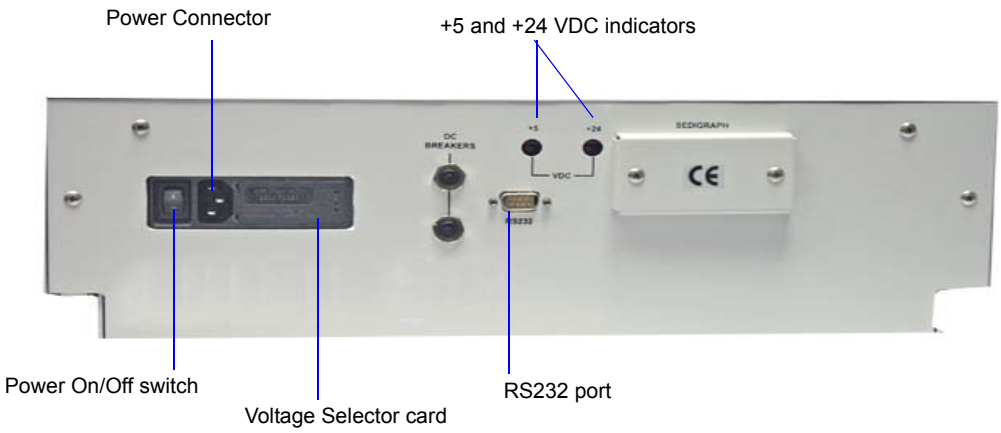
The **AUTO** position places the pump under automatic control.

The **OFF** position turns off power to the pump.

Transfer tubing connectors

For attaching the sample transfer tubing. Attach the tubing to the side that coordinates with the one used on the MasterTech pump during installation of the MasterTech.

Rear Panel



POWER ON/OFF switch	Turns the MasterTech on (|) and off (O).
Power connector	Supplies electrical power to the MasterTech.
Voltage selector card	Allows you to specify the proper operating voltage.
+5 and +24 VDC indicators	Illuminate when appropriate power is present in the MasterTech.
RS232 port	Allows connection of the communications cable.
DC Breakers	Protects internal power supplies.

Turning On and Off the System

Turning On the System

Components of the DigiSizer system must be turned on in a certain order so that all installed components are detected. Turn on the components in the following order:

1. Computer
2. Ultrasonic probe (if installed)
3. MasterTech 052 Autosampler (if installed). Wait for initialization to complete (rotation of the turntable will stop) before turning on the liquid sample handler.
4. Liquid sample handler
5. DigiSizer analyzer

After all components have been turned on, start the analysis program.

Turning Off the System

Turn off the system as follows:

1. Select **Close** from the System menu or **Exit** from the **File** menu.

   - If an analysis is in progress, the following message is displayed:

   2459- An analyzer is busy. A delay in restarting this application could result in loss of new data. Continue with program exit?

   Yes **No**

   If you click **Yes**, the analysis program closes. However, analysis and data collection continue and queued reports will print. If a power failure occurs and an uninterruptible power supply (UPS) is not attached to the analyzer, the data collected after exiting the analysis program are lost.

   - If data calculations are in progress, the following message is displayed:

   2458- An analyzer is performing a critical operation. Wait a few moments before exiting the application.

   OK

   You cannot exit the analysis program until calculations are complete.

2. Turn off components as follows:

   - DigiSizer
   - Liquid sample handler
   - MasterTech 052
   - Ultrasonic probe
   - Computer

Preparing the System for Idle Periods

When the DigiSizer is not being used for analyses, it should be left with liquid in the reservoir so that the plumbing system remains primed. Perform the following steps to prepare the DigiSizer for idle periods of up to 7 days:

1. Fill the reservoir to the primed level with clean analysis (or rinse) liquid.

2. Select **Unit [n] > Enable manual control** (select **Unit [n] > Show instrument schematic** if the schematic is not displayed).

3. Select the circulating pump; right-click and choose **Set speed**.

4. Enter **600**; click **OK**.

5. Exit the analysis program; DO NOT turn off the analyzer or liquid sample handler.

If the DigiSizer is to remain idle for a period of more than 7 days.

1. Select **Unit [n] > Drain** to drain all liquid from the system. This also moves the rotation arm out of the way so that the sample cell is easily accessed.

2. Remove the sample cell (refer to **Cleaning the Optics**, page **9-4** for removal instructions).

3. Using a lens paper, dry the sample cell completely and place it inside its container. If the container is unavailable, wrap the cell with a lens paper and store it in a secure location.

4. Exit the analysis program and turn off all components as outlined in **Turning Off the System**, page **2-9**.

5. Be sure to clean the sample cell before reinstalling. When turning components back on, refer to **Turning On the System**, page **2-9** for the proper order.

Using the Software

The DigiSizer analysis program requires familiarity with standard Windows operations such as using the mouse, menus, and dialog boxes. While this manual provides brief instructions for such standard operations, you may have to refer to your Windows documentation or to its online help system to clarify functions which are specific to Windows.

Shortcut Menus

Shortcut menus (sometimes referred to as context-sensitive menus or pop-up menus) are available for certain components on the instrument schematic when in manual mode, and for onscreen graphs and tabular reports. These menus are accessed by selecting the item for which you wish to display its menu and clicking the right mouse button. For example, right-click in a column of an onscreen report and the following menu is displayed.

Shortcut Keys

Shortcut keys can be used to activate some menu commands. Shortcut keys or key combinations (if assigned) are listed to the right of the menu item. Instead of opening the menu and choosing the command, simply press the key combination. For example, to open a sample information file, press **F2**; the Open Sample Information dialog is displayed.

You can also use shortcut keys to access a menu or any function that contains an underlined letter by pressing **Alt** plus the underlined letter in the command. For example, to access the **File** menu, press **Alt**, then **F**.

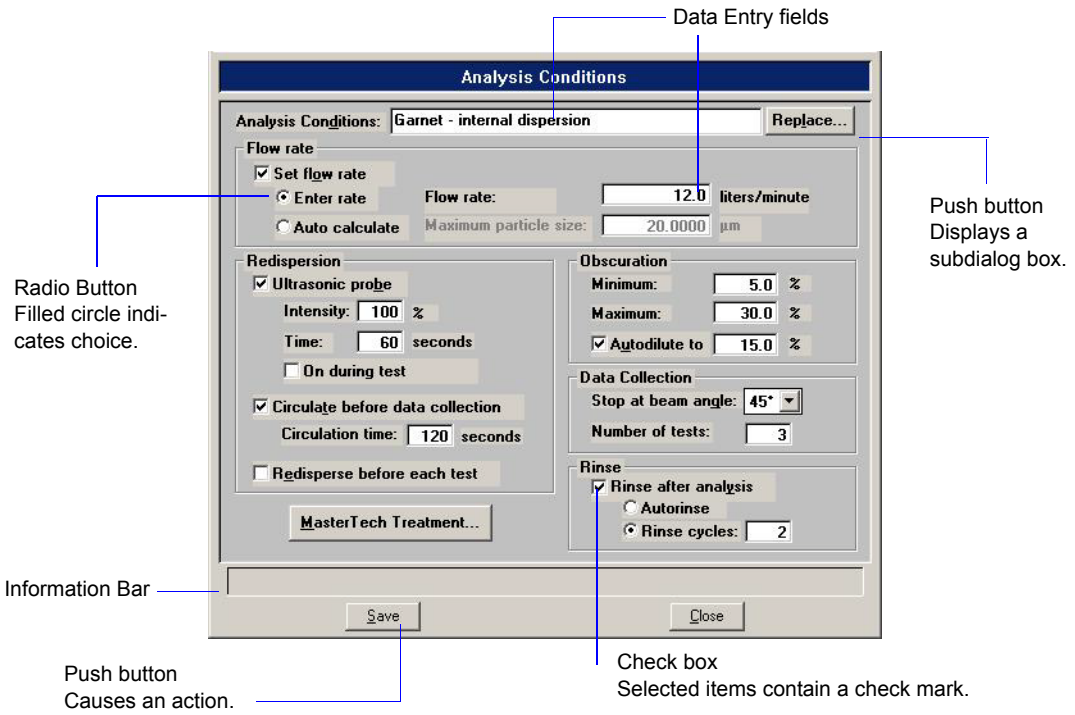
Table 2-1 provides a list of the Shortcut keys available for the Saturn DigiSizer program.

Table 2-1. Shortcut Keys

Select...	To...
F1	Access electronic copy of operator's manual in PDF format
F2	Open a sample information file (main menu bar)
	Clear the field of existing date (Select Dates dialog)
F3	Open an analysis conditions file (main menu bar)
	Insert the current date (Select Dates dialog)
F4	Open a material properties file (main menu bar)
	Display a calendar from which to choose a date (Select Dates dialog)
F5	Open a report options file
F6	Tile windows
F7	Cascade windows
F8	Start a report
F9	Close all open report windows
Alt + F4	Exit the analysis program
Shift + F2	List sample information files
Shift + F3	List analysis conditions files
Shift + F4	List material properties files
Shift + F5	List report options files
Shift + F9	Access shortcut menu of (1) onscreen reports, or (2) selected component on instrument schematic when manual control is enabled

Dialog Boxes and Subdialog Boxes

Dialog boxes are displayed when an item followed by an ellipsis (...) is selected. Subdialog boxes are displayed when certain push buttons are selected. Both types of boxes may contain one or more of the items listed below.



Data entry field — A data entry field is used to enter text; either numeric (numbers only) or alphanumeric (numbers, letters, or printable characters).

Information Bar — Some dialog boxes contain information pertinent to the selected field in an information bar across the bottom of the dialog. For example, a range is shown for fields in which numeric entries are required.

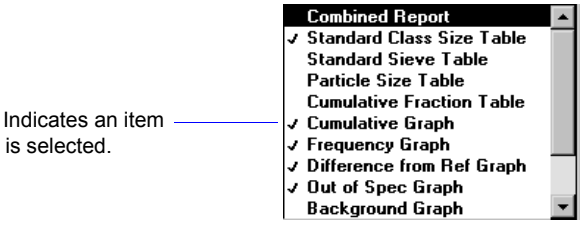
Push Button — A push button is used to display a subdialog box in which to enter additional information about the subject matter, or to cause an action.

Radio Button — Radio buttons are contained within a group box and are used to make choices. Only one radio button can be selected.

Check Boxes Check boxes are used to select options. You can select as many options as desired.

Drop-down List A drop-down list contains a list of options and is indicated by a down arrow to the right of the field. If there are more items than can fit in the box, a scroll bar is provided for navigating through the list.

List box A list box also displays options, but allows you to select as many as you wish. To select an item in a list box: move the mouse pointer to the desired selection and double-click. Alternatively, you may highlight the desired item and press the **Spacebar**. An item is selected when it is preceded with a check mark (✓).



The following push buttons are common to the DigiSizer analysis program and appear on many of the dialogs:

Browse Displays a dialog allowing you to select a file for the subject matter.

Cancel Closes the open dialog, discarding any information you may have entered and/or cancels the current operation.

Next Advances you to the next screen. This push button is disabled if this is the last screen of a series.

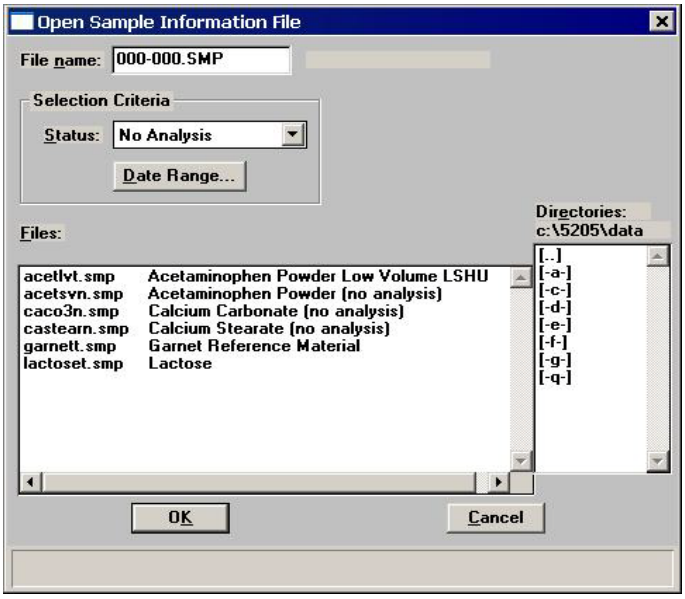
OK Closes the open dialog, saving any entries you may have made.

Prev Returns to the previous screen. This push button is disabled if this is the first screen of a series.

Replace	Allows you to copy file values from an existing file into the current one. This allows you to edit the values in the new file without changing the ones in the original file.
Resume	Resumes a suspended operation.
Suspend	Suspends the current operation. The push button changes to **Resume**.

Selecting Files

Sample information is stored in files and saved under file names. Certain dialogs contain a **Files** window which displays a list of files available for that particular operation. For example, the Open Sample Information dialog:



A default string appears in the **File name** field. To select a file, simply move the mouse pointer to the desired file in the list and double-click.

You may limit the list of files displayed in the **Files** list by choosing one of the following:

- Use wildcard characters in the path name you enter in the **File name** field. Wildcard characters such as * and ? can be used to filter file names. For example, you can limit the list of files displayed to those beginning with garnet by entering garnet*.smp.

- Enter a range of dates. Select **Date Range**; the Select Dates dialog is displayed.

Select **Show Date Range** to enable the **From** and **To** fields and enter a beginning and ending date. Or, you can double-click in each field to display a calendar to select a date. The range of dates remains the default until you change the dates or select **Show All Dates**.

For convenience, the following shortcut keys are available when the Select Dates dialog is displayed:

F2 Clears the field
F3 Inserts the current date
F4 Displays a calendar from which to select a date

Use the Regional Settings function on the Windows Control Panel to change the date format.

- Select a file status from the Status drop-down list. Table 2-2 describes each file status.

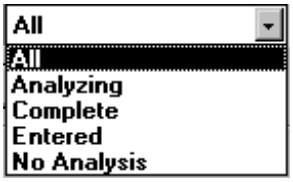
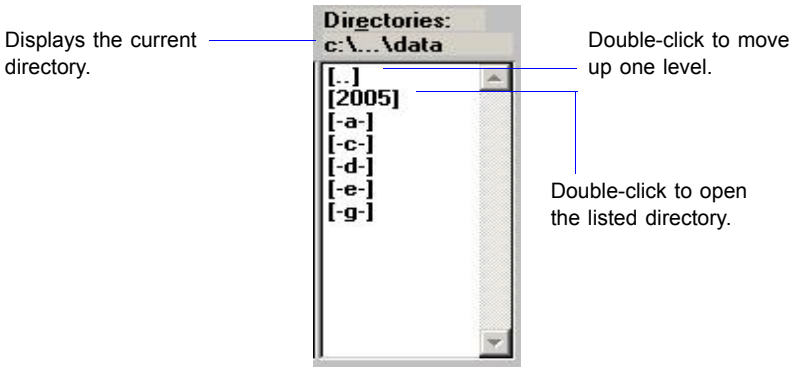


Table 2-2. File Status and Description

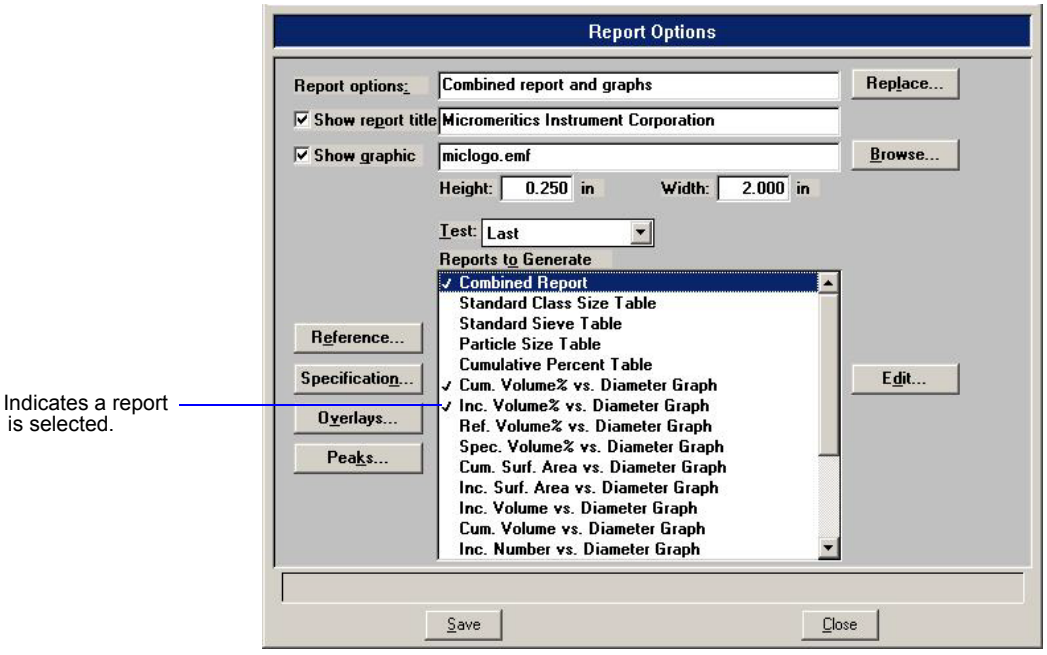
Status	Description
All	All sample information files in the specified directory and within the specified range of dates.
Analyzing	Sample information files that are currently being used in an analysis.
Complete	Sample information files that have had at least one test performed. Eight tests can be performed with each file.
Entered	Sample information files that contain manually entered data.
No Analysis	Sample information files that have not been used in an analysis.

- Use the **Directories** window to navigate to a different directory. The current directory is displayed just above the **Directories** list window. To change directories: 1) double-click a directory in the **Directories** list window, 2) double-click **[...]** to move up one level, or 3) enter the desired directory in the **File Name** field. For example, enter C:\5205file\sample*.smp to display sample files in the **5205file\sample** directory on your local drive.



Selecting Reports

Reports are selected from the Report Options dialog, or any dialog containing a **Reports to Generate** list. Simply select (highlight) the report and then double-click, or press the **Spacebar**. A report is selected when it is preceded with a check mark (✓). Reports are deselected in the same manner.



File Name Conventions

For sample information files, a default file name (the next available sequence number) and a default extension display. For Analysis Conditions, Report Options, and Material Properties files, only a default extension displays.

The following table shows the file name extensions for the Saturn DigiSizer analysis program.

Table 2-3. Default File Name Extensions

File Type	Extension
Sample Information	SMP
Analysis Conditions	ANC
Material Properties	MTP
Report Options	RPO
Export to disk (ASCII)	EXP
Report (saved from the Report window)	REP
List to disk	LST

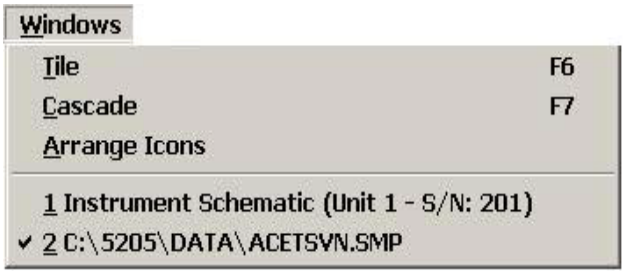
Menu Structure

Main Menu Bar

All functions for the Saturn DigiSizer are accessed from the main menu bar. Brief descriptions are provided below; refer to the chapter given in parentheses for a detailed description of the commands contained on that menu.

File	Allows you to manage sample and parameter files. (Chapter 5, **FILE MENU**)
Unit [n]	Enables you to perform analyses and other instrument operations. (Chapter 6, **UNIT MENU**)
Reports	Enables you to generate, open, and close reports. (Chapter 7, **REPORTS MENU**)
Options	Allows you to edit sample defaults, select data presentation formats, and manage models. (Chapter 8, **OPTIONS MENU**)
Windows	Enables you to arrange the windows and icons on your screen. It also displays the names of all open windows. (this chapter, page **2-20**)
Help	Provides access to an electronic copy of the operator's manual. (this chapter, page **2-20**)

Windows Menu



Tile Resizes all open windows and arranges them side by side so that the contents of all open windows are visible.

Cascade Resizes all open windows and arranges them in a stacked fashion. The active window is positioned on top of the stack. Each window's title remains visible, making it easy to select other windows.

Arrange icons Arranges all minimized icons in an orderly manner.

The Windows menu also displays all open files; the active window is preceded with a check mark (✓).

Help Menu

Operator's Manual Provides an electronic copy of the DigiSizer operator's manual in Adobe® PDF format.

About DigiSizer Displays information about the Saturn DigiSizer analysis program.

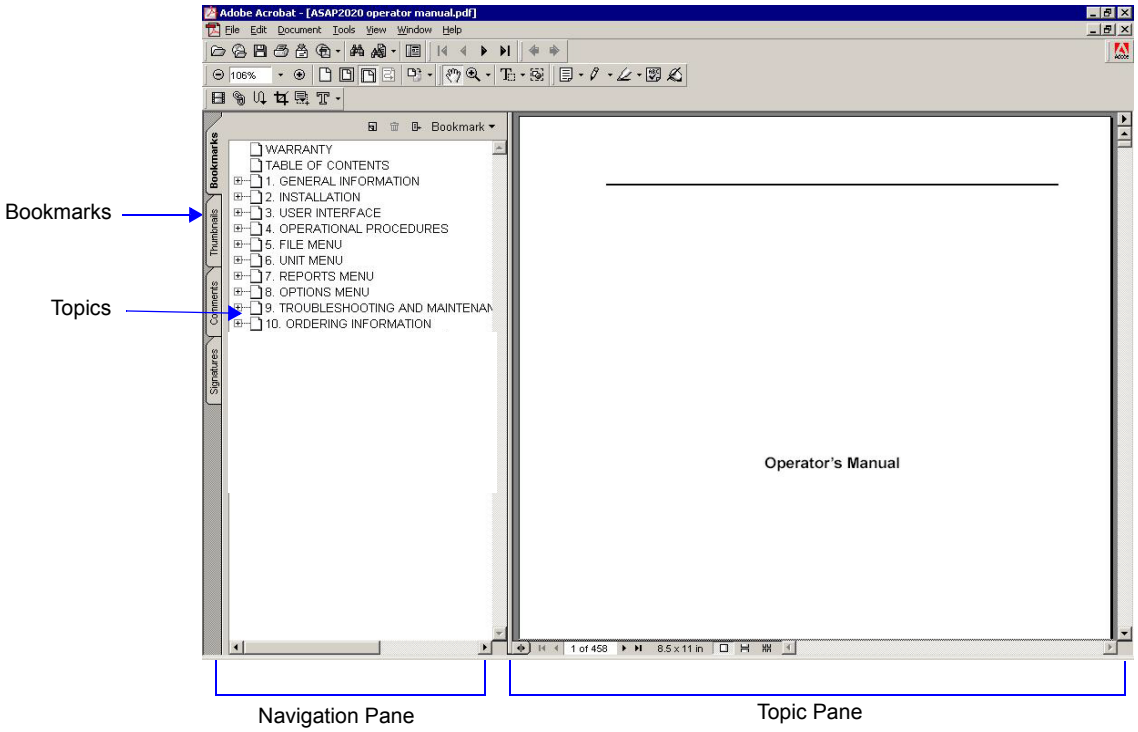
Online Manual

For your convenience, the Operator's Manual is available online. You can access the manual by selecting **Help**, then **Operator's Manual** from the analysis program main menu. The manual appears in an Adobe® Acrobat® Reader®.

Following are some tips to help you quickly locate the information you need in the manual. Refer to the Adobe Acrobat Help system (click the **Help** button on the Acrobat menu) for more information on the Acrobat features you can use while viewing the manual.

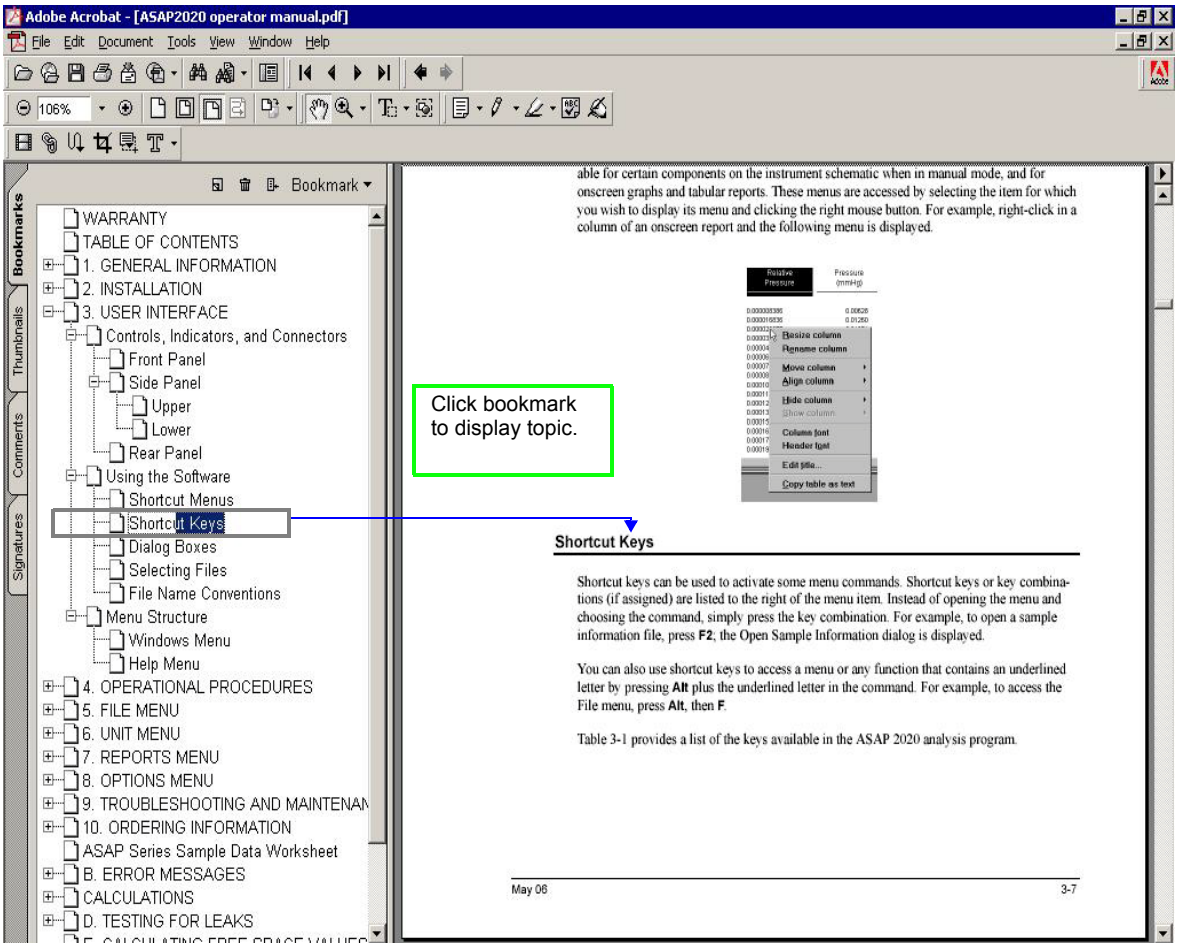
Using Bookmarks

Click the **Bookmarks** tab to list and access the topics included in the manual.



You can use the + and – buttons next to topics as they are used in Windows Explorer to expand or collapse the topic list.

To display a topic, click the topic name in the Bookmarks section. The related information appears in the topic pane of the window as shown in the following example.



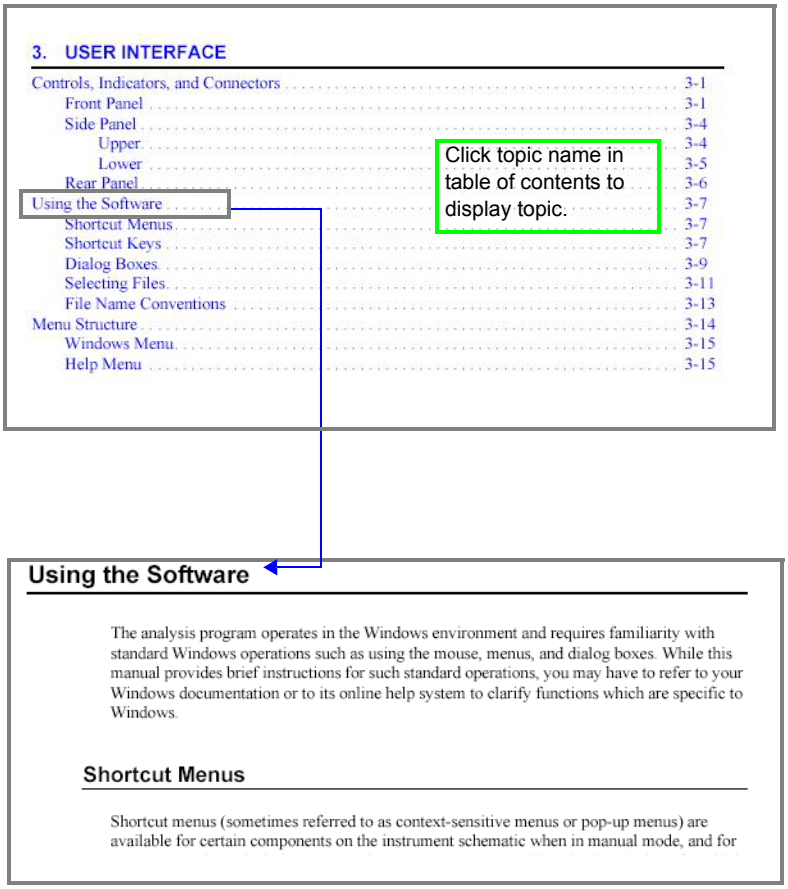
Using the Table of Contents, Index, and other Links

Links provide direct access to selected information. All links appear in blue type. Links are contained in:

- the table of contents
- index entries
- cross-references within the manual

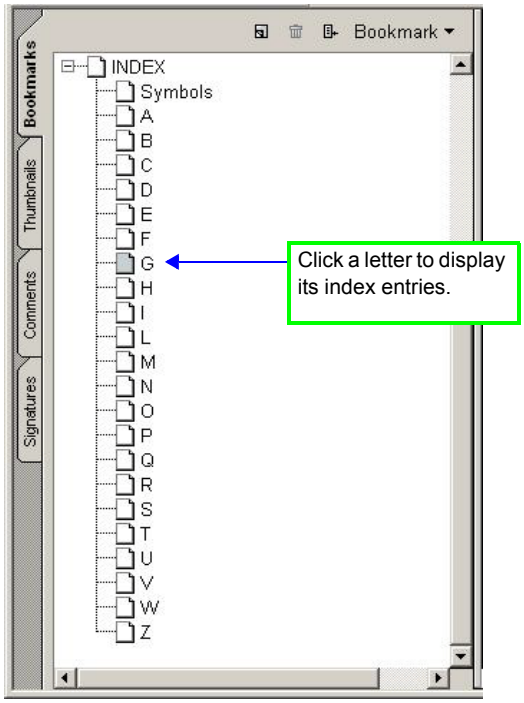
Table of Contents

To display the table of contents, click **Table of Contents** in the **Bookmarks** section. When the table of contents is displayed, you can click an entry to display its associated page. For example, clicking **Using the Software** in the table of contents, displays the page containing information about the software.



Index

To use the index in the online manual, click the **Bookmarks** tab, scroll down to **INDEX** (the last topic in Bookmarks), then click the + button to expand the index. The letters A through Z are displayed. Click a letter to display its corresponding index entries as shown in the following example.



After you display the entries, locate the item of interest and click on the page reference to access the information.

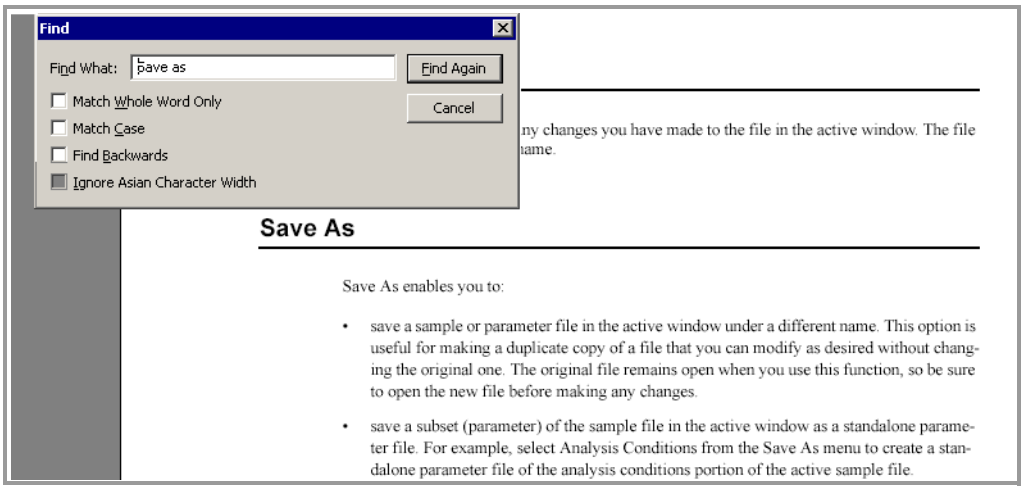
Cross References

Cross-references work in the same manner. In the example below, clicking on the cross-reference, **FILE MENU** (shown on the screen in blue type) will display the first page of the chapter describing the commands found on the File menu.

FILE MENU
Provides a description of the commands available on the File menu.

Using the Find Command

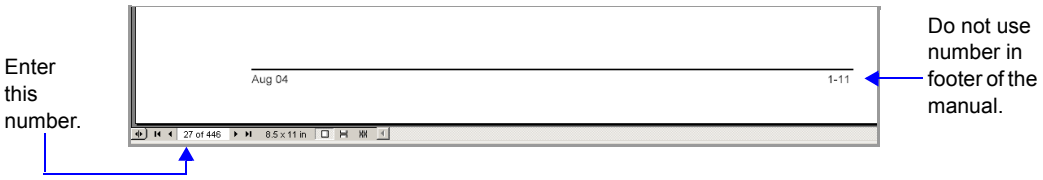
The Adobe Acrobat **Find** command provides another method of easily accessing specific information. For example, suppose you want to know how the **Save as** command works. You could select **Edit > Find** from the Adobe Acrobat menu, then enter **Save as** in the Find dialog. The following example shows the results.



Printing

You can print the entire manual, a selected page, or range of pages. There are several options for printing. You can:

- Select the printer icon ( ) on the Adobe Acrobat toolbar.
  A standard Print dialog is displayed. Select the page(s) to print, then click **OK**. When using this option (or the next one), be sure to enter the page number(s) displayed in Adobe Acrobat; do not use the page number(s) listed in the footer(s) of the manual.



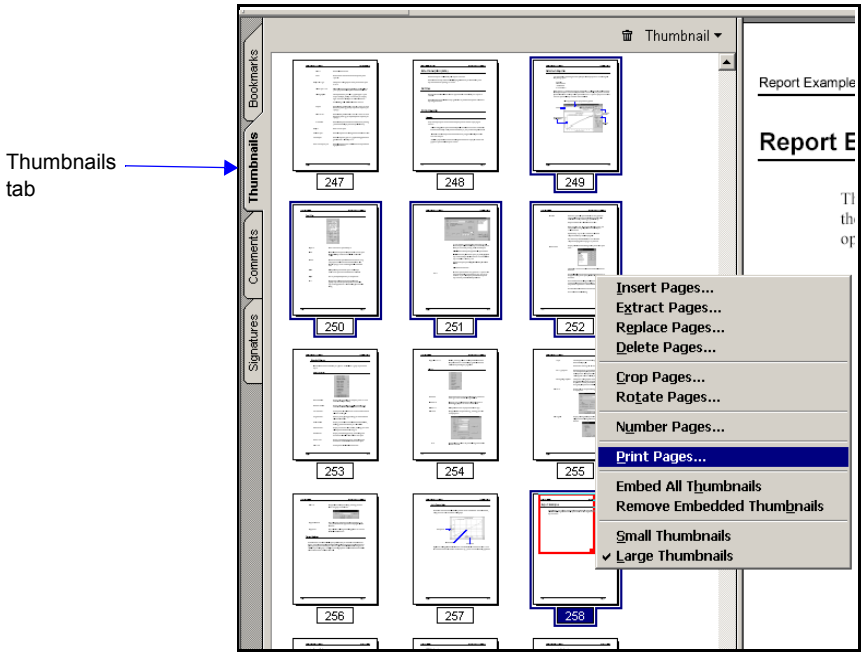
- Select **File > Print**.
  A standard Print dialog is displayed. Select the page(s) to print, then click **OK**.

- Click the **Thumbnails** tab.
  Thumbnails of manual pages are displayed.

  a. Click the pages you want to print.

  b. Right-click to display a shortcut menu, then select **Print Pages**.

  c. A standard Print dialog is displayed; click **OK**.



3. OPERATIONAL PROCEDURES

This chapter describes brief, step-by-step instructions on how to:

- Specify sample defaults, page **3-1**
- Rinse the system, page **3-5**
- Measure a background, page **3-8**
- Change analysis liquids, page **3-10**
- Create sample files, page **3-12**
- Create parameter files, page **3-15**
- Prepare a sample for analysis, page **3-21**
- Perform an analysis, page **3-22**
- List file statistics, page **3-30**
- Export sample data, page **3-31**
- Generate reports, page **3-32**
- Overlay data, page **3-41**

This chapter does not contain detailed descriptions of the dialogs used to perform these procedures. Refer to Chapters 5 through 8 for dialog descriptions. Use the index or the online manual to assist you in locating the appropriate dialog.

Specifying Sample Defaults

You can specify sample defaults in the Advanced or Basic format. The defaults you specify are the ones you see when you create a new sample file in the respective format. Therefore it is best to specify (or enter) parameters that you plan to use most frequently. For example; specify defaults for your most commonly analyzed sample material. You can always edit parameters in the sample file when it is created.

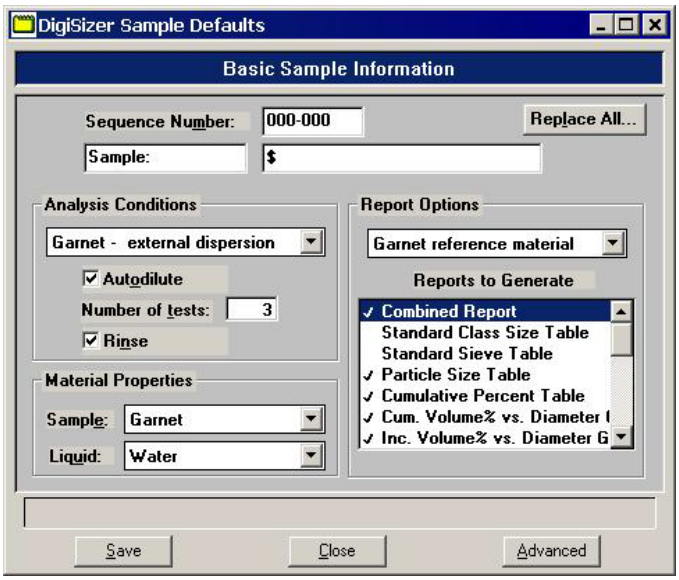
Basic Format

Refer to **Basic**, page **8-9.** for a detailed description of the fields on this dialog.

Perform the following steps to define defaults for a Basic sample information file.

1. Select **Options > Option Presentation > Basic**.

2. Select **Options > Sample Defaults**; the Default Basic Sample Information dialog is displayed.



3. In the **Sequence Number** field, specify a default string for the sample file number, you can use up to eight characters. This is the number that appears in the **File name** field when you select **File > Open > Sample information**.

4. In the right field of the **Sample** line, enter a format for the sample's identification. Be sure to include the $ symbol if you wish to have the sample file number included as part of the identification.

You can also edit the word Sample. For example, you may prefer to use Test.

5. From the **Analysis Conditions** drop-down list, choose the analysis conditions file you wish to use as the default; selections chosen in the file display for the **Autodilute**, **Number of tests**, and **Rinse** options.

6. In the **Material Properties** group box, choose the sample and dispersing liquid you wish to use as the defaults.

7. From the **Report Options** drop-down list, choose the report options file you wish to display as the default; reports selected in the file show in the **Reports to Generate** window.

8. Click **Save**, then **Close**.

Advanced Format

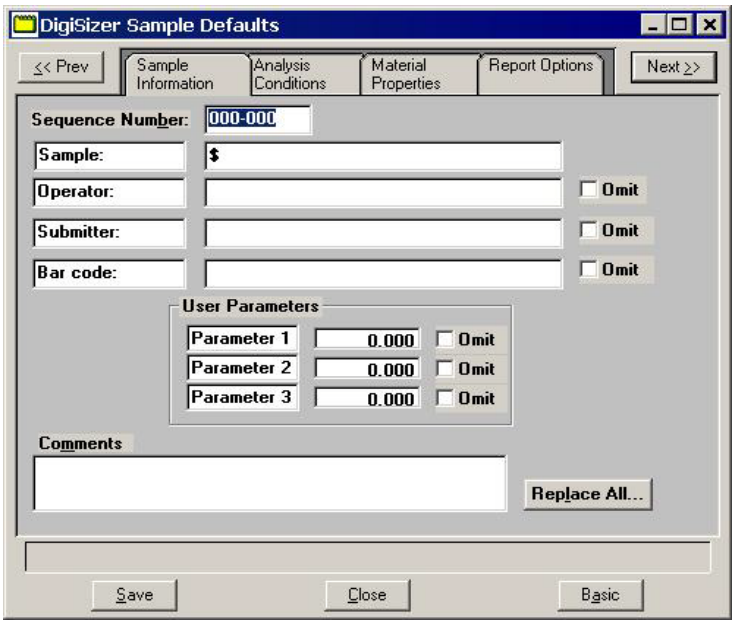
Defining sample defaults in this format allows you to customize sample files. The values you specify in the parameter portions of the sample file (Analysis Conditions, Material Properties, and Report Options) also are saved as the defaults for newly created parameter files.

For example, after specifying defaults:

- Select **File > Open > Sample Information**; name and create the file; and all defaults you specified display for all parameters.
- Select **File > Open > Analysis Conditions**; **Yes** to create the file; and the defaults you specified in the Analysis Conditions portion of the Advanced Sample Defaults dialog display in the fields.

Refer to **Advanced**, page **8-6.** for a detailed description of the fields on this dialog.

1. Select **Options > Option presentation > Advanced**.
2. Select **Options > Sample Defaults**; the DigiSizer Sample Defaults dialog is displayed.



3. In the **Sequence Number** field, specify a default string for the sample file number; you can use up to eight characters. This is the number that appears in the **File name** field when you select **File > Open > Sample information**.

4. In the right field of the **Sample** line, enter a format for the sample's identification. Be sure to include the $ symbol if you wish to have the sample file number included as part of the identification.

You can also edit the word Sample. For example, you may prefer to use Test.

5. Edit the **Operator** and **Submitter** lines as desired. Or have them omitted entirely by selecting **Omit**.

6. Specify user parameters (if desired). These fields provide additional sample characterization available for SPC (statistical process control) reports. For example, you may wish to specify sample weight or temperature. If you specify a parameter, enter a default for that parameter in the field on the right. Or, if SPC reporting is not desired, you may have them omitted by selecting **Omit**.

7. Select the **Analysis Conditions** tab.

   a. Choose analysis conditions appropriate for your most commonly analyzed sample.

   b. Click **Save**.

8. Select the **Material Properties** tab.

   a. Choose the sample material you most commonly analyze, a suitable dispersing liquid, and appropriate values.

   b. Click **Save**.

9. Select the **Report Options** tab.

   a. Choose desired report options.

   b. Click **Save**, then **Close**.

Performing a Rinse Operation

A rinse operation should be performed to rinse the analysis cell of any debris or contaminants from previous analyses. Since contaminants from previous analyses can affect results of subsequent analyses, it is best to perform a rinse operation after each analysis.

Refer to **Rinse**, page **6-26** for a detailed description of the fields on this dialog.

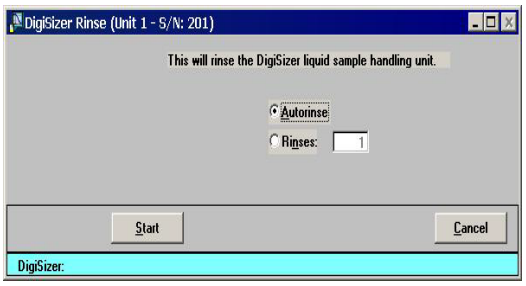
When you select **Unit [n] > Rinse**, three choices are presented:

- **DigiSizer** - rinses the cell, the reservoir, and the tubing of the liquid sample handler and DigiSizer
- **MasterTech** - rinses the MasterTech tubing into a specified beaker
- **MasterTech then DigiSizer** - rinses the MasterTech first, then the liquid sample handler and DigiSizer as described above

DigiSizer

Perform the following steps to rinse the analysis cell, the reservoir, and the tubing of the DigiSizer.

1. Select **Unit [n] > Rinse > DigiSizer**; the DigiSizer Rinse dialog is displayed.



2. Choose **AutoRinse** to have the analyzer automatically determine how many rinse cycles to perform based on beam obscuration, or **Rinses** to specify an exact number of rinses.

3. Click **Start**; progress messages are displayed until rinsing is complete, then the dialog closes automatically.

MasterTech

This option is enabled only if a MasterTech is connected to the analyzer.

Perform the following steps to rinse the MasterTech tubing:

1. Select **Unit [n] > Rinse > MasterTech**; the MasterTech Rinse dialog is displayed.

2. Enter the position number of the beaker that is to catch the rinse liquid. Be sure the beaker contains a small amount (approximately 10 mL) of liquid; otherwise, its presence may not be detected by the MasterTech.

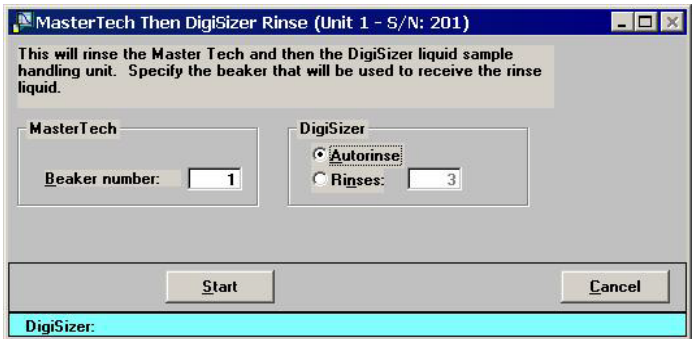
3. Click **Start**; progress messages are displayed until rinsing is complete, then the dialog closes automatically.

MasterTech then DigiSizer

This option is enabled only if a MasterTech is connected to the DigiSizer.

Perform the following steps to rinse the analysis cell, the reservoir, and the tubing of the DigiSizer and the MasterTech.

1. Select **Unit [n] > Rinse > MasterTech then DigiSizer**; the MasterTech then DigiSizer Rinse dialog is displayed.



2. In the MasterTech group box, enter the position number of the beaker that is to catch the rinse liquid. Be sure the beaker contains a small amount (approximately 10 mL) of liquid; otherwise, its presence may not be detected by the MasterTech.

3. In the DigiSizer group box, choose **Autorinse** to have the analyzer automatically determine how many rinse cycles to perform based on beam obscuration, or **Rinses** to specify an exact number of rinses.

4. Click **Start**; progress messages are displayed until rinsing is complete, then the dialog closes automatically.

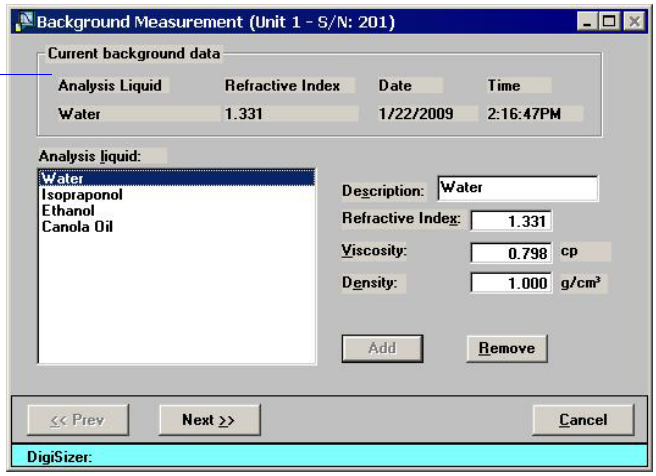
Performing a Background Measurement

A background measurement is required for data collection. It is not necessary to measure a background for each analysis. It is recommended that you perform a background measurement once per shift and when you change analysis liquids. You can measure up to eight backgrounds, but only the last one can be saved and used. Refer to **Appendix I,** page I-1 for a discussion and examples of acceptable and unacceptable backgrounds.

Perform the following steps to measure a background.

1. Select **Unit [n] > Background**; the Background Measurement dialog is displayed.

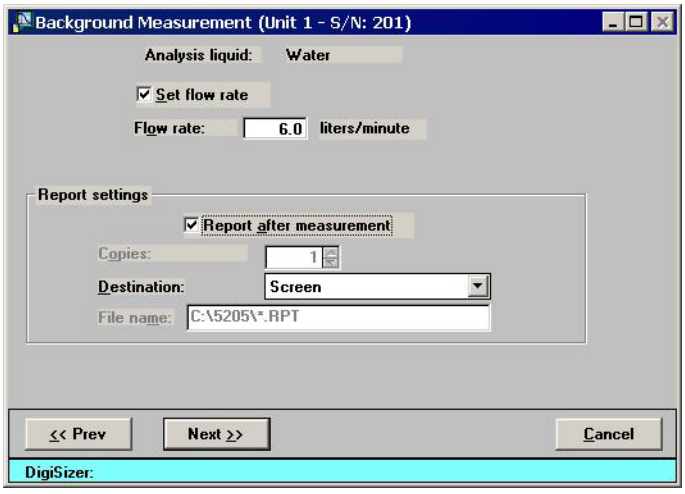
This group box displays statistics for the current background.



2. Select the liquid you are using to measure the background (if different from the current one).

If using a different liquid, be sure that you have inserted the analysis liquid inlet tube (extending from the front panel of the liquid sample handler) into the new liquid.

3. Click **Next**; another view of the Background Measurement dialog is displayed.



4. Ensure that the **Flow rate** option is selected; enter **6**.

5. Select **Report After Measurement** to have a background report generated automatically after the background is measured. Then select the drop-down list to choose a destination.

   This background can be overlaid with backgrounds from other analyses for comparison if desired (refer to **Background**, page **7-6**).

6. Click **Next**; a progress screen of the background being measured is displayed. The measurement is displayed in the final view of the Background Measurement window when it is finished. The current background is also displayed for comparison.

The progress view of the background window provides a suspend and skip option if either action is desired.

7. Click **Done** to accept the measured background and close the window.

If this background measurement is unsatisfactory, you can perform another one by selecting Repeat. If you choose to measure another background, the current one becomes inaccessible. You must use the last background measured. Refer to Appendix I, page **I-1 for guidelines on determining acceptable backgrounds.**

Changing Analysis Liquids

When changing analysis liquids, it is very important to remove all traces of the old liquid from the system and any air bubbles remaining in the liquid inlet pump.

If the new liquid is immiscible with the old liquid, this procedure must be performed twice:

- the first time to change to a transition liquid which is miscible with the old and new liquid. Isopropanol (IPA) is often used as a transition liquid because it is miscible with water and many hydrocarbon-based liquids.
- and the second time to change from the transition liquid to the new liquid.

If a MasterTech is attached, its tubing must be drained and rinsed along with the rest of the system. Note that if a MasterTech is attached, it must always contain the same type of liquid used in the rest of the system, even if it is not used in analyses. This is necessary in order to prevent contamination or air bubbles.

1. Remove the analysis liquid inlet tube from the liquid supply. Drain the inlet tube, then wipe clean the outer surface; place it on a paper towel to absorb any further residue.
   - If your DigiSizer is equipped with the standard liquid sample handler, repeat this step for the rinse inlet tube.
2. Select **Unit > Drain** to drain the system of liquid.
3. Select **Unit > Enable Manual Control** to enable manual control.
4. Click the analysis pump icon. Turn on the pump and allow the pump to operate for approximately 10 seconds, then turn it off.

A quick-and-easy method for turning pumps on and off is simply to press the spacebar after selecting the appropriate pump.

5. Select **Unit > Drain** to drain any liquid remaining in the system.
   - If your DigiSizer is equipped with the standard liquid sample handler, repeat steps 4 and 5 for the rinse pump.
6. If a MasterTech is attached:
   a. Place an empty beaker in position 1 of the MasterTech tray.
   b. Select **Unit** > **Load from MasterTech**; ensure that beaker **1** is designated and that the stirrer and probe times are specified as **0**.

If you receive an error message indicating that the beaker is not present, press down on the beaker to enable the sensing mechanism. then repeat the Load operation (step 6-b).

c. Select **Unit > Drain** to drain the system again.

7. Wipe any additional residue from the analysis liquid inlet tube and place it into the new liquid supply. If the new liquid requires a new **Waste** container, replace the container.

8. Turn on the analysis pump; allow the inlet tube to fill until the liquid level reaches the fitting on the front panel of the liquid sample handler, then turn off the pump.

9. Repeatedly turn on and off the analysis pump at one-second intervals until the Full liquid level sensor is on (sensor turns blue).

10. Select **Unit > Drain** to drain the system again.

11. For the standard sample handler, repeat steps 6 through 10 for the rinse inlet.

12. Select **Unit > Rinse > DigiSizer;** for the**:**

    - **Standard sample handler**: perform three separate rinse operations of one rinse cycle each (this flushes both the analysis inlet and rinse inlet three times).

    - **Low-volume sample handle**r: perform one rinse operation with 3 rinse cycles.

13. If a MasterTech is attached:

    a. Place an empty beaker in position 1 of the MasterTech tray.

    b. Select **Unit > Rinse > MasterTech**.

    c. Empty the beaker, replace it onto the MasterTech tray, and repeat the rinse cycle.

    d. Select **Unit > Rinse > DigiSizer**; rinse the DigiSizer with one rinse cycle.

14. Select **Unit > Background**, select the new liquid, then complete the measurement.

If the background intensity is unusually high, remove and clean the cell (refer to **Cleaning the Optics**, page **9-4****); then repeat this step. Appendix I,** page **I-1 provides guidelines for determining a good background.**

15. Select **Unit > Rinse > DigiSizer**; perform one rinse cycle.

16. Perform another Background analysis.

17. Examine the overlay of the current and previous background intensities. With the graph window maximized, most of the intensity data for the two curves should coincide so that only one color is showing. It is acceptable to have small differences (two colors showing with little or no white space between them) in small regions, and particularly in the data at greater than 10 degrees scattering angle. If the difference in the two background intensity curves is greater than 10 degrees, repeat steps 15 and 16 until a stable background intensity is achieved.

Creating a Sample Information File

Every analysis requires a sample information file. The file consists of information groups which, collectively, identify the sample (sample information), guide the analysis (analysis conditions, material properties), and specify the data reduction (report options).

A sample file may be created in three different formats:

- **Advanced**. This format provides complete access to all parts of the sample file, allowing you to quickly edit parameters as required.
- **Basic**. This format presents a single window in which you select predefined parameter files for your analysis.
- **Restricted**. This format is identical to the Basic format, except that certain menu options become disabled. In the Restricted mode, you cannot define defaults for SPC reports or sample files, nor can you switch to the Advanced format. This mode is also password-protected.

Select **Options > Option presentation** to choose the format you wish to use.

Basic and Restricted Formats

The Basic and Restricted formats are the easiest and most popular methods for creating a sample file because you create your file using predefined parameter files. If more detailed conditions or custom files are required, you must use the Advanced format (discussed later). Even if you begin your sample file in the basic format, you can switch to the Advanced format by clicking **Advanced**.

The instructions for creating sample files in the Restricted format are the same as for the Basic format with the following exceptions:

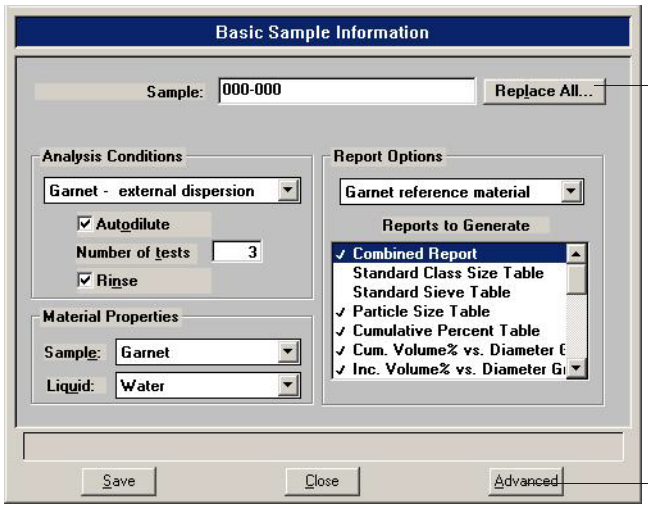
- You must enter a password to access this format
  (refer to **Restricted**, page **8-4**)
- Certain menu options become disabled
- You cannot switch to the Advanced format

Refer to **Basic**, page **5-5** for a detailed description of the fields on this dialog.

Perform the following steps to create a sample information file using the Basic format.

1. Select **File > Open > Sample information**; the Open Sample Information File dialog is displayed.
2. Accept the next sequenced file number or enter a new name (up to eight characters) in the **File name** field.

3. Click **OK**, then **Yes** to create the file; the Basic Sample Information dialog is displayed.



Use this push button to copy parameters from an existing file into the current one.

Not displayed when using the Restricted format.

Click Replace All to copy parameters from an existing file into this one. After copying the parameters, you may edit them as desired.

4. Select the down arrow at the **Analysis Conditions** field and choose an Analysis Conditions file from the drop-down list; selections specified in the file display for the **Autodilute**, **Number of tests**, and **Rinse** options. You can edit these selections if desired; it will not change the parameter file.

5. Choose the sample material and the analysis liquid from their respective drop-down lists.

6. Select the down arrow at the **Report Options** field and choose a Report Options file from the drop-down list; reports selected in the file show in the **Reports to Generate** window. You can edit these selections if desired.

7. Click **Save**, then **Close**.

Advanced Format

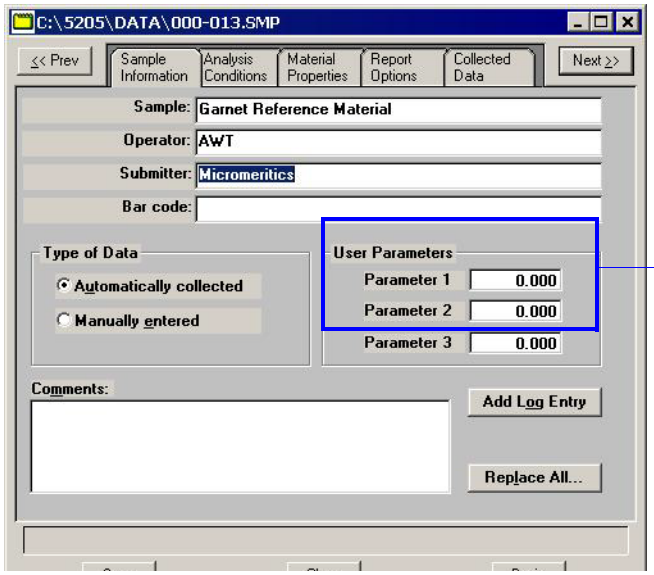
The Advanced format presents all parts of the sample file in an index-card manner. This allows you to create a customized sample file.

Refer to **Advanced**, page **5-8** for a detailed description of the fields on this dialog.

1. Select **File > Open > Sample Information**; the Open Sample Information File dialog is displayed.

2. Accept the next sequenced file number or enter a new name in the **File name** field.

3. Click **OK**, then **Yes** to create the file; the Advanced Sample Information dialog is displayed.



These fields are used for SPC reporting only. The labels (parameters on which to report) can be specified by selecting Options > Sample Defaults.

4. Enter the names of the operator and submitter.

5. Choose whether you wish to have data collected automatically or whether you plan to enter the data.

6. Unless you are gathering statistical process control information, it is unnecessary to enter parameter values. These are user-definable parameters that can be entered and tracked along with other statistical process control data.

The steps for completing the remaining parameters of the sample information file are explained in subsequent sections. Simply click on the next tab to open its associated dialog.

Creating Parameter Files

Parameter files can exist as part of the sample information file or as a standalone file:

- Analysis conditions, starting on this page
- Material properties, page **3-18**
- Report options, page **3-20**

Having these files exist independently allows you to use them over and over again.

Several predefined parameter files are included with the Saturn DigiSizer program. Although these files may come close to the needs of your laboratory, you may wish to define additional ones. Or you can use a predefined file as a starting point. This is easily accomplished by creating a new file and then selecting **Replace**. A dialog is displayed so that you can select the existing file containing the values you wish to use. After the values are copied into the current file, you can edit the values as desired; the original file remains intact and ready for the next use.

If you wish to have parameter files display in the drop-down list on the Basic Sample Information dialog, be sure to save them to the directory specified as the Parameter Files Directory (see **Parameter Files Directory**, page **8-12**). Unless you have edited the parameter files directory, the files are saved to the default **params** directory automatically.

Analysis Conditions

Analysis conditions specify the data used to guide an analysis. An analysis conditions file may be assigned a unique name, and you can direct any sample to be analyzed according to the conditions in any existing analysis conditions file.

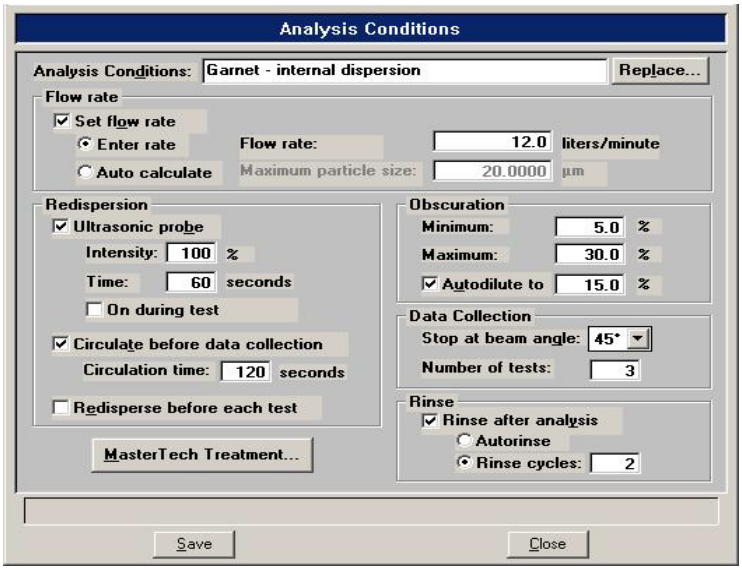
Refer to **Analysis Conditions**, page **5-11** for a detailed description of the fields on this dialog.

Perform the following steps to define an analysis conditions file.

1. Select **File > Open > Analysis Conditions**; the Open Analysis Conditions File dialog is displayed.

2. Enter a name (up to eight characters) in the **File name** field, then click **OK**.

3. Click **Yes** to create the file; the Analysis Conditions dialog is displayed.



4. Enter a description in the **Analysis Conditions** field.

Use an intuitive description, one that will help you identify the type of sample you plan to analyze using these analysis conditions. You may want to use a description that contains the type of sample material and dispersing liquid. For example, Garnet/Water.

5. Specify flow rate requirements. You can have the flow rate calculated automatically by the DigiSizer or you can enter a value.

6. In the **Redispersion** group box:

   a. Select **Ultrasonic probe** if you are using an ultrasonic probe, then enter the percent of intensity for operation and how long you wish to have the sample agitated before analysis. You can also choose to have the probe remain on during analysis.

   b. Select **Circulate before data collection** if you wish to have the analysis liquid circulated through the system after adding the sample, then enter how long circulation is to occur.

   c. Select **Redisperse before each test** to have the sample redispersed just before each analysis.

7. In the **Obscuration** group box:

   a. Specify a range for beam obscuration, or accept the defaults.

   b. Select **Autodilute** to have the Saturn DigiSizer automatically maintain dilution of the sample concentration.

8. In the **Data Collection** group box:

    a. Enter the beam angle at which to stop data collection. This field defaults at **45**, and is generally appropriate for most samples. The beam angle can be decreased if the sample does not contain small particles, or increased if the sample contains a significant quantity of particles smaller than 0.3 micrometers.

    b. Enter the number of tests to be used with this file. Eight tests can be performed using the same file.

9. Select **Rinse after analysis** to rinse the system after all specified tests are complete. Then choose **Autorinse** (the system determines the rinses) or enter a specified number of rinses.

10. If you are using the MasterTech, click **MasterTech Treatment** and specify the stirring time, stirring speed, and probe time.

11. Click **Save**, then **Close**.

Material Properties

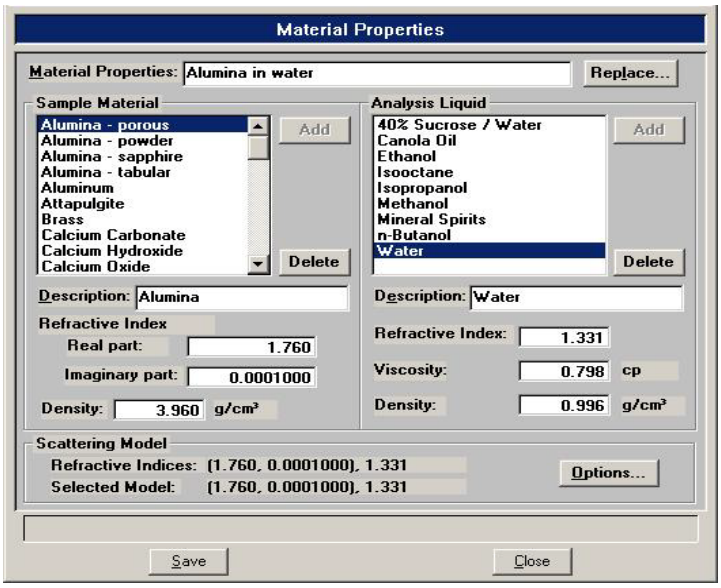
Material properties specify data for the sample material and its dispersant.

Refer to **Material Properties**, page **5-15** for a detailed description of the fields on this dialog.

1. Select **File > Open > Material Properties**; the Open Material Properties dialog is displayed.

2. Enter a name (up to eight characters) in the **File name** field, then click **OK**.

3. Click **Yes** to create the file; the Material Properties dialog is displayed.



4. Enter a description in the **Material Properties** field.

Use an intuitive description, one that will help you identify the type of sample you plan to analyze using these analysis conditions. You may want to use a description that contains the type of sample material and dispersing liquid. For example, Garnet/Water.

5. Choose the sample material from the Sample Material list box. If your material is not listed, add it to the list:

   a. Enter the sample material in the **Description** field.

   b. Enter the real and imaginary portions of the material's refractive index.

   c. Enter the material's density.

   d. Click **Add**.

6. Choose a dispersing liquid from the Analysis Liquid list. If your dispersing liquid is not listed, add it to the list:

   a. Enter the dispersing liquid in the **Description** field.

   b. Enter the refractive index for the liquid.

   c. Enter the viscosity and density for the liquid.

Refer to Appendix D, page D-1 for a list of common dispersing liquids and their density and viscosity values.

   d. Click **Add**.

7. The refractive indices for the sample material (in parentheses) and the dispersing liquid are displayed on the top line of the **Scattering Model** group box. The model chosen by the system is displayed on the second line. Click **Options** to choose a different model or to generate a model for the exact refractive indices selected.

8. Click **Save**, then **Close**.

Report Options

Report options files specify the types of reports which can be generated from an analysis or from manually entered data. They also contain details of the reports such as axis scale, axis range, and column headings. You can specify for reports to be generated automatically after each analysis, or you can generate reports at any time during or after an analysis. A report generated during an analysis only includes data collected up to the time of the report.

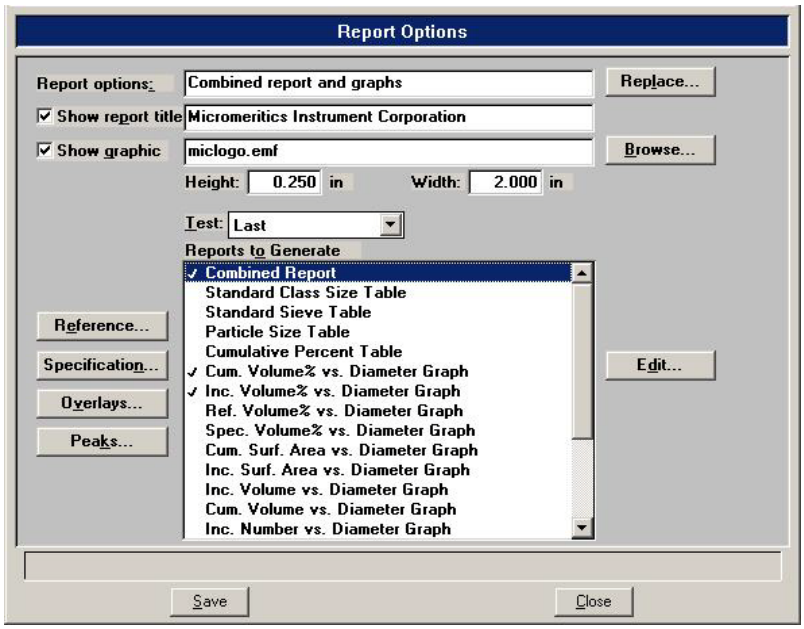
Report options files also may be defined to include three different types of overlays (refer to **Generating Overlays**, page **3-41**).

Refer to **Report Options**, page **5-19** for a detailed description of the fields on this dialog.

1. Select **File > Open > Report Options**; the Open Report Options dialog is displayed.

2. Enter a name (up to eight characters) in the **File name** field, then click **OK**.

3. Click **Yes** to create the file; the Report Options dialog is displayed.



4. Enter a description in the **Report options** field. Enter an identifier which gives a more intuitive description of the file's contents. For example, *Tabular Report using Volume Distribution*.

5. Select **Show report title** and enter the title you wish to appear at the top of the report. Or deselect this option if you do not wish to have a report title.

If your company logo exists as a bitmap (bmp) or an enhanced metafile (emf) file and you wish to have it display in the report header, select Show graphic. Then click Browse to select the file.

6. If you wish to compare analysis results for the current sample to those obtained for a reference sample, click **Reference** and choose a file. Results are reflected in the **Difference from Reference** report.

7. If you wish to determine if the results for the current sample are within coarse and fine specifications, click **Specification** and choose a sample file for each boundary. Results are reflected in the Out of Specification report.

8. If you wish to overlay graphs, click **Overlays** and choose the sample file(s) you wish to overlay with a graph of the current sample. Then be sure you edit the graph and choose **Samples** in the **Overlay** field.

9. Click **Peaks** to choose how peaks are detected.

10. From the **Test** drop-down list, choose the analysis for which you wish to have a report generated.

    - If you select **Average**, an average for all tests will be generated.
    - If you select **All**, a separate report is generated for each test.

11. From the **Reports to Generate** list box, choose the reports you wish to have generated. A report is selected when it is preceded with a check mark. To select (or deselect) a report: highlight the report, then double-click or press **Spacebar**.

12. Click **Edit** for selected reports to specify details; for example, x- and y-axis variables.

13. Click **Save**, then **Close**.

Preparing a Sample For Analysis

A sample must be dispersed properly before it can be analyzed. Refer to Appendix B, page **B-1** for a discussion on sample dispersion and concentration. After the dispersed sample has been loaded into the reservoir, particle dispersion can be maintained using an ultrasonic probe (optional).

Performing an Analysis

There are four different ways in which an analysis (or analyses) may be performed:

- **Sample Analysis**: Used to perform up to eight analyses on a single sample.
- **QuickStart Analysis**: Used to perform a series of samples of the same type with the same analysis conditions; sample files are generated automatically.
- **MasterTech Automatic**: Used to analyze a series of samples of the same type with the same analysis conditions. Sample files are created automatically; samples are transferred from the MasterTech automatically.
- **MasterTech Schedule**: Used to analyze a series of samples which are different and, consequently, require different analysis conditions. Samples files are user-specified; samples are transferred from the MasterTech automatically.

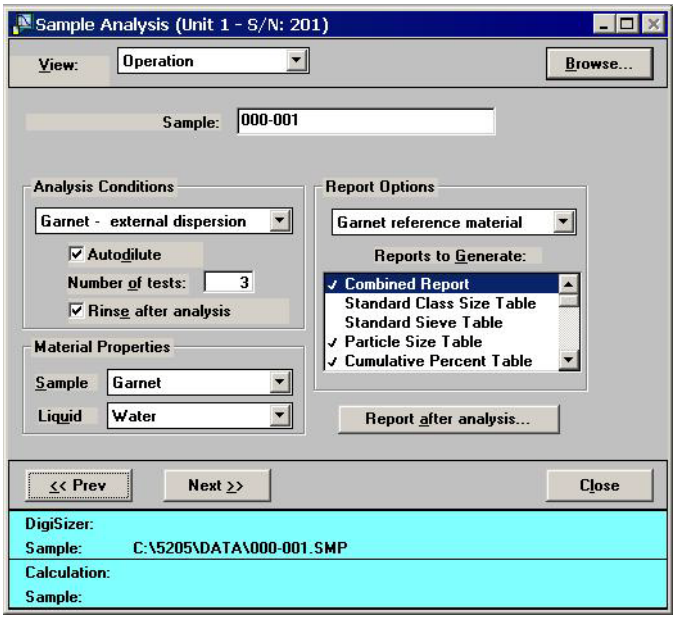
Choose the method you wish to use and proceed accordingly.

Sample Analysis

Refer to **Sample Analysis**, page **6-4** for a detailed description of the fields on this dialog.

Perform the following steps to perform up to eight analyses on one sample.

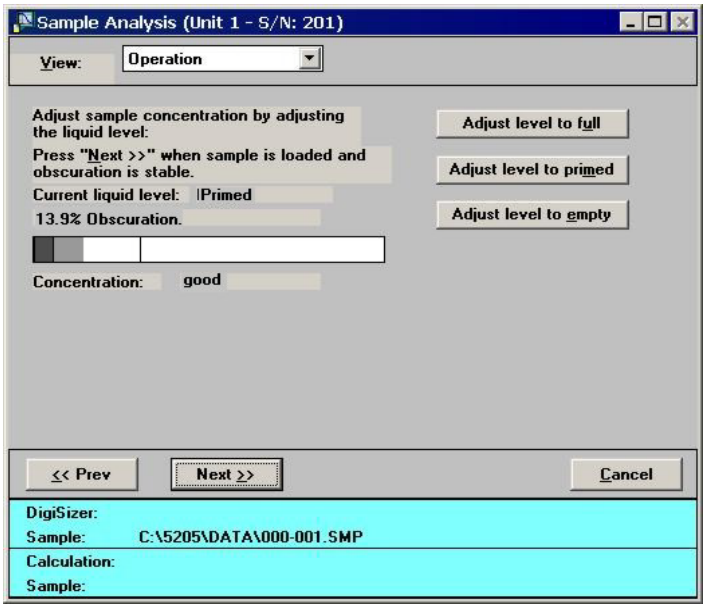
1. Select **Unit [n] > Sample Analysis**; the Sample Analysis dialog is displayed with all fields grayed.
2. Click **Browse** and choose a file for your analysis; the Sample Analysis dialog containing the parameters of the selected file is displayed.



3. Verify analysis conditions and report options; edit if needed.

4. Ensure that the sample material and analysis liquid are correct; if not, use the drop-down list(s) to select the correct one(s).

5. Click **Next**; the beam obscuration view of the Sample Analysis dialog is displayed.



6. While observing the beam concentration, slowly begin to add sample. Add enough sample to achieve the proper range for your material, using the following guidelines:

If your DigiSizer is equipped with the low-volume sample handler, be sure the sample is deposited into the liquid and does not adhere to the sides of the reservoir.

Sample Type (micrometers)	Beam Obscuration
Less than 0.1	4%
0.1 to 1	5% to 10%
1 to 10	10% to 20%
10 to 100	20% to 30%
100 to 1000	30% to 45%

- If the beam obscuration is too high and you have chosen **Autodilute**, the concentration will be adjusted automatically until the correct beam obscuration is achieved.

- If the beam obscuration is too low, continue to add sample.

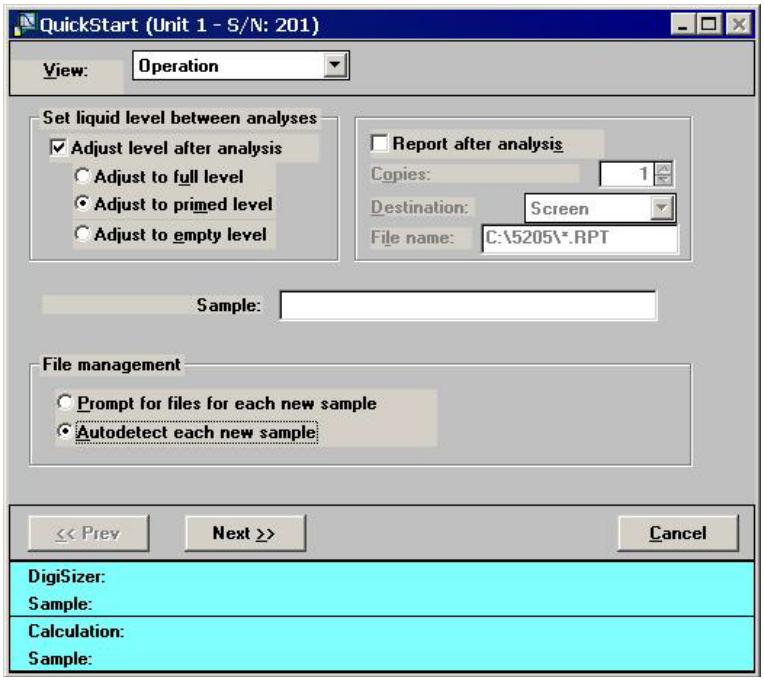
7. Click **Next** when the proper obscuration is achieved to begin data collection.

QuickStart

Refer to **QuickStart**, page **6-10** for a detailed description of the fields on this dialog.

Perform the following steps if you wish to perform analyses on multiple samples using the same analysis conditions.

1. Select **Unit [n] > QuickStart**; the QuickStart dialog is displayed.



2. Choose whether you wish to have the liquid level adjusted after each analysis before loading the next sample; if so, in which state.

   - **Full**: when a maximum quantity of liquid is desired, a flow rate higher than 12 L/min is used, or if you anticipate problems with bubbles.
   - **Primed**: for normal operation and when a limited amount of sample is available, the reservoir will be filled with just enough liquid for circulation to occur.
   - **Empty**: for previously dispersed samples already at the proper concentration.

   If you deselect this option, the system will leave the liquid level unchanged.

3. Select report output:

   a. Enter the number of reports you wish to have generated (enabled when **Printer** is the destination).

   b. Select a destination. If you choose **File**, enter a name in the **File name** field.

4. If you wish to have an identification string for this series of samples different from the one specified in sample defaults, enter a new one in the **Sample** field. Be sure to include the $ symbol if you want the sample file number included as part of the identification.

5. In the **File Management** group box:

   - Choose **Prompt for files for each new sample**; a dialog allowing you to select a file for every new sample is displayed. Analysis proceeds when you add the sample and click **Next**.

   - Choose **Autodetect each new sample**; a file is created by the system using the file name sequence specified in Sample Defaults. The file will also use the same description unless you specified a different one in the previous step. Analysis proceeds each time a new sample is added to the reservoir, creating a sample file automatically.

6. After all analyses are performed click **Cancel** to exit QuickStart mode.

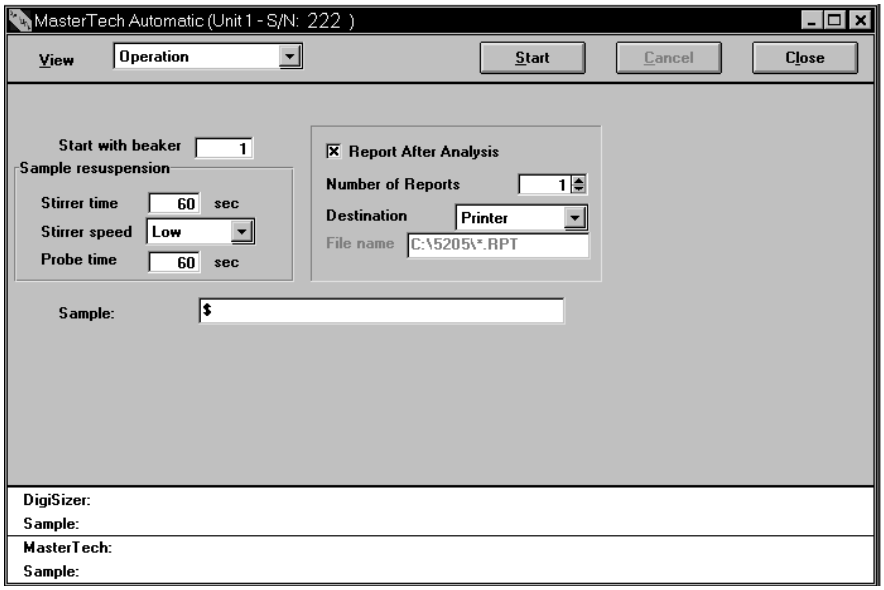
MasterTech Automatic

This option is functional only if you have a MasterTech connected to your analyzer.

Refer to **MasterTech Automatic**, page **6-15** for a detailed description of the fields on this dialog.

Perform the following steps to analyze a series of samples of the same type using the same analysis conditions; sample files are created automatically.

1. Select **Unit [n] > MasterTech Automatic**; the MasterTech Automatic dialog is displayed.



2. In the **Start with beaker** field, enter the position number of the beaker containing the first sample to be analyzed.

3. Enter the stirrer time, stirrer speed, and probe time for sample resuspension.

Samples tend to settle in the beaker while waiting for analysis, especially if several samples are prepared ahead of time. this option allows you to redisperse samples before analysis. Coarse materials and less stable dispersions may require a higher speed as well as more stirring and probe time than finer samples.

4. Select report output:

   a. Enter the number of reports you wish to have generated (enabled when **Printer** is the destination).

   b. Select a destination. If you choose **File**, enter a name in the **File name** field (or accept the default).

5. In the **Sample** field, enter an identification string for this series of samples. Be sure to include the $ symbol if you want the sample file number included as part of the identification. If you do not enter an identification string, the default identification string specified in Sample defaults will be used.

You can also have the beaker number containing the sample included in the sample identification by entering # (number symbol) within the name you specify. For example, Garnet in beaker #.

6. Click to begin analyses; analyses of samples in consecutive beakers will continue as long as a beaker is present in the next beaker position. Be sure to remove used beakers after analysis.

If you wish to view the analyses in progress, select Analysis Results from the View drop-down list.

MasterTech Schedule

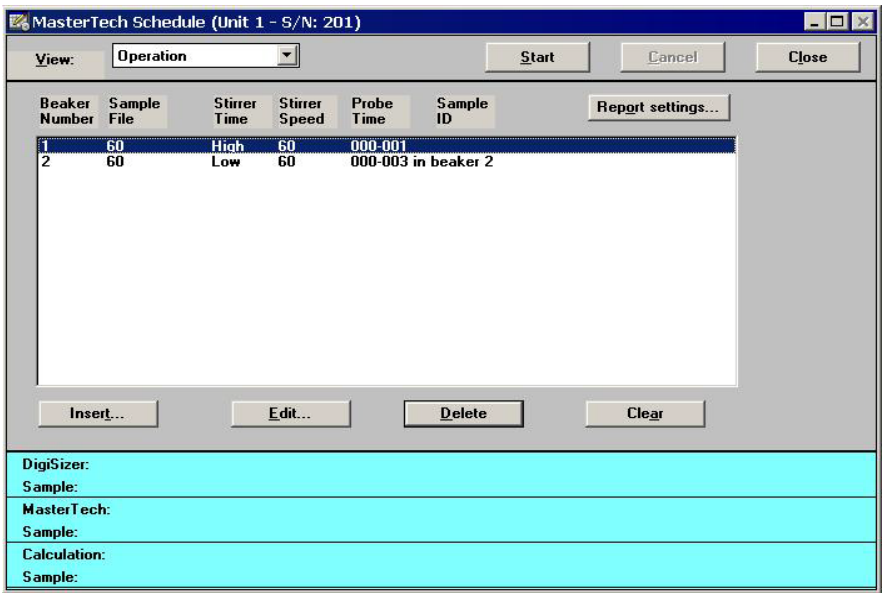
This option is functional only if you have a MasterTech connected to your analyzer.

This mode of operation is used to analyze a series of samples that are different in size and shape and, consequently, require different analysis conditions. You also can schedule background measurements between samples.

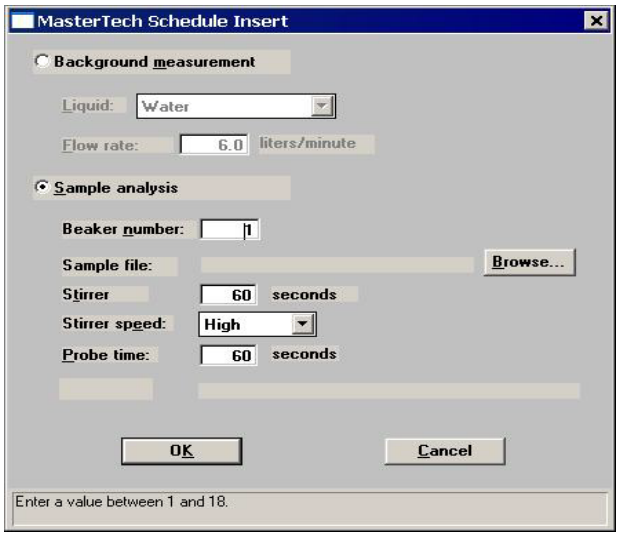
Refer to **MasterTech Schedule**, page **6-18** for a detailed description of the fields on this dialog.

Perform the following steps to use this mode of operation.

1. Select **Unit [n] > MasterTech Schedule**; the MasterTech Schedule dialog is displayed.



2. Click **Insert**; the MasterTech Schedule Insert dialog is displayed.



a. Select **Sample analysis**.

b. Enter the position number of the beaker containing the current sample.

c. Click **Browse** and choose the sample file you wish to use with the sample in this beaker position.

d. The values contained in the fields for **Stirrer time**, **Stirrer speed**, and **Probe time** are copied from the sample file you select. You may change them if you wish.

e. Click **OK**; the MasterTech Schedule dialog again is displayed. Note that the beaker information you just entered is shown in the list box.

3. Repeat step 2 for each beaker containing sample.

You can also insert a background measurement between analyses if desired.

4. Click **Report Settings** if you wish to have reports generated automatically after analysis.

   a. Enter the number of reports you wish to have generated (enabled when **Printer** is the destination).

   b. Select a destination. If you choose **File**, enter a name in the **File name** field (or accept the default).

   c. Click **OK** to close the dialog.

5. Click **Start** to begin the analyses.

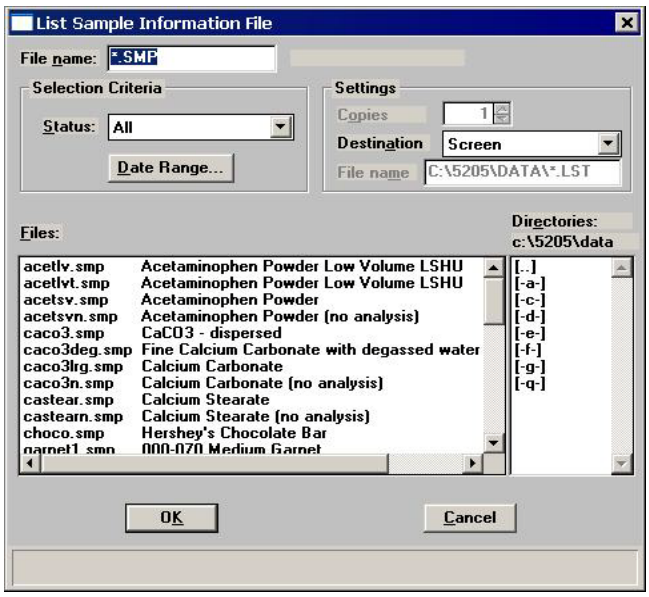
Listing File Statistics

You can generate a list of the following information on one or more files:

- File name
- Date the file was created (or edited)
- Time the file was created (or edited)
- File identification
- File status

Perform the following steps to generate a list:

1. Select **File > List** > [**file type**]; a dialog similar to the one shown below is displayed:



2. From the **Files** list box, choose the desired file(s). If you wish to include all files in the list, leave all files deselected.

3. At the **Destination** field, click on the down arrow and choose a destination for the list output. If you choose **File** as the destination, enter a name in the **File name** field.

4. Click **OK**, a list for the requested file(s) is sent to the specified destination.

Exporting a Sample Information File

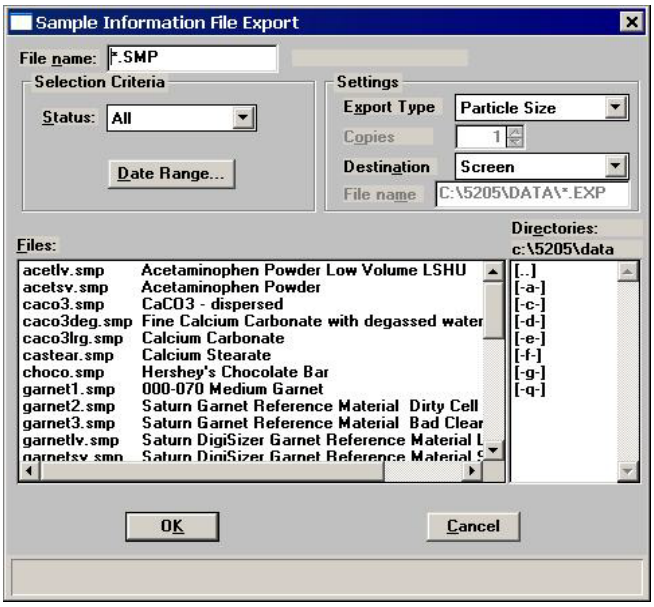
Use the Export option to:

- copy the particle distribution data (**Particle size** option) in a sample information file and export it as ASCII text.
- copy the intensity and background data (**Intensity** option), and export it as ASCII text.

If exported and saved as a file, these data can be imported into applications (such as spreadsheets) accepting ASCII format. Refer to **Appendix G**, page G-1 for exporting format.

Perform the following steps to export a sample information file in ASCII format:

1. Select **File > Export**; the Export Sample File dialog is displayed.



2. From the **Files** list box, choose the file(s) you wish to export by holding down **Ctrl** and clicking on the desired files.
3. From the Settings group box:
   a. Choose the export type; **Particle Size** generates particle distribution data and **Intensity** generates the light intensity vs. scattering angle data, as well as the background.
   b. Choose a destination for your exported file. If you choose **File** as the destination, enter a name in the **File name** field (or accept the default).
4. Click **OK**, the requested file is exported and sent to the specified destination.

Generating Reports

The following types of reports are available with the Saturn DigiSizer analysis program:

- Tabular and/or graphical
- Background
- Statistical process control

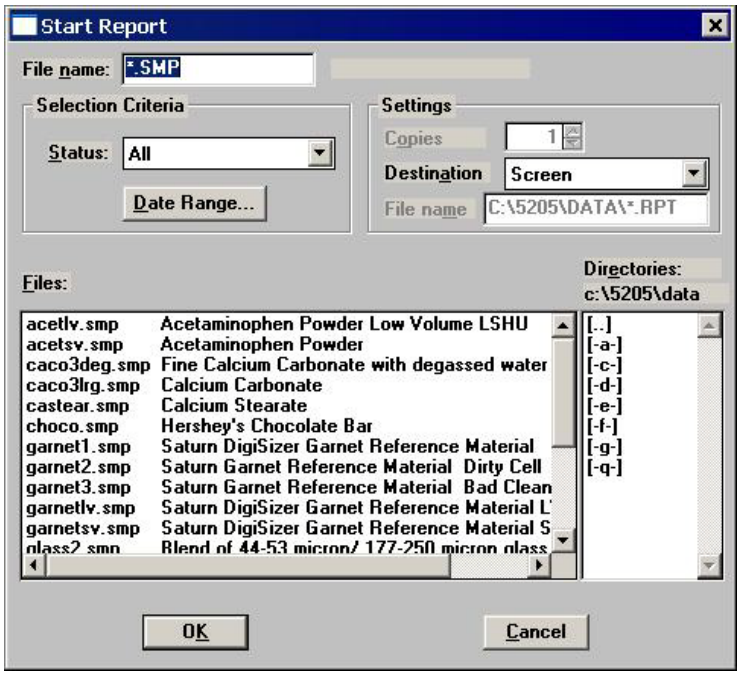
Refer to Chapter 7 for sample reports and ways in which to edit and change the appearance of your report.

Tabular/Graphical Reports

Tabular and graphical reports are generated automatically (if requested) after an analysis. You can also generate reports manually if you simply wish to view a report, print additional copies, or change parameters and reprint.

Perform the following steps to generate reports manually.

1. Select **Reports > Start Report**; the Start Report dialog is displayed.

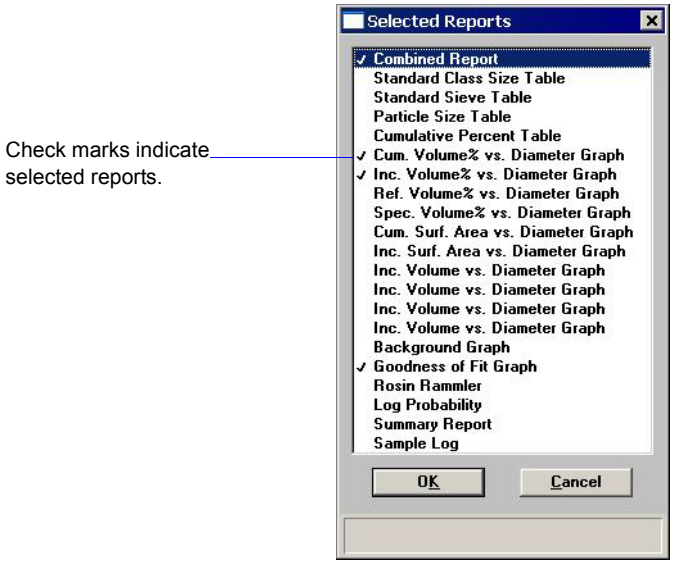


2. From the **Files** list box, click on the name of the file(s) for which you wish to have reports generated.

3. At the **Destination** field, click on the down arrow and choose a destination for report output.

   If you choose **File** as the destination, enter a name in the **File name** field (or accept the default).

4. Click **OK**; the Reports to Generate dialog is displayed if you have selected only one file from the **Files** window.



This dialog allows you to verify or edit report selections. It is not displayed if you have selected multiple files; the reports selected in the files will be generated.

5. Select the report(s) you wish to generate. A report is selected when it is preceded with a check mark. Reports may be selected (or deselected) by double-clicking (or pressing the **Spacebar**) on the desired report.

6. Click **OK**; the selected reports are generated and sent to the specified destination.

If you select a Screen destination, there are many options for manipulating reports. Refer to Onscreen Reports, page 7-20 for information on these options.

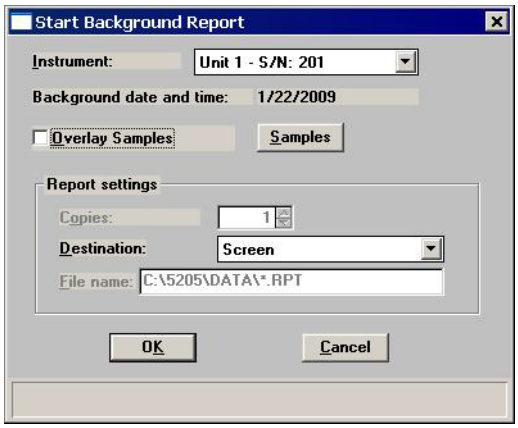
Background Reports

A report can be generated for the instrument's background. This report generates a graph illustrating light intensity versus scattering angle when no sample is present. The header of this report also contains background statistics, such as the unit serial number, date the background was performed, etc.

You can also overlay the current background with backgrounds used with other analyses for reference.

Perform the following steps to generate a background report. Refer to **Background**, page **7-6** for detailed information on this option.

1. Select **Reports > Background**; the Start Background Report dialog is displayed.



2. From the **Instrument** drop-down list, select the instrument on which you wish to have the background report generated.

3. If you wish to compare the current background with backgrounds for a sample (or multiple samples), select **Overlay Samples** and then click **Samples** to select the file(s).

4. At the **Destination** field, click on the down arrow and choose a destination for report output. Since background reports are graphical data, they cannot be printed to a **File**.

5. If you choose **Printer** for the destination, enter the number of reports you wish to have generated; you can print up to four copies.

6. Click **OK**; the background report is generated and sent to the specified destination.

Statistical Process Control Reports

Statistical process control (SPC) reports assist you in maintaining control of a manufacturing process.

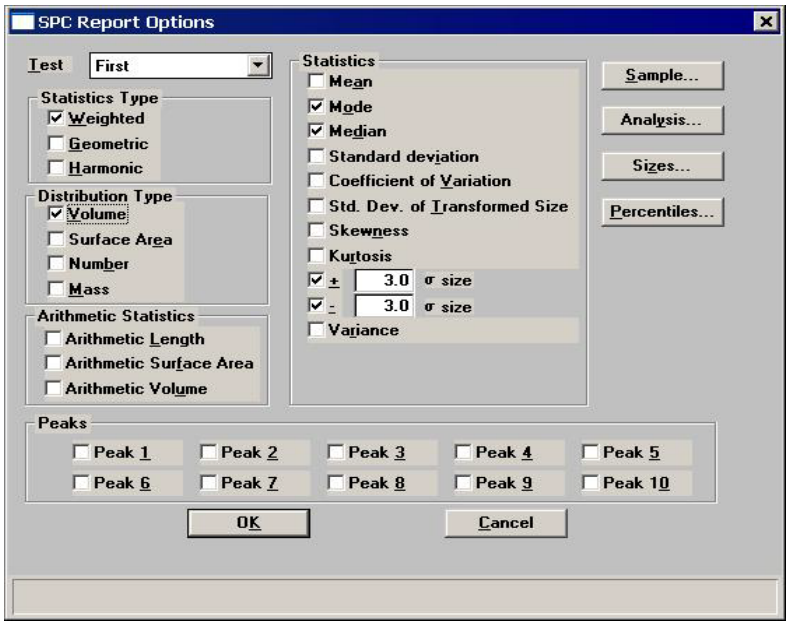
There are three types of SPC reports: Regression, Control Chart, and PSD History. Before you can generate SPC reports, you must specify the calculation parameters to be used. These selections determine what values are available for SPC reporting. For efficiency, it is best to choose only the variables you actually intend to use since all variables selected are computed for each sample file used in an SPC report.

Specifying SPC Options

Refer to **SPC Report Options**, page **7-7** for a detailed description of the fields on this dialog.

Perform the following steps to specify calculation parameters:

1. Select **Reports > SPC Report Options**; the SPC Report Options dialog is displayed.



2. From the **Test** drop-down list, select the analysis on which you wish to report. If you select **Average**, an average of all analyses for the specified sample file is reported.

3. Select the types of statistics you wish to report.

4. Select the type of distribution you wish to apply.

5. Select the arithmetic statistics.

6. From the **Statistics** group box, select the statistics you wish to be included in SPC reporting.

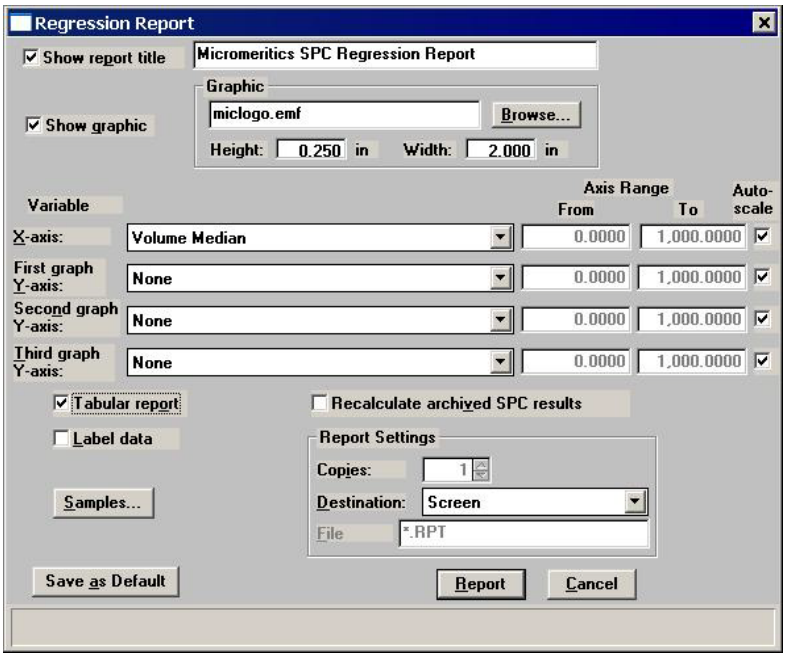
7. Click **Sample** to choose the sample parameters you wish to report.
8. Click **Analysis** to choose the analysis conditions you wish to report.
9. Click **Sizes** to specify the percentiles for the corresponding diameters.
10. Click **Percentiles** to specify the diameters for corresponding percentiles.
11. If peak statistics are desired, select the peaks you wish to include.
12. Click **OK** to save SPC report options.

Generating a Regression Report

Refer to **Regression Report**, page **7-10** for a detailed description of the fields on this dialog.

Perform the following steps to generate a regression report.

1. Select **Reports > Regression Report**; the Regression Report Options dialog is displayed.



2. Select **Show report title** and enter the title you wish to appear at the top of the report (or accept the default). Deselect this option if you do not wish to have a report title.

If your company logo exists as a bmp or emf file and you wish to have it display in the report header, select Show graphic. Click Browse to select the file.

3. Select your X- and Y-axes variables. The variables displayed in these drop-down lists are the ones specified in SPC report options.

4. Deselect **Autoscale** if you do not wish to have data scaled automatically; then enter the desired ranges.

5. Select **Tabular** if you wish to have tabular, as well as graphical, data of the included samples generated.

6. Select **Label** to have the points on the plot correspond with the sample files from which they came.

7. Click **Samples** to choose the files you wish to have reported; you can choose up to 200 files.

8. Select **Recalculate archived SPC results** if you wish to have the SPC statistics recalculated for each of the included sample files. You may wish to use this option when a statistic you have selected is labeled N/A (not available) on the tabular report.

9. Select a destination; if you choose **File**, enter a name in the **File name** field (or accept the default). Remember, if you choose this option, only tabular reports are generated.

You can click Save as Default if you wish to have the selected options become the defaults for Regression reports.

10. Click **Report**; the regression report is generated and sent to the specified destination.

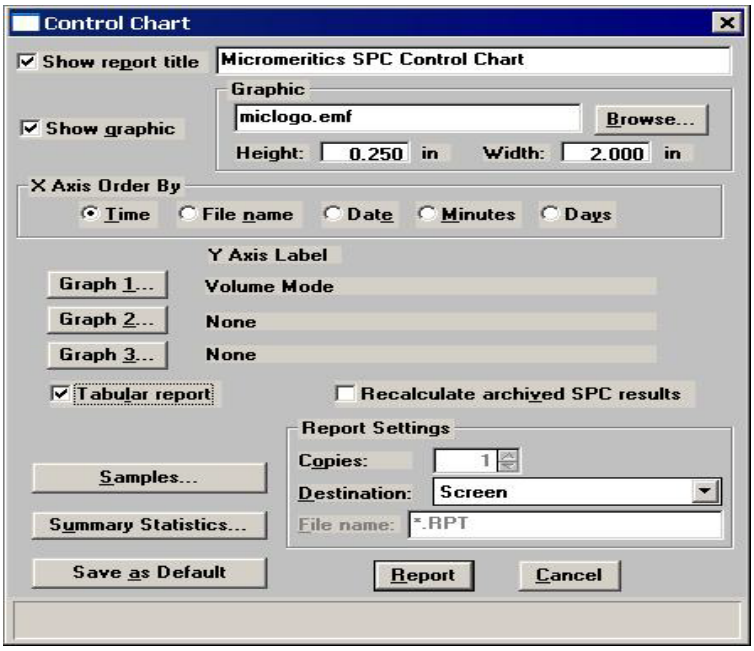
Generating a Control Chart Report

Control chart reports can be generated to illustrate process variations.

Refer to **Control Chart**, page **7-13** for a detailed description of the fields on this dialog.

Perform the following steps to generate a control chart.

1. Select **Reports > Control Chart**; the Control Chart Options dialog is displayed.



2. Select **Show report title** and enter the title you wish to appear at the top of the report (or accept the default). Deselect this option if you do not wish to have a report title.

If your company logo exists as a bmp or emf file and you wish to have it display in the report header, select Show graphic. Click Browse to select the file.

3. Choose whether you wish to have files listed in order by **Time**, **File name**, **Date**, **Minutes**, or **Days**.

4. Click **Graph [n]** to select Y-axis labels.

5. Select **Tabular report** if you wish to have tabular, as well as graphical, data generated.

6. Select **Recalculate archived SPC results** if you wish to have the SPC statistics recalculated for each of the included sample files. You may wish to use this option when a statistic you have selected is labeled N/A (not available) on the tabular report.

7. Click **Samples** to choose the files you wish to have reported; you can choose up to 200 files.

8. Select a destination; if you choose **File**, enter a name in the **File name** field (or accept the default). Remember, if you choose this option, only tabular reports are generated.

9. Click **Summary Statistics** to choose the type of statistics you wish to report.

You can click Save as Default if you wish to have the selected options become the defaults for Regression reports.

10. Click **Report**; the control chart report is generated and sent to the specified destination.

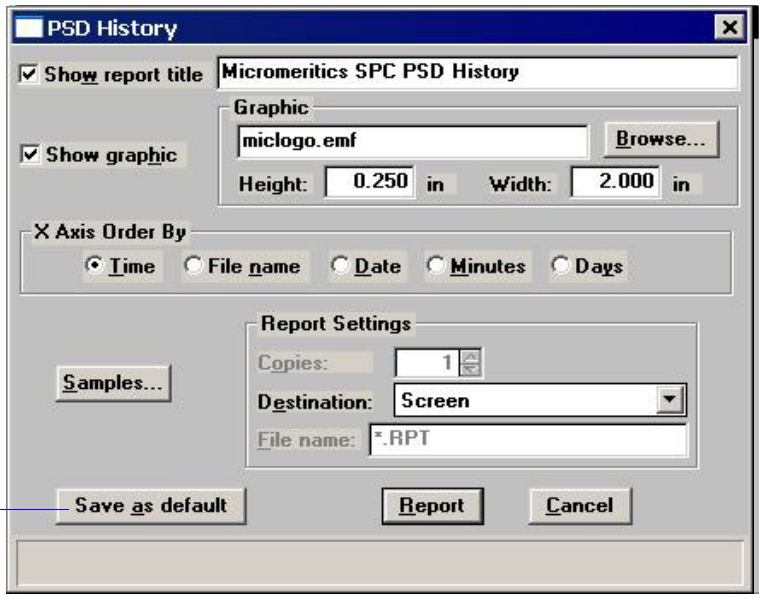
Generating a PSD History Report

PSD History reports allow you to generate a sequence of particle size distributions on up to 200 files.

Refer to **PSD History**, page **7-17** for a detailed description of the fields on this dialog.

Perform the following steps to generate a PSD History report:

1. Select **Reports > PSD History**; the PSD History Options dialog is displayed.



Click this push button to save the current definitions as the default.

2. Select **Show report title** and enter the title you wish to appear at the top of the report (or accept the default). Deselect this option if you do not wish to have a report title.

If your company logo exists as a bmp or emf file and you wish to have it display in the report header, select Show graphic. Click Browse to select the file.

3. Choose whether you wish to have the X-axis order by **Time**, **File name**, **Date**, **Minutes**, or **Days**.

4. Click **Samples** to choose the files you wish to have reported; you can choose up to 200 files.

5. Choose the report destination and click **Report**; the report is generated to the specified destination.

Generating Overlays

Use the overlay function when you wish to compare graphically multiple graph options. Overlays may be generated in three ways:

- **Multiple-Graph Overlay**
  Overlay two different types of plots from one sample
- **Multiple-Sample Overlay**
  Overlay up to eight plots of the same type with the current plot
- **Multiple-Test Overlay**
  Overlay the same plot of all tests in one sample file

Varying symbols are used to differentiate the graphical lines and reported in a legend at the top of the output. If color output is available, different colors are used instead.

It is much easier to generate overlays if you have predefined report options files created for specific overlay functions. For example, if you frequently compare Out of Specification graphs, define a report options file containing the desired options and assign an identification such as Out of Spec Overlays. Then you can use **Replace** to load the predefined file into the sample file. You do not have to save the file to have overlays generated, so the report options for your original sample file remain intact.

Multiple-Graph Overlay

This option enables you to overlay two graphs from the same sample file:

1. Select **File > Open > Sample information**. Then choose the desired sample file. If your window is presented in the Basic format, click **Advanced**.
2. Select the Report Options tab; the report options dialog is displayed.
3. Use one of the following methods:

If...	Then...
You are using a predefined Report Options file:	Click **Replace** and choose the report options file you wish to use.
You are defining report options:	Select which test you wish to use.
	In the Reports to Generate list box, select the graph(s) you wish to overlay with other graph(s).
	Click **Edit** for each requested graph; a Graph Options dialog is displayed.
	From the **Overlay** drop-down list, choose the type of graph you wish to overlay; then click **OK**.

You do not have to save these options to generate the overlays. If you do save, the reports options for your original sample file will be replaced with the new ones.

4. Select **Reports > Start Report**; the Start Report dialog is displayed. Your file should be highlighted and in the **File name** field.

5. Choose your print destination.

6. Click **OK**; the Reports to Generate dialog is displayed, allowing you to change report selection if you wish.

7. Click **OK**; requested overlays are generated and sent to the specified destination.

Multiple-Sample Overlay

To overlay the same type of graph(s) from multiple samples:

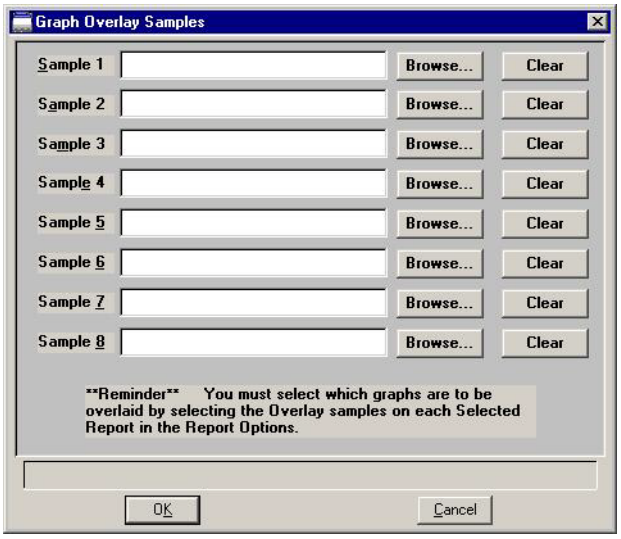
1. Select **File > Open > Sample information**. Then choose the desired sample file. If your window is presented in the Basic format, click **Advanced**

2. Select the Report Options tab; the report options dialog is displayed.

3. Use one of the following methods:

If...	Then...
You are using a predefined Report Options file:	Click **Replace** and choose the report options file you wish to use.
You are defining report options:	From the **Test** drop-down list, select the test you wish to use. The graph(s) you select will be overlaid with the same type of graph(s) of the same test number in the sample file(s) you choose for overlay.
	In the **Reports to Generate** list, select the graph(s) you wish to overlay.
	Click **Edit** for each requested graph; a Graph Options dialog is displayed.
	Ensure that **Samples** is selected in the **Overlays** field.
	Click **OK** to display the Report Options dialog.

4. Click **Overlays**; the Graph Overlay Samples dialog is displayed.



5. Click **Browse**; the Graph Overlay Sample Selection dialog is displayed.

6. Choose the file(s) you wish to use; then click **OK**. You may choose up to eight files in this manner.

You do not have to save these options to generate the overlays. If you do save, the reports options for your original sample file will be replaced with the new ones.

7. Select **Reports > Start Report**; the Start Report dialog is displayed. Your file should be highlighted and in the **File name** field.

8. Choose your print destination.

9. Click **OK**; the Reports to Generate dialog is displayed, allowing you to confirm or change report selection.

10. Click **OK**; requested overlays are generated and sent to the specified destination.

Multiple-Test Overlay

This options enables you to overlay the same type of graph for all tests from the same sample file:

1. Select **File > Open > Sample Information**. Then choose the desired sample file. If your window is presented in the Basic format, click **Advanced**.

2. Select the Report Options tab; the report options dialog is displayed.

3. Use one of the following methods:

If...	Then...
You are using a predefined Report Options file:	Click **Replace** and choose the report options file you wish to use.
You are defining report options:	In the Reports to Generate list box, select the graph(s) you wish to overlay.
	Click **Edit** for each requested graph; a Graph Options dialog is displayed.
	Ensure that **Tests** is selected in the **Overlays** field.
	Click **OK** to return to the Report Options dialog.

You do not have to save these options to generate the overlays. If you do save, the reports options for your original sample file will be replaced with the new ones.

4. Select **Reports > Start Report**; the Start Report dialog is displayed. Your file should be highlighted and in the **File name** field.

5. Choose your print destination.

6. Click **OK**; the Reports to Generate dialog is displayed, allowing you to confirm or change report selection.

7. Click **OK**; requested overlays are generated and sent to the specified destination.

4. SOFTWARE AND SETUP MODIFICATIONS

This chapter provides instructions for:

- Installing the software, beginning on this page
- Using the Setup Program for Other Functions, page **4-8**

You can also install the 5205 analysis program for offline data manipulation on a computer other than the one controlling the analyzer. This allows you to:

- create or edit sample and parameter files
- generate reports on completed sample files

Review the Micromeritics PROGRAM License Agreement for restrictions on the use of another copy of the analysis program.

Installing the Software

Be sure you have completed the following tasks before installing the software for the first time.

- Configure the ethernet port the analyzer will use (refer to **Configuring the Ethernet Port**, page **H-1**)
- Disable the firewall setting for the connection between your computer and analyzer (refer to **Configuring the Firewall Setting**, page **H-7**)
- Connect the analyzer to the configured port and turn the analyzer on.

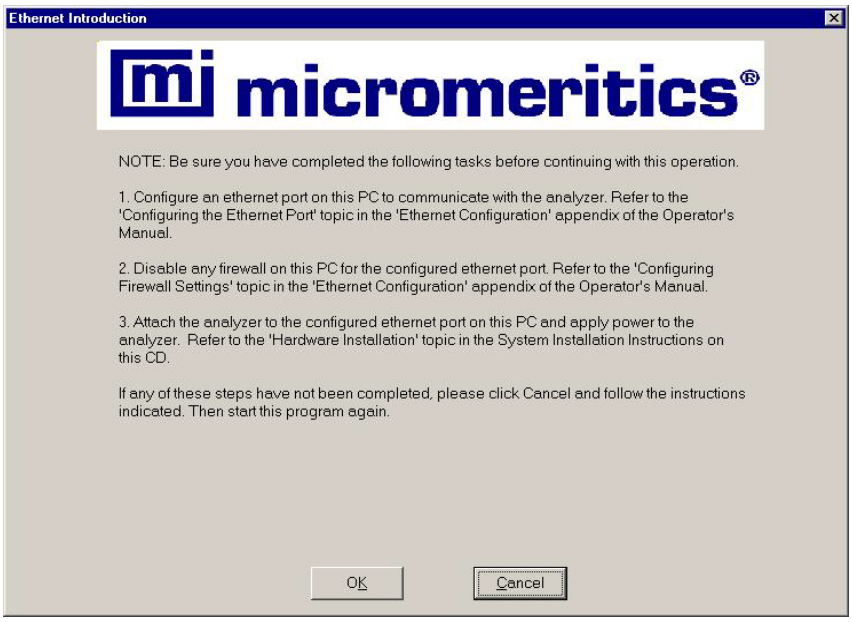
If installing multiple analyzers, connect the ethernet switch to the configured port and the analyzers to the ethernet switch (refer to Ethernet Switch, page 4-11); turn the analyzers on.

Install the program as follows:

1. Turn on the analyzer and the liquid sample handler.
2. Insert the Saturn DigiSizer CD into the CD-ROM drive.
3. Select **Start > Run** from the Windows menu bar.
4. Enter the drive designator for the CD-ROM, followed by **setup**. For example: **e:setup**

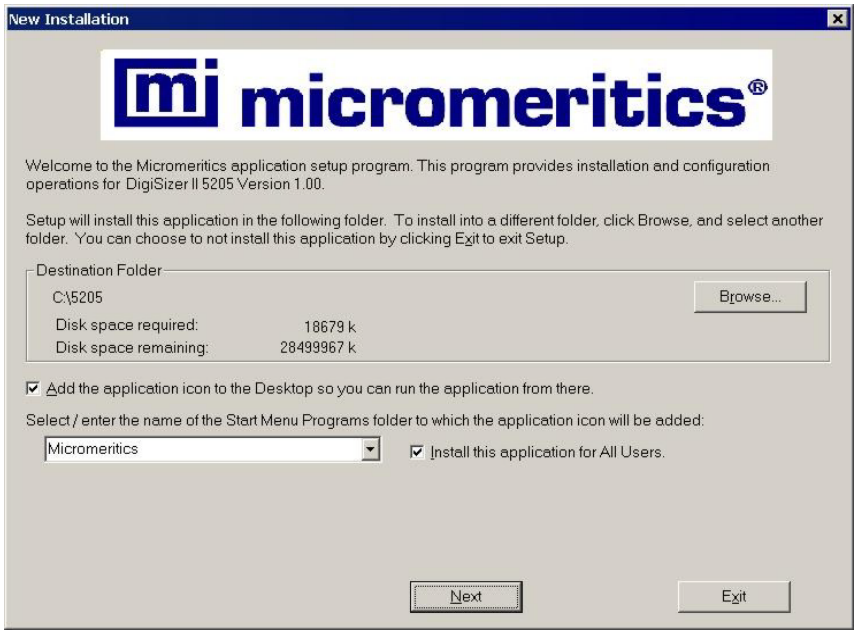
   Alternatively, you can click **Browse**, navigate to your CD-ROM drive, and select **setup.exe**.

5. Click **OK;** the Ethernet Introduction dialog is displayed. This screen outlines the steps that should be completed before installing the software.



If all of the steps have not been completed, click **Cancel** and perform the steps; then restart the installation program. Do not proceed with installation until these tasks have been completed.

6. Click **OK**; the New Installation dialog is displayed.



The **Destination** Folder group box displays the amount of current disk space required for the analysis program, and the directory into which the application will be installed. If you prefer a different directory for installation, click **Browse** to select the desired directory.

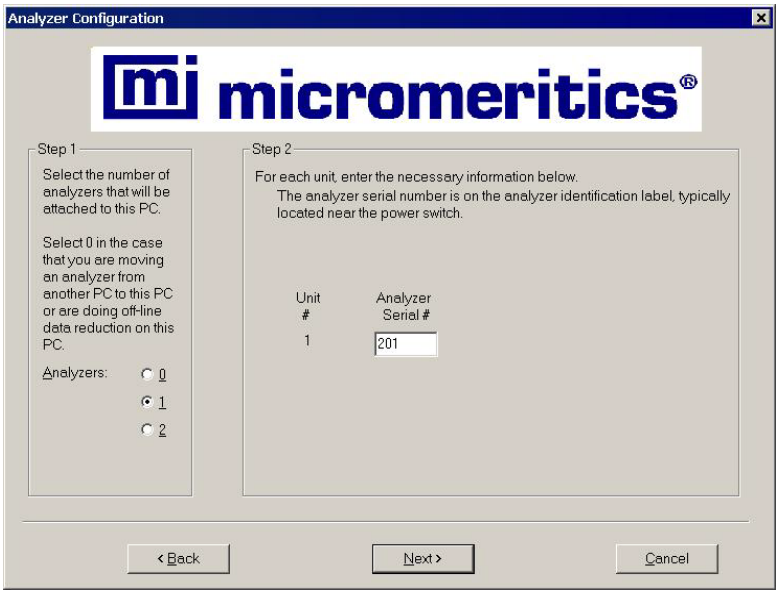
7. Select the check box just below the **Destination Folder** group box to add an icon to your desktop; this enables quick access to the analysis program.

8. The DigiSizer icon is added to the Micromeritics folder by default. If you prefer a different folder, enter or select one from the drop-down list.

9. The **Install this application for All Users** check box enables you to allow or prohibit users other than the installer to access the application.

   - Select the check box to allow access for all users logged onto Windows.
   - Deselect the check box to allow access for only the user installing the application.

10. Click **Next**; the Analyzer Configuration dialog is displayed.

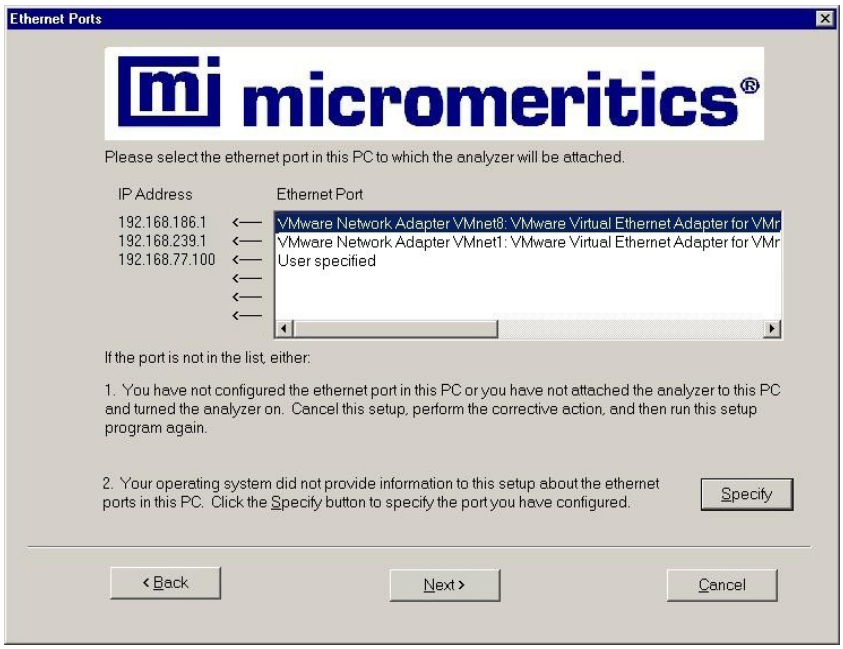


a. In the **Step 1** group box:

If...	Then...
you are installing the analysis program at initial installation:	select the number of analyzers you are installing.
you plan to use the analysis program for offline data reduction:	select **0**
you are moving an analyzer from another computer to this one:	select **0** (Refer to **Moving an Analyzer from One Computer to Another Computer**, page **4-13**.)

b. In the **Step 2** group box, enter the serial number(s) for the analyzer(s) you are attaching to this computer.

11. Click **Next**; the Ethernet Ports dialog is displayed.



12. Choose one of the following:

If	Then ....
the port you configured is listed:	select the port and proceed to the next step.
the port you plan to use has been configured but is not listed:	Click **Specify**, the Specify Ethernet Port dialog is displayed.
	Enter the remaining portion of the IP address in the enabled fields, then proceed to the next step.

13. Click **Next**; the calibration files are installed.

If you selected 0 as the number of instruments to install, calibration files are not installed. the analysis program will install and the model management utility displayed for installation of models.

If you are installing two analyzers, the Calibration File Installation dialog instructing you how to proceed with installation of calibration files for the second analyzer is displayed. Read the instructions carefully; they are restated here.

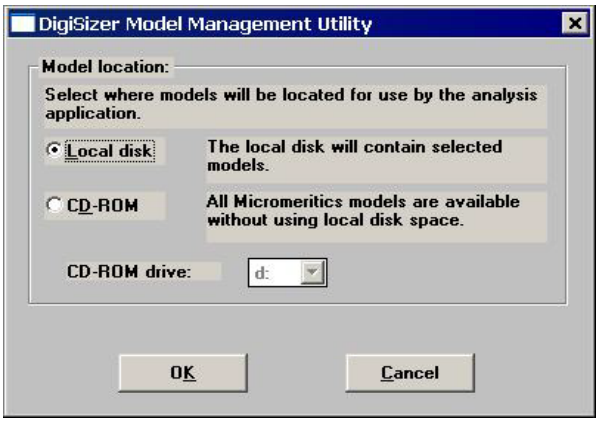
a. Remove this setup CD.

b. Insert the CD containing the files for the analyzer serial number requested.

IMPORTANT: To prevent the CD from AutoPlay, hold down the **Shift** key before you close the CD door. Do not release the **Shift** key until the CD light stops blinking.

c. When the CD lights ceases to blink, click **Next**. After the calibration files are installed, you will be prompted to reinsert the original setup CD.

14. Click **Next**; the Model Management dialog is displayed. Models are collections of data detailing how light is scattered by particles of differing sizes made of a given substance in the liquid chosen to disperse them. Models are used to translate the measured light-scattering pattern into a particle size distribution.



You can also install models using the Model management command on the Options menu in the analysis program. Click Skip if you prefer to install the models at a later time.

Local disk — Allows you to install models to your local drive or to remove models already installed on the local drive.

If you choose to install the models on your local drive, keep in mind that each model uses 1.7 MB of disk space.

Proceed to Step 15 for the **Local disk** option.

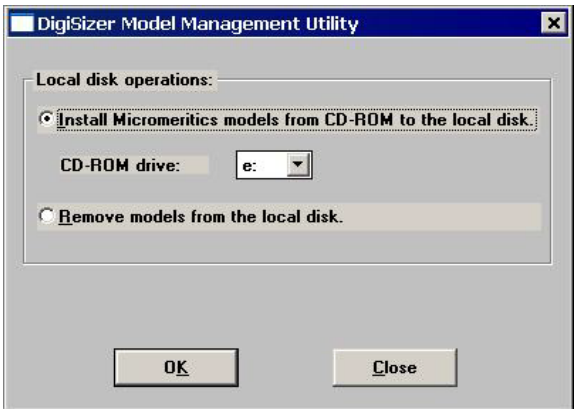
CD-ROM — Allows you to access the models from the CD-ROM drive so that you do not have to use disk space on your local drive. Use the drop-down list to select the drive designator for the CD-ROM drive.

If you choose to use this option, be sure that the CD-ROM is in the drive when the analysis program is in use.

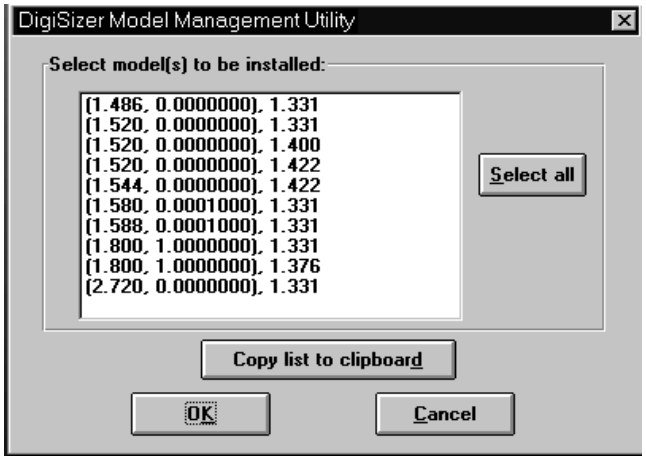
Proceed to Step 16 for the **CD-ROM** option.

15. To install the models on your local drive:

    a. Choose **Local disk**; this dialog is displayed.



    b. Choose **Install Micromeritics models from CD-ROM to the local disk**. Ensure that the appropriate drive designator is displayed as the CD-ROM drive, then click **OK**; a dialog containing the current models is displayed.



    c. Click **Select all** to install all models. Alternatively, you can click on the models you wish to install while holding down the **Ctrl** key.

    d. Click **OK** to copy the models to your local hard disk; each model uses approximately 1.7 MB of disk space. After selected models are installed, a dialog confirming the number of models installed is displayed.

    e. Click **OK**; the Install Complete dialog containing the Readme file is displayed.

    f. Click **Finish**; a dialog informing you to restart Windows may display; if so, select **OK** to have the system restart Windows.

16. To use the models from your CD-ROM drive:

    a. Choose **CD-ROM**; ensure that the correct drive designator is displayed. Be sure to have your analysis program CD inserted in the CD-ROM drive when the analysis program is in use.

    b. Click **OK**; the Install Complete dialog containing the Readme file is displayed.

17. Click **Finish** to close the dialog.

18. Remove the program CD and store in a safe place. The original program CD contains the calibration files specific to your instrument. Upgrade CDs do not contain calibration files. Therefore, it is important that you maintain your original program CD in a secure location in the event calibration files need to be reinstalled.

Using the Setup Program for Other Functions

After initial installation of the DigiSizer analysis program, the application setup program can be used to:

- install software upgrades, page **4-10**
- add an analyzer, page **4-11**
- move an analyzer from one computer to another computer, page **4-13**
- change the analyzer setup, page **4-18**
- remove an analyzer from the computer, page **4-17**
- reinstall calibration files, page **4-20**
- uninstall the analysis program, page **4-21**

To start the application setup program:

1. Ensure that the analysis program is not operating and the analyzer is idle.

2. Insert the CD into your CD-ROM drive.

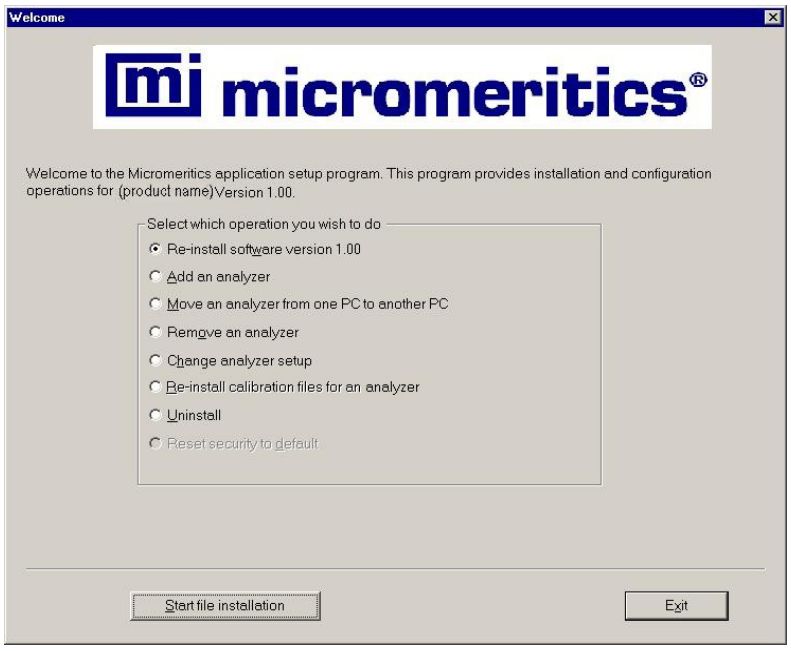
3. Select **Start** from the Status bar, then **Run** from the start menu.

4. Enter the drive designator of the CD-ROM drive, followed by **setup**. For example: **e:setup**

   Alternatively, you can click **Browse**, navigate to your CD-ROM drive, and select **setup.exe**.

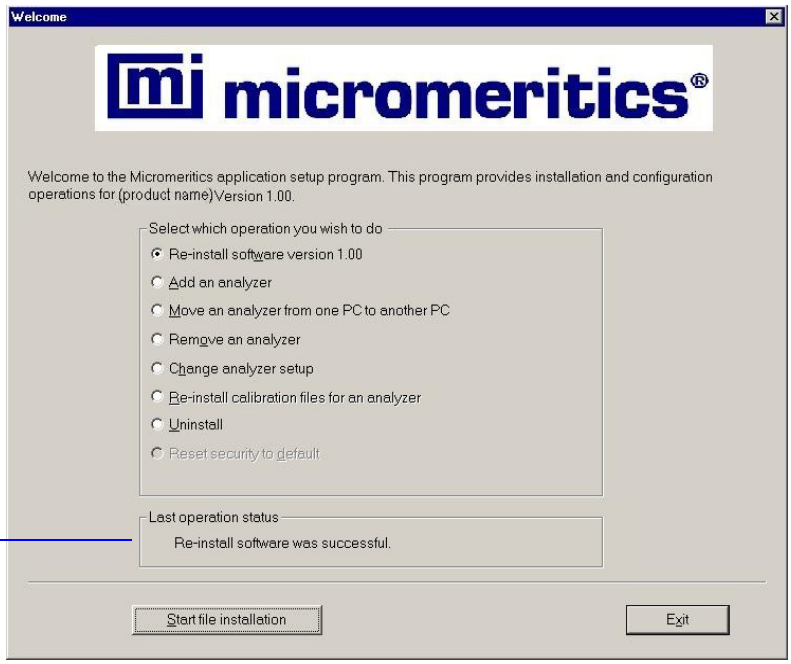
5. Click **OK**; the Setup Welcome screen showing the options available is displayed.

Options available for the DigiSizer program are enabled.



6. Select the operation you wish to perform. Procedures for performing each operation are in subsequent sections.

After the requested operation is completed, the setup Welcome screen is again displayed. A confirmation message indicating completion of the operation is shown in the lower section of the dialog.



7. After you have completed all desired operations, click **Exit** to close the Welcome screen.

8. Remove the CD and store in a secure location.

Installing Subsequent Software Versions

When you install a software upgrade, the system installs all of the application files and any status files that do not already exist on the computer. Existing analyzer status files are not affected and default and data files are not overwritten. There are three types of subsequent installation; the software version controlled by the setup program is:

- a later version than the version installed on the computer
- the same version as the version installed on the computer
- an earlier version than the version installed on the computer

The setup program automatically detects which type of installation applies and customizes the selection in the Setup dialog accordingly.

1. In the Setup dialog, choose the software option. Remember, only the applicable option displays; it will be one of the following:

   - Upgrade software to version (number) from version (number)
   - Reinstall software version (number)
   - Downgrade software to version (number) from version (number)

2. Click **Start file installation**. The application installs the software and the Setup Welcome dialog is displayed.

Adding an Analyzer

An ethernet switch is required when connecting two analyzers. After connecting the ethernet switch, continue with the software section.

Ethernet Switch

An Ethernet switch with a straight-through cable is required when installing multiple analyzers.

1. Connect the power cord of the Ethernet switch to an appropriate power outlet.

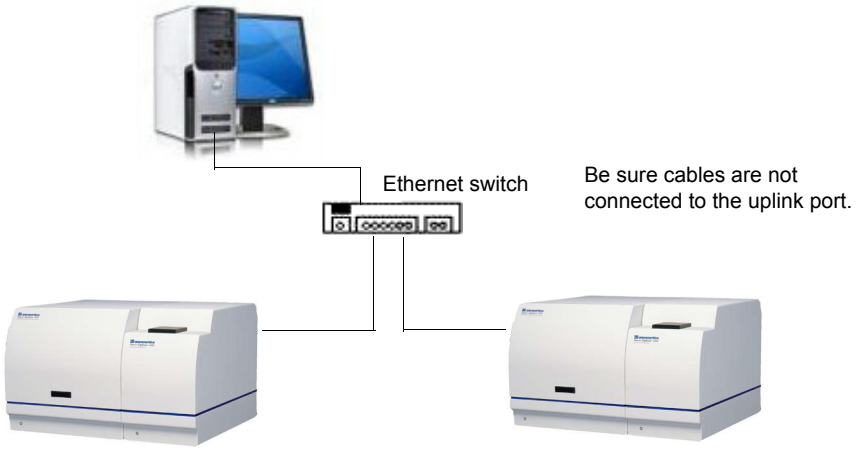
2. Disconnect the ethernet cable of the current analyzer from the computer; do not disconnect it from the analyzer.

3. Connect one end of the straight-through cable to the Ethernet switch and the other end to the computer.

4. Connect the ethernet cable of the current analyzer to a numbered port on the Ethernet switch (do not use the uplink port).

5. Connect one end of the Ethernet cable (for the analyzer you are adding) to the connector labeled **Ethernet** on the rear panel of the analyzer and the other end to a numbered port on the Ethernet switch. Repeat this step for each analyzer you are adding.

   The finished configuration should look like the following illustration.



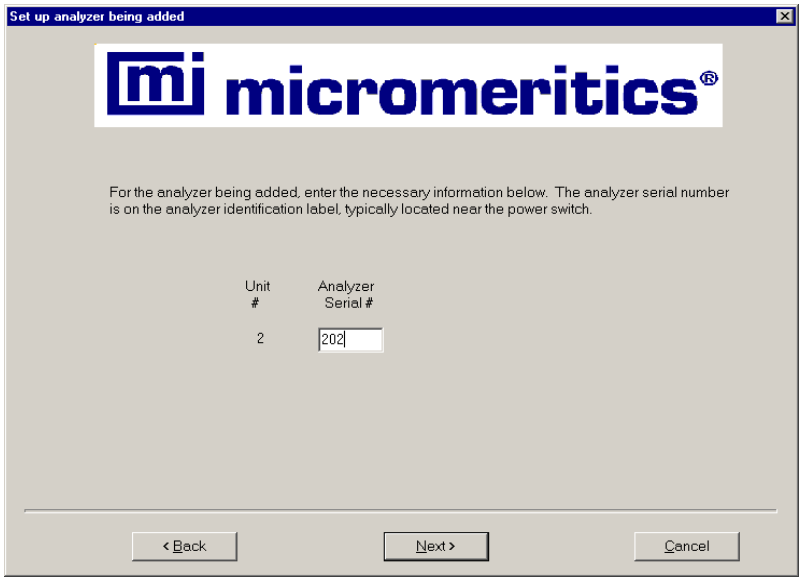
6. Turn on the analyzer that was added. Also ensure that the computer and current analyzer are on.

Software

1. Insert the analysis program CD for the analyzer you are adding into the CD-ROM drive.

2. Start the Setup program (refer to **Using the Setup Program for Other Functions**, page **4-8**).

3. Select **Add an analyzer**, then click **Next**; the Set up analyzer being added dialog is displayed.



You may see the Ethernet Introduction screen. This information is not applicable since you are connecting to an ethernet switch which is connected to a port that has been configured. Click OK to close the screen and proceed.

4. Enter the serial number of the analyzer being added.

5. Click **Next**; the calibration files are installed and the Welcome screen is displayed.

Moving an Analyzer from One Computer to Another Computer

Use the instructions in this section to move a configured analyzer (along with its status, calibration, and log file) from one computer (**Source PC**) to a different computer (**Destination PC**). This operation does not move sample or parameter files. Use a file management program such as Explorer or a backup/restore utility to move these types of files.

Moving a Configured Analyzer to a New Computer

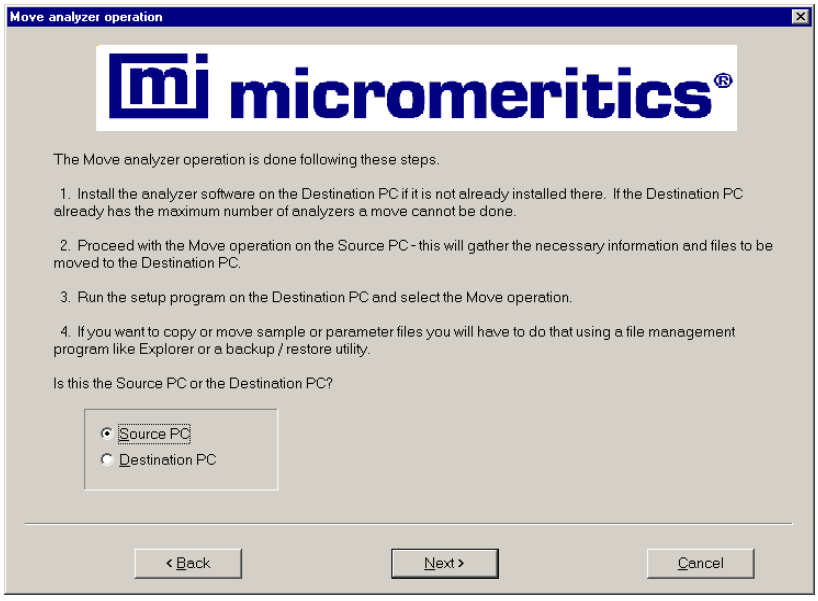
This section provides steps for moving a configured analyzer to a computer that does not have an analyzer installed.

If the analysis program is already installed on the destination computer, begin with Step 2.

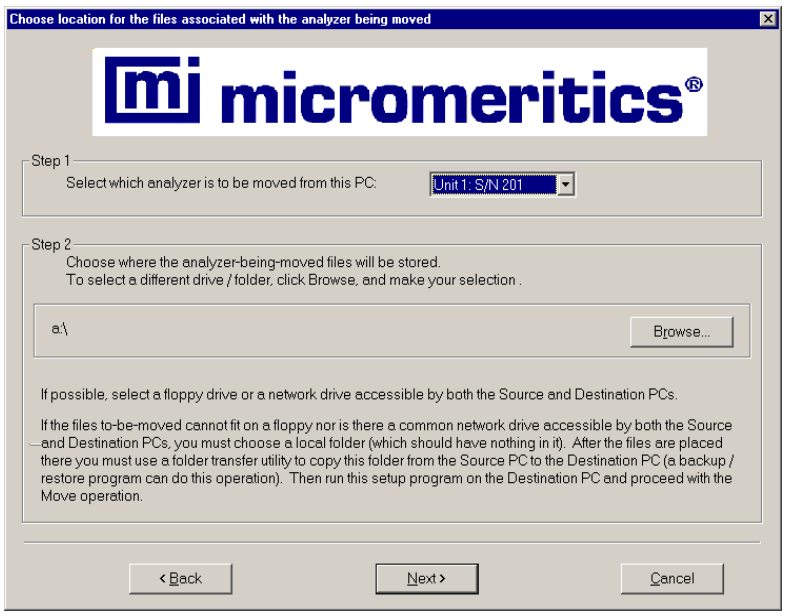
1. Install the analysis program on the **destination** computer (refer to **Installing the Software**, page **4-1**). Be sure to select **0** as the number of instruments on the Analyzer Configuration screen; all related instrument information will be transferred in the **Move** operation.

2. Start the application setup program on the **source** computer (refer to **Using the Setup Program for Other Functions**, page **4-8**).

3. Select **Move an analyzer from one PC to another PC**, then click **Next**; the Move analyzer operation dialog is displayed.



4. Select **Source PC**, then click **Next**; the following dialog is displayed.



5. From the drop-down list in the Step 1 group box, select the analyzer that is to be moved from this computer.

6. In the Step 2 group box, click **Browse** to select a location for storing the status, calibration, and log files associated with the source computer. If possible, the location should be a shared network drive. If this is not possible, select a local folder and then use a transfer utility to copy its contents from the **Source PC** to the **Destination PC**.

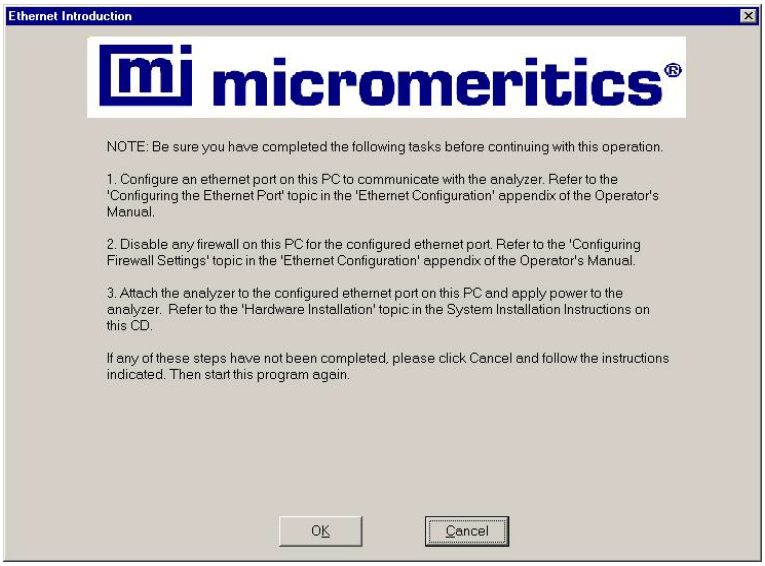
Sample and parameter files are not copied and moved with the analyzer. Use a file management program such as Explorer or a backup/restore utility to move these files.

7. Click **Next**; the files are copied to the specified location and the setup Welcome screen is displayed.

8. Start the Setup program on the **destination** computer.

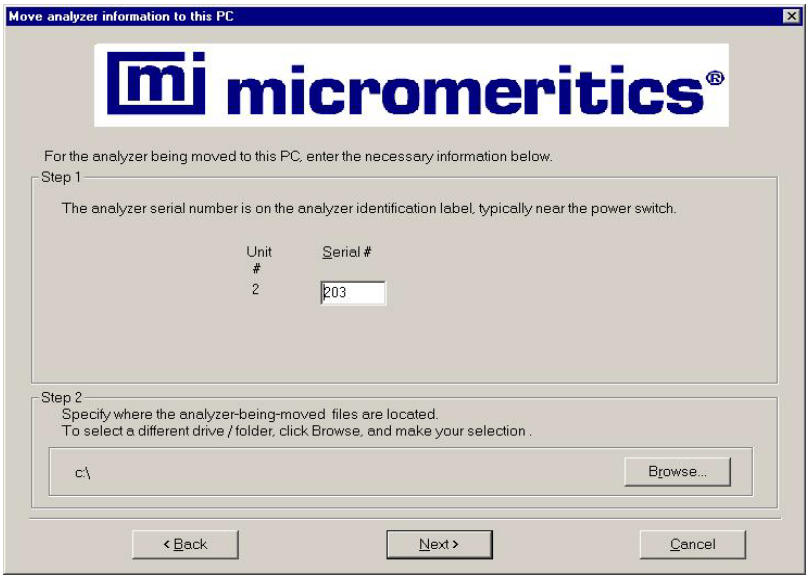
9. Select **Move an analyzer from one PC to another PC**; the Move analyzer operation dialog is displayed (shown on previous page).

10. Select **Destination PC**, then click **Next**; the Ethernet Introduction screen is displayed. This screen outlines the steps that should be completed to configure the ethernet port to which the analyzer is connected to on the computer.



If these tasks have not been completed, click **Cancel** and complete them; then restart the setup program. Do not proceed until the ethernet port in the computer has been configured.

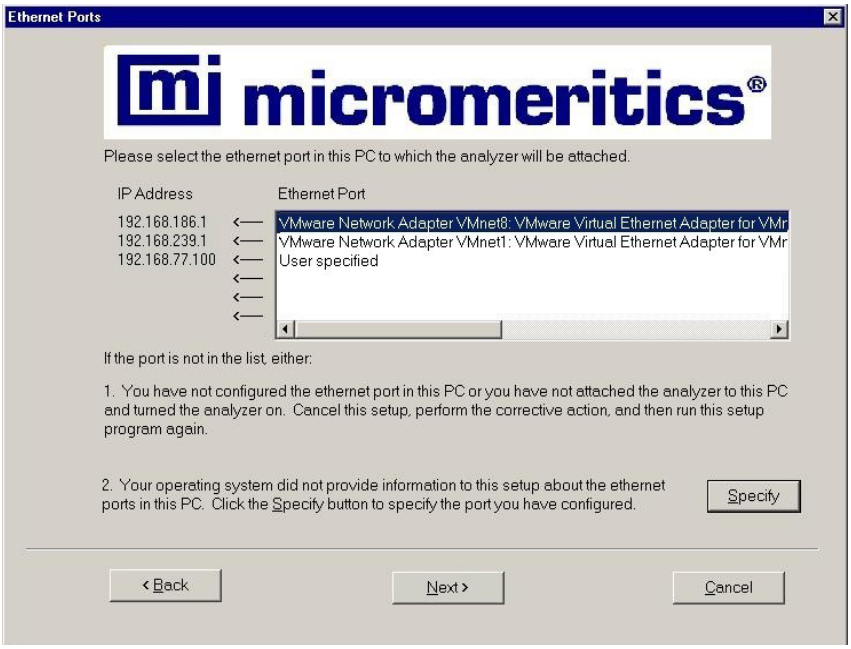
11. Click **OK**; the Move analyzer information dialog to this PC dialog is displayed.



12. In the **Step 1** group box, enter the serial number of the unit you are moving to this computer.

13. In the **Step 2** group box, click **Browse** to choose the location of the files that were stored previously from the **Source** computer.

14. Click **Next**; the files are transferred and the Ethernet Ports dialog is displayed.



Select the desired ethernet port.

15. Click **Next**; the setup Welcome screen is displayed.

16. Turn on the analyzer and start the analysis program.

Moving a Configured Analyzer to a Computer with an Existing Analyzer

This section provides steps for moving a configured analyzer to a computer that already has the analysis program and a configured analyzer installed, this being the second analyzer. When installing two analyzers on one computer, an ethernet switch is required. Refer to **Ethernet Switch**, page **4-11**.

1. Perform Steps 2 through 7 (steps for **Source** computer) of the procedure **Moving an Analyzer from One Computer to Another Computer**, page **4-13**.

2. Disconnect the Ethernet cable of the analyzer from the **Source** computer (or Ethernet switch). Reconnect the cable to the Ethernet switch for the **Destination** computer. You must use a switch when attaching multiple analyzers.

3. After ethernet connections have been established, return to page **4-14** and begin with Step 8 (steps for **Destination** computer). You will not see the Ethernet Ports dialog (Step 13) since an ethernet port has already been assigned.

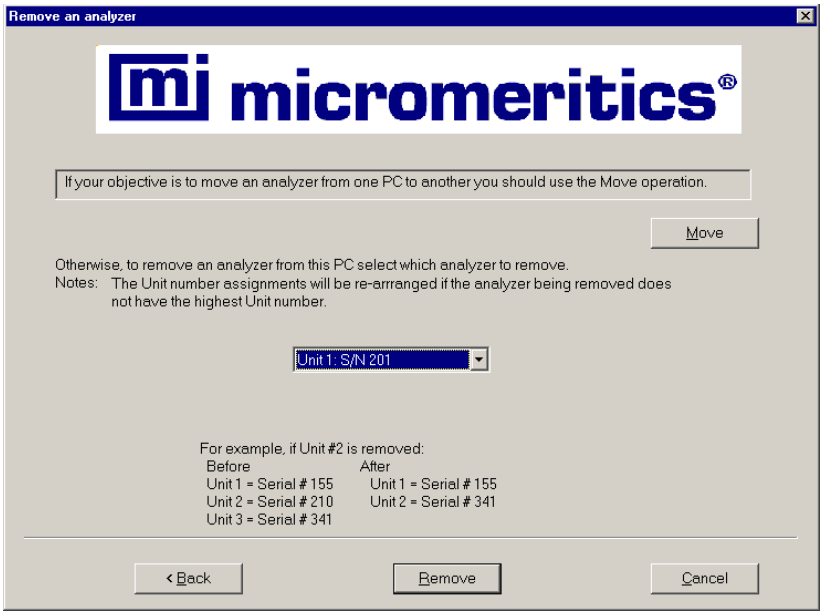
4. Turn on the computer, the liquid sample handlers and the analyzers, then start the analysis program.

Removing an Analyzer

You can remove an analyzer from the system as follows. When you do so, the system removes the calibration and status files from the computer.

1. Start the Setup program (refer to **Using the Setup Program for Other Functions**, page **4-8**).

2. Select **Remove an analyzer**, then click **Next**; the Remove an analyzer dialog is displayed.



3. From the drop-down list, choose the serial number of the analyzer you wish to remove.

This operation removes the selected instrument from the list of attached instruments. It does not remove calibration and status files associated with the analyzer, nor does it remove sample and parameter data files.

4. Click **Remove**; the analyzer is removed and the Welcome screen is displayed.

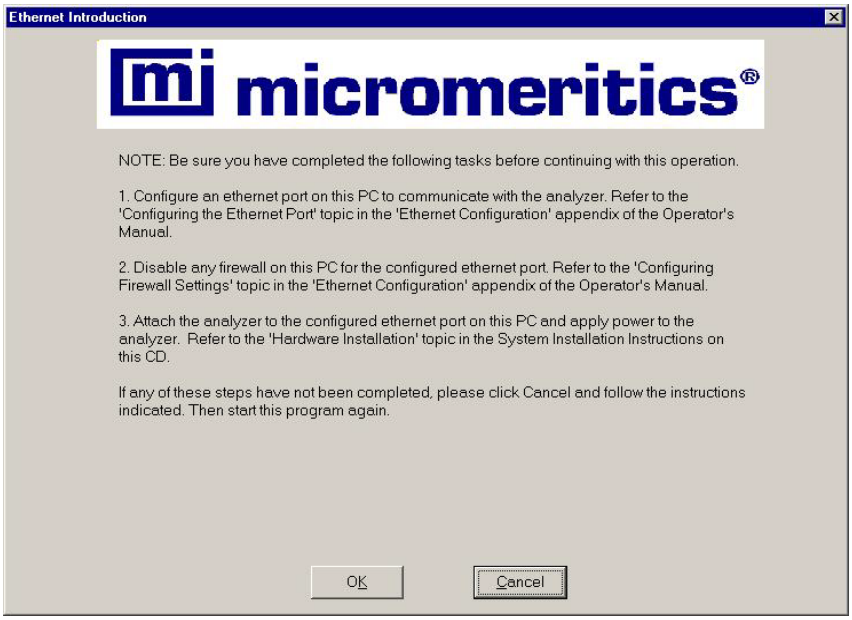
Changing the Analyzer Setup Configuration

This option allows you to change the ethernet port being used by the analyzer(s). For example if the current ethernet port malfunctions, you would use this option to move the analyzer to another ethernet port.

Be sure that the ethernet port you are switching to has been configured and the firewall setting between the computer and the analyzer is turned off. Refer to **Configuring the Ethernet Port**, page **H-1** and **Configuring the Firewall Setting**, page **H-7**.

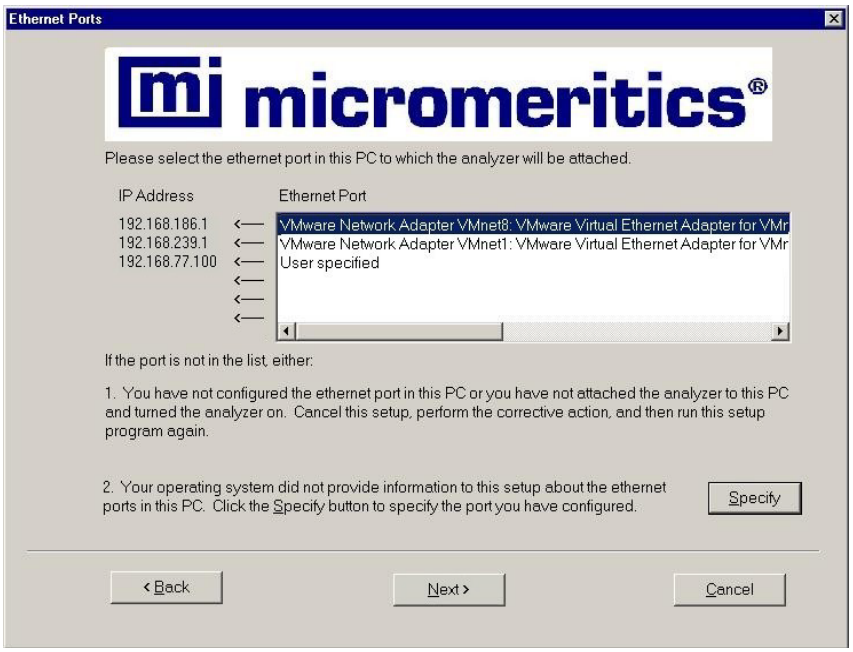
1. Start the Setup program (refer to **Using the Setup Program for Other Functions**, page **4-8**).

2. Select **Change analyzer setup**, then click **Next**; the Ethernet Introduction screen is displayed. This screen outlines the steps that should be completed to configure the ethernet port to which the analyzer will be connected.



If these tasks have not been completed, click **Cancel** and complete them; then restart the setup program. Do not proceed until the ethernet port in the computer has been configured.

3. Click **OK**; the Ethernet Ports dialog is displayed.



4. Choose one of the following:

If	Then ....
the port you plan to use is listed:	select the port and proceed to the next step.
the port you plan to use has been configured but is not listed:	Click **Specify**, the Specify Ethernet Port dialog is displayed.
	Enter the remaining portion of the IP address in the enabled fields, then proceed to the next step.

5. Click **Next;** the change is completed and the Welcome screen is displayed

Reinstalling Calibration Files

Calibration files specific to the analyzer are contained on the original program CD; they are not contained on an update CD. It is important that you store your original program CD in a safe location. CDs containing calibration files will always end with a suffix of **99**. Update CDs end with a suffix of **00**.

Reinstall calibration files as follows:

1. Using the CD containing the appropriate calibration files, start the Setup program (refer to **Using the Setup Program for Other Functions**, page **4-8**).

2. Select **Re-install calibration files for an analyzer**, then click **Next**:

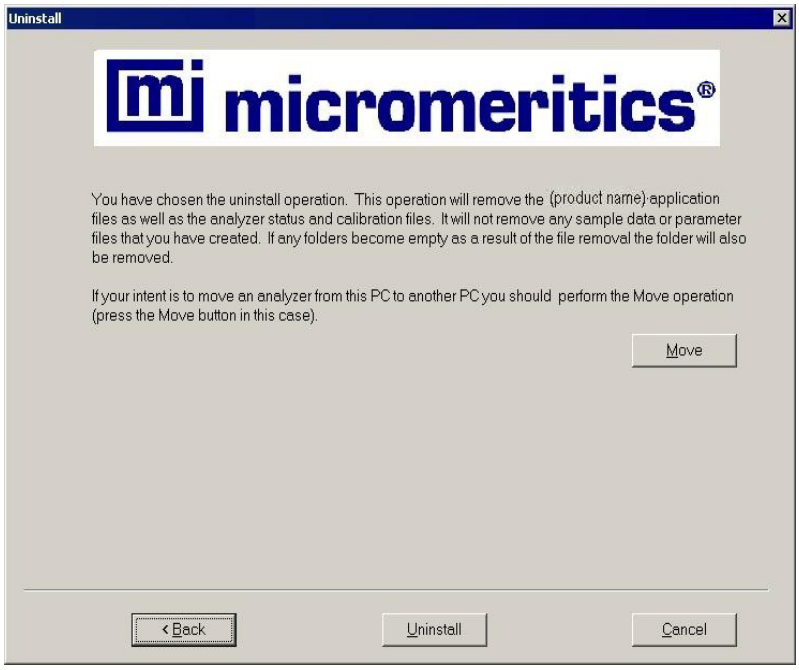
If	Then ....
you have only one analyzer installed	the calibration files are installed and the Welcome screen is displayed.
you have multiple analyzers installed, a dialog enabling you to choose the desired analyzer is displayed.	select the appropriate analyzer, then click **Next**; the calibration files are installed and the Welcome screen is displayed.

Uninstalling the Analysis Program

You can remove the DigiSizer analysis program as follows. When you perform this operation, the application removes the analysis program, status files, analyzer setup files, and resulting empty directories. It does not remove data files.

1. Start the Setup program (refer to **Using the Setup Program for Other Functions**, page **4-8**).

2. Select **Uninstall**, then click **Next**; the Uninstall dialog is displayed.



3. Click **Uninstall**; the Select Uninstall Method dialog is displayed.

5. FILE MENU

The File menu contains commands which allow you to manage sample and parameter files.

Description

Listed below are brief descriptions of the File menu commands. Detailed descriptions follow this section.

Open — Enables you to open an existing sample or parameter file, or to create a new one. Page **5-3**.

Save — Saves the file in the active window. Page **5-38**.

Save As — Allows you to save the file in the active window under a different name. It also can be used to save a subset of the sample file as a parameter file. Page **5-38**.

Save All — Saves all open files. Page **5-39**.

Close — Closes the file in the active window. Page **5-39**.

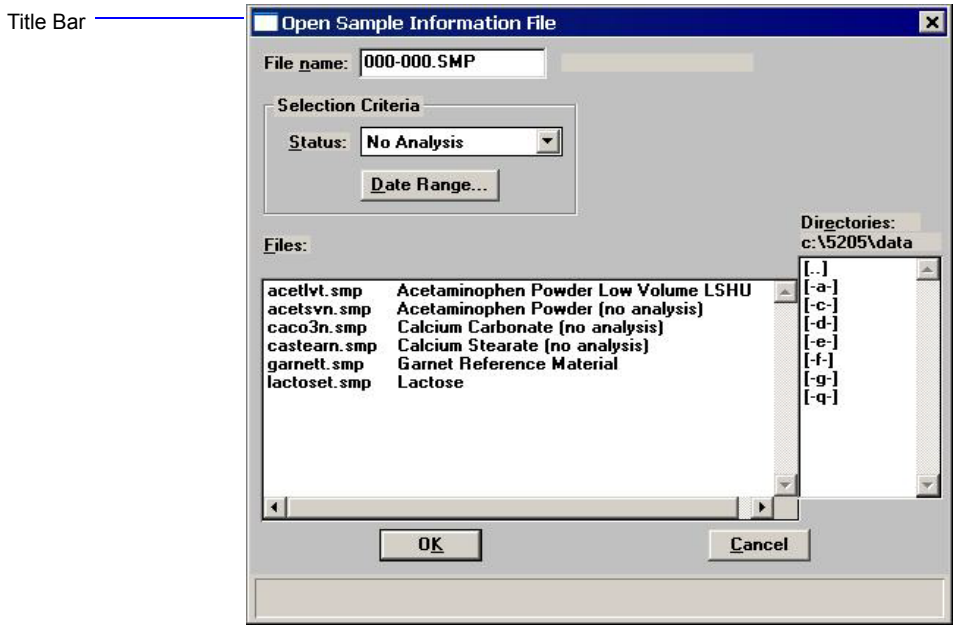
Close All — Closes all open files. Page **5-39**.

Print	Enables you to print the contents of a sample or parameter file. Page **5-40**.
List	Generates statistics for a sample or parameter file. Page **5-42**.
Export	Exports a sample file in ASCII format. Page **5-44**.
Exit	Exits the analysis program. Page **5-46**.

Open

Select **Open** to open an existing sample or parameter file, or to create a new one.

The Open dialog is common to all file types. The title bar will display the type of file you are opening. The example shown here is a Sample Information File.



File name

For *sample information files*, this field contains the next sequenced file name generated by the system in the format specified in Sample Defaults.

- **To create a file**: accept the default or enter an appropriate name and click **OK**.
- **To open a file**: select the desired file from the **Files** window and click **OK**.

For *parameter files*, this field contains the wild card (*) and a default extension:

- **To create a file**: enter an appropriate name (up to eight characters) and click **OK**.
- **To open a file**: select the desired file from the Files: window and click **OK**.

Refer to **Selecting Files**, page **2-15** for a description of the options in the Selection Criteria group box.

Sample Information

Sample information files contain information used to control the analysis, as well as collected or manually entered data. You must assign a sample information file to every analysis. You can also edit an existing sample information file. A sample information is comprised of the following:

- sample identification
- analysis conditions
- material properties
- report options
- collected (when an analysis is complete) or entered data

Portions of the sample file can also exist as standalone parameter files. These parameter files contain frequently used analysis conditions, material and dispersant properties, and report options which may be conveniently loaded into a new sample information file. They can also be edited if required.

Sample information files are presented in three formats:

- **Advanced**
  Presents all parts of the sample information file in a tabbed dialog. Each tab opens its associated dialog.

- **Basic**
  Presents all parts of the sample information file as a single dialog. With this format, you can quickly create a sample information file using previously defined analysis conditions and report options files.

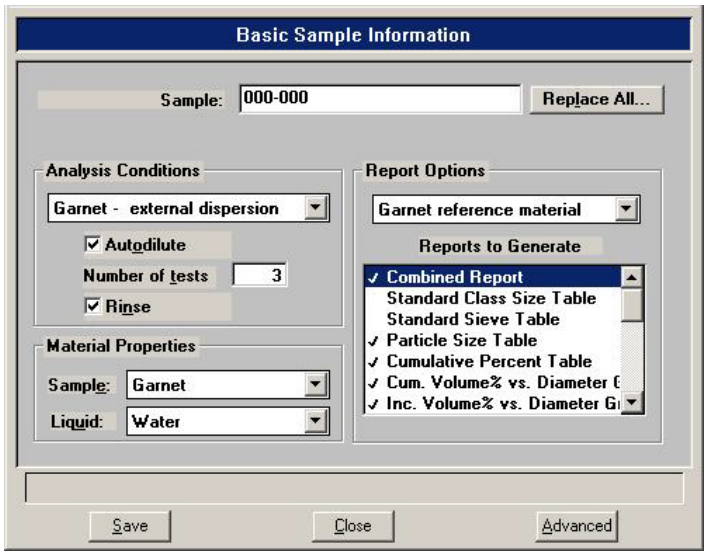
- **Restricted**
  This format is identical to the Basic format except that you cannot switch to the Advanced format for editing and certain functions are disabled.

Select **Options > Options Presentation** to specify the format most suitable for your laboratory's use.

Basic

The Basic format displays all parts (parameters) of the sample information file on a single dialog. This format allows you to create a sample information file using predefined parameter files. It is quick, easy, and the most popular format among Saturn DigiSizer users. If you wish to view or edit specific parameters of the sample file, you can switch easily to the Advanced format by clicking **Advanced**.

Refer to **Basic and Restricted Formats**, page **3-12** for step-by-step instructions on creating a sample information file using the Basic format.



Sample

Contains the description of the current sample file.

If this is a new file, this field contains the next sequenced file description based on the format you specified in Sample Defaults.

You can enter a new description or add to the existing one if desired.

Range: 50 alphanumeric characters

Replace All

Click this push button to replace all parameters of the current sample file with those from another one.

Analysis Conditions

Contains the name of the current Analysis Conditions file.

If this is a new file, this field contains the name of the file you specified as the default.

Click on the down arrow to choose a different file. This list contains previously defined parameter files; those included with the analysis program as well as any you may have created specifically for your laboratory.

This list is disabled for files which have been used for an analysis (**Complete** status).

Autodilute

Enables monitoring of the sample's concentration and adds liquid as needed to attain the appropriate concentration before analysis and data collection begin.

Number of tests

Enter the number of analyses you wish to perform using this sample file; you can perform up to eight tests with one file.

Rinse

Allows rinsing of the cell, the tubing, and the reservoir after each analysis. We recommend this option remain selected. If you deselect this option and rinses are not performed after analysis, inaccurate results may be obtained on subsequent analyses.

Sample

Displays the type of sample material that was analyzed using the current file.

If this is a new file, this field contains the name of the material you specified as the default.

Click on the down arrow to choose a different sample material from the list.

Add sample materials to the list by switching to the Advanced format.

Liquid

Displays the dispersing liquid used in the analysis for the current file.

If this is a new file, this field contains the dispersing liquid you specified as the default.

Click on the down arrow to choose a different liquid from the list.

Add dispersing liquids to this list by switching to the Advanced format.

Report Options

Contains the name of the current Report Options file.

If this is a new file, this field contains the Report Options file you specified as the default.

Click on the down arrow to choose a different file. This list contains previously defined parameter files; those included with the analysis program as well as any you may have created specifically for your laboratory.

Reports to Generate

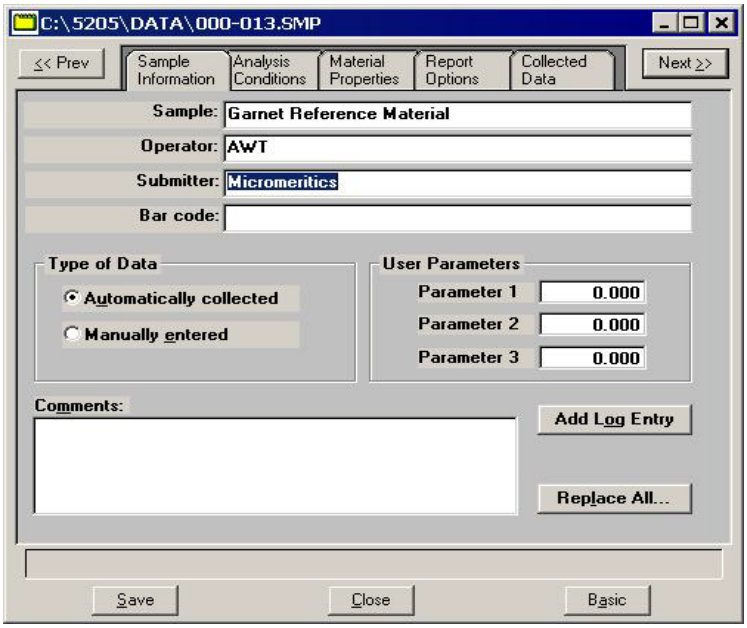
Displays a list of available reports. The reports selected for the current Report Options file are preceded with a check mark (✓).

Certain parameters of some reports can be edited by switching to the Advanced format.

Advanced

The Advanced format displays the sample information file in a tabbed dialog. Each parameter is accessed by clicking its tab. You can also use **Prev** and **Next** to move through the dialogs. This format allows you to customize sample files.

Refer to **Advanced Format**, page **3-14** for step-by-step instructions on creating a sample information file using the Advanced format.



The prompts for the **Sample**, **Operator**, **Submitter**, and **User Parameter** fields may be customized by selecting **Options > Sample Defaults**. Refer to **Sample Defaults**, page **8-6** for instructions on customizing these prompts.

Sample

Contains the description of the current sample information file.

If this is a new file, this field contains the next sequenced file description based on the format specified in Sample Defaults (see Chapter 8).

You can enter a new description or add to the existing one if desired.

Range: *50 alphanumeric characters*

Operator
Submitter

Displays the **Operator** and **Submitter** names (if specified) of the current sample file.

If this is a new file, these fields contain the names specified in Sample Defaults.

You can enter a different name for either (or both) fields if desired.

Range: 40 characters

Bar code

This field enables you to enter bar code information. If bar code information is not used, you can use this field to enter additional information about the sample; for example, you may wish to enter the lot number of your sample. This field can also be omitted in Sample Defaults if it is not needed.

This field will also accept data from a bar code reader.

Range: 40 characters

Type of Data

Displays the type of data for the current sample file.

If this is a new file, choose whether you wish to have data collected automatically or whether you wish to enter data.

User Parameters

These fields are used primarily for SPC (Statistical Process Control) reporting. However, they can be used for other data as well. You may wish to enter specific analysis conditions or sample criteria. These parameters print on the Options report. Select **Options > Sample Defaults** to specify the parameters you wish to report. The parameter(s) you specify replace the User Parameter label(s).

If SPC reporting is not desired, these fields can be omitted from the sample information file.

Comments

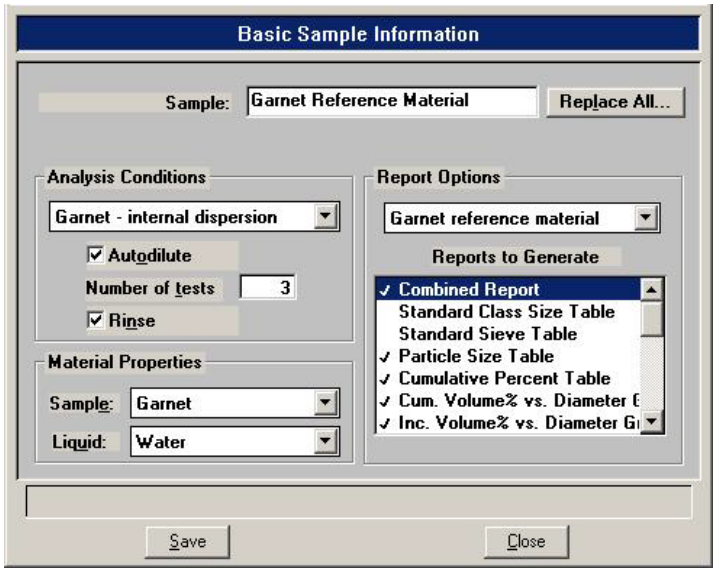
Allows you to enter comments about the sample or its analysis conditions. Anything you enter in this window is printed in the header of the report.

Add Log Entry Allows you to enter comments about the sample or its analysis conditions. Anything you enter using the dialog displayed by this push button appears in the Instrument Log Report; it does not display in the report header.

Replace All Click this push button to replace all parameters of the current sample file with those from another one.

Restricted

A third format is provided to control access to some portions of the sample information file. The Restricted format displays in the same manner as the Basic presentation format.



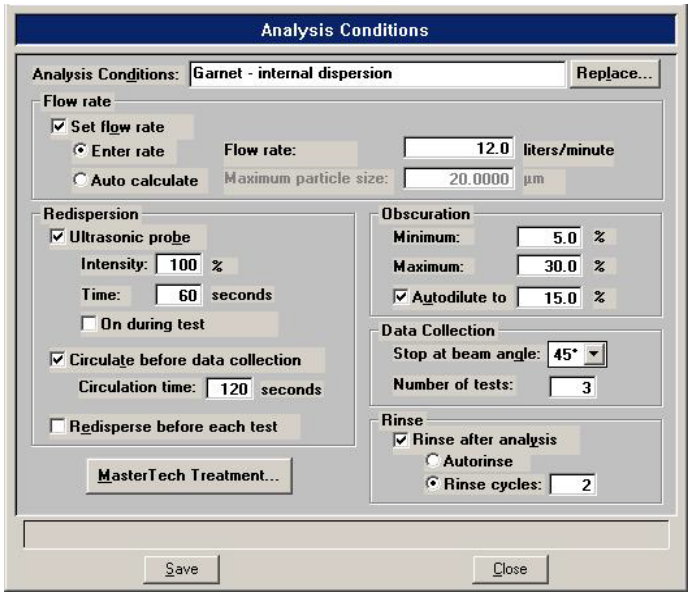
This format displays in the same manner as the Basic format; however, you cannot switch to the Advanced format for editing.

The fields on this dialog are identical to the ones on the Basic Information dialog except that this dialog does not contain an Advanced push button allowing you to switch to the Advanced format. This format is also password-protected, preventing the operator from making changes to file parameters. Refer to **Restricted**, page **8-4** for additional information on the Restricted format.

Restricted presentation is ideal for laboratories in which standard analysis procedures are established by a lab manager, while one or more lab technicians actually perform the analyses. The lab manager can create independent parameters files containing standard sets of operating conditions, then the operator(s) can use Restricted mode for daily operations, selecting the standard parameter files from the drop-down lists.

Analysis Conditions

The Analysis Conditions dialog allows you to specify analysis conditions for your sample. You can create an Analysis Conditions file as an independent parameter file or include it as part of the sample information file. The dialog shown here is for creating a standalone file.



Analysis Conditions

Contains the description of the current Analysis Conditions file.

If this is a new file, this field contains the name you specified as the default.

You can enter a new description or add to the existing one if desired. Be sure to use an intuitive name (perhaps one that characterizes the analysis conditions) so that it can be easily recognized when needed.

Range: 40 alphanumeric characters

Replace

Allows you to replace the values in the current analysis conditions file with those from an existing file. A dialog is displayed so that you may select the desired file. Click **OK**; the values are copied into the new file automatically.

Flow rate group box

Displays the flow rate conditions for the current sample file.

If this is a new file, use the options in this group box to specify flow rate requirements.

Set flow rate

Select this option to enter a flow rate or have the flow rate calculated automatically.

Select **Enter**; the **Flow rate** field is enabled so that you can enter a specific flow rate.

Select **Auto calculate**; the **Maximum particle size** field is enabled so that you can enter the estimated maximum particle size of your sample. This enables you to set a flow rate large enough so that no sampling error (due to a slow flow rate) is introduced.

If you deselect this option, the previous flow rate (typically, from the previous analysis) is used.

Redispersion group box

Displays redispersion parameters for the current sample file.

If this is a new file, use the options in this group box to specify redispersion parameters.

Ultrasonic probe

Select this option if you are using an ultrasonic probe.

In the **Intensity** field, enter the percent of intensity at which to have the ultrasonic probe operate. In the **Time** field, specify how long the sample is to be agitated before each analysis. Or you can select **On during test** to have the probe operate during analysis.

Coarse materials and less stable dispersions may require more agitation than finer materials.

Circulate before data collection

Circulates the analysis liquid through the system after you have added the sample. Enables the **Circulation time** field so that you can enter how long the sample circulates before analysis and data collection begin.

Redisperse before each test

Redisperses the sample just before each test (analysis) is performed. You can perform up to eight tests with one sample file.

Obscuration

Displays details of the beam obscuration criteria.

Minimum
Maximum

These fields allow you to specify a recommended range for the beam obscuration. The range you specify will be used on the obscuration bar graph during sample loading. Refer to **Appendix B**, page **B-1** for guidelines on appropriate obscuration levels for various particle sizes.

Autodilute to

Allows monitoring of the sample's concentration and adds liquid as needed to attain the appropriate concentration before analysis and data collection begin.

Data Collection

Specify the beam angle at which to stop data collection.

- Lower beam angles produce shorter analysis times.
- Lower beam angles can be used for samples that do not contain small particles.
- Higher beam angles allow smaller particles to be detected.

Generally, the default of 45º is suitable for most samples unless a significant quantity of the material has particle size less than 0.3 micrometers; if this is the case, 65º is recommended.

Number of tests

Enabled when the current file has not been used for its maximum number of analyses. Enter the number of tests (analyses) you wish to perform using this sample file; you can perform up to eight tests with one file.

Rinse after analysis

Deselect this option if you wish to examine the reports before proceeding with, perhaps, further tests on the file or further dispersion. If this is the case, however, you should perform a rinse using the option on the **Unit [n]** menu or select a sample file and enable the **Rinse after analysis** option to prepare for the next analysis.

Select this option to rinse the cell, the tubing, and the reservoir after each analysis.

Autorinse

Rinses the system until a beam obscuration of 0.1 or less is attained.

If your analysis and rinse liquids are the same, rinsing stops when:

- No significant decrease in beam obscuration is attained twice in a row, displaying an error message.
- The system has performed 10 rinses and was unable to attain 0.1 or less; an error message is displayed.

If your analysis and rinse liquids are different, rinsing stops when:

- Successive rinses show no significant decrease in beam obscuration. If the beam obscuration is greater than 1.0, an error message is displayed. If less than 1.0, it is assumed to be due to the difference in liquids and operation continues.
- The system has performed 10 rinses and was unable to attain a beam obscuration of less than 0.1, displaying an error message.

Rinse cycles

Allows you to specify an exact number of rinses to perform.

MasterTech Treatment

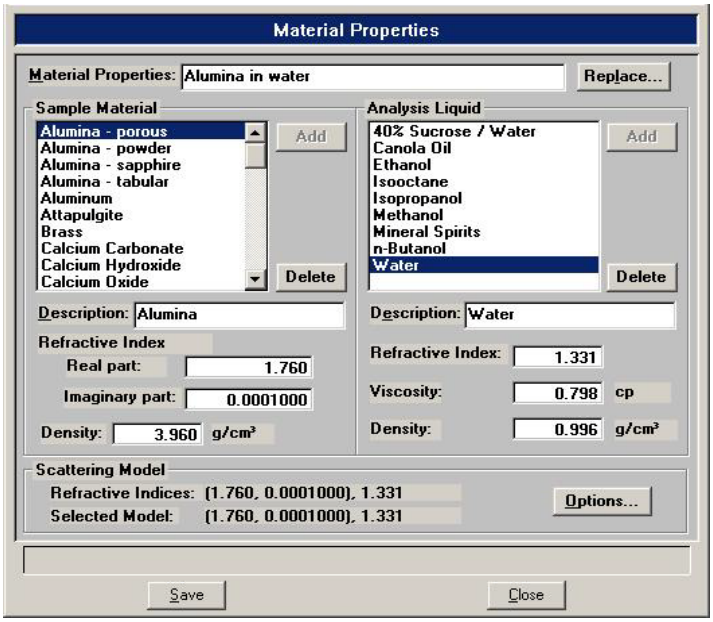
Displays the Mastertech Treatment dialog so that you can specify the stirrer time, stirrer speed, and probe time for the MasterTech.

Samples tend to settle in the beakers while waiting for sample analysis, especially if they are prepared in advance (as in most cases when using a MasterTech). The options in this dialog allow you to program the MasterTech stirrer and probe to redisperse the sample prior to analysis.

This option is applicable only if a MasterTech is being used in the analyses.

Material Properties

This dialog allows you to specify the properties of the sample material being analyzed and the dispersing liquid in which it is dispersed. A Material Properties file can be created as an independent parameter file or included as part of the sample information file.



Material Properties

Contains the description of the current Material Properties file.

If this is a new file, this field contains the description you specified as the default.

You can enter a new description or add to the existing one. Be sure to use an intuitive name (one that characterizes the material properties) so that it can be easily recognized when needed.

Range: 40 alphanumeric characters

Replace

Allows you to replace the values in the current analysis conditions file with those from an existing file. A dialog is displayed so that you may select the desired file. Click **OK**; the values are copied into the new file automatically.

Sample Material Displays a list of available sample materials. After you select a sample material from the list, its description and properties are displayed.

Description Displays the sample material you select from the list. This field is also used to add sample materials to the list.

Refractive Index Displays the real and imaginary portions of the refractive index for the selected material.

Density Displays the density of the selected material.

Add Enables you to add sample materials to the list

- In the **Description** field, enter the name of the sample material you wish to add.
- In the **Density** field, enter the density of the material you are adding.
- In the **Refractive Index** fields, enter the real (Re) and imaginary (Im) portions of the refractive index.
- Click **Add**.

Density and refractive index values can be obtained from a laboratory handbook.

Add This push button is also used to change density and/or refractive index values for a sample material.

- Select (highlight) the sample material you wish to edit.
- Enter the new value(s) in the appropriate field(s).
- Move the mouse pointer to another field; note that **Add** changes to **Change**.
- Click **Change**; the values are changed.

Delete Deletes the selected sample material from the list.

Analysis Liquid

Displays a list of available analysis (dispersing) liquids. After you select a liquid from this list, its description and properties are displayed.

Description

Displays the analysis liquid you select from the list. This field also is used to enter the name of analysis liquids you wish to add to the list.

Refractive Index

Displays the refractive index (real portion) of the selected analysis liquid.

Viscosity

Displays the viscosity of the selected analysis liquid.

Density

Displays the density of the selected analysis liquid.

Add

Enables you to add analysis liquids to the list.

Analysis liquids are added in the same manner as sample materials.

Delete

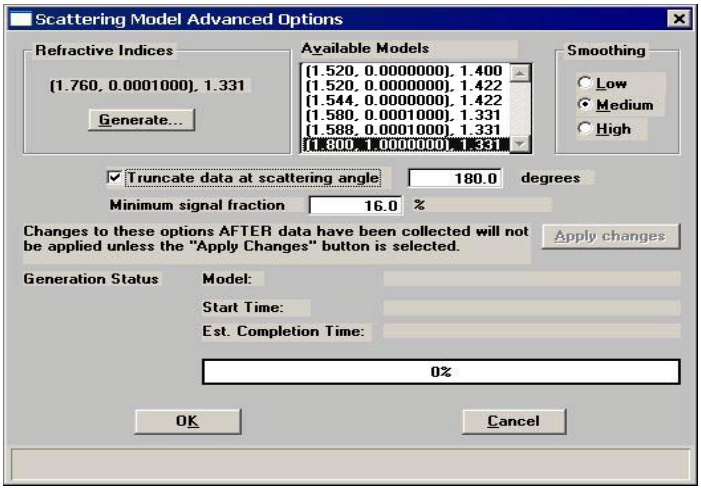
Deletes the selected analysis liquid.

Scattering Model

Displays the refractive indices for the sample material (real and imaginary) and analysis liquid, as well as the model chosen by the system to be the closest match.

Options

Use this push button to select a different model or to generate a new one; the Scattering Model Advanced Options dialog is displayed.



Options

(continued)

You can choose a different model from the **Available Models** list, as well as specify the type of smoothing desired.

Low should be used when high resolution is desired, and your sample material consists of near-perfect spheres with accurately known refractive indices.

Medium is the default and typically is appropriate for most materials.

High should be used for (1) materials in which an accurate refractive index is unknown, or (2) materials that differ greatly from the Mie scattering patterns (nonhomogeneous materials or materials that have a large aspect ratio in particle shape).

If a suitable model is unavailable, you can click **Generate** to create a new model. When you generate a new model, its progress is displayed across the lower portion of the dialog. Generation times vary, depending on computer speed. Typically for a 333 megahertz computer, generating a new model takes approximately 20 minutes.

Truncate data at scattering angle
Choose this option to truncate the intensity data used in fitting the model; data will be truncated at the angle specified in the adjacent field.

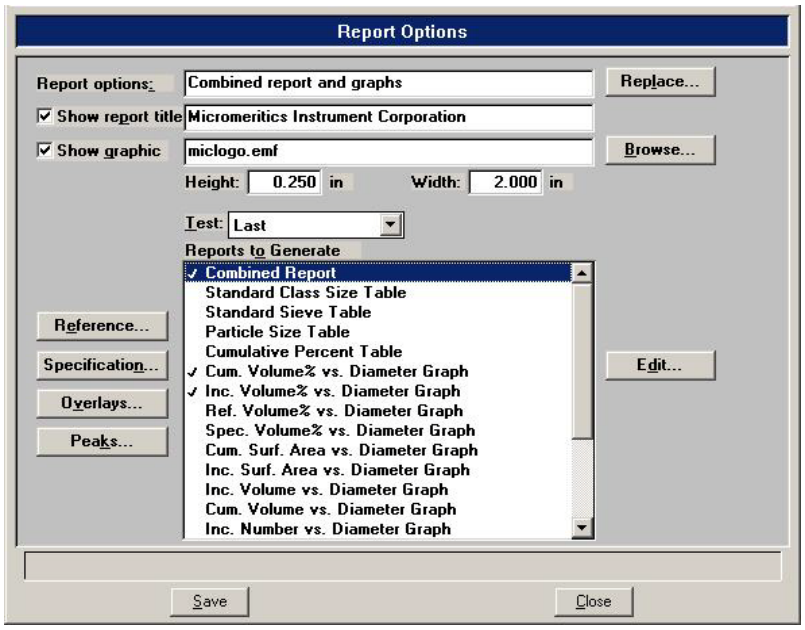
Minimum signal fraction
This field allows you to restrict intensity data used in fitting the model based on a percentage due to sample scattering rather than background.

Apply Changes
Enabled when the changes requested in this dialog are to a file that has been used in a completed analysis. You must select this push button to apply the changes in fitting the model to the data from all tests used with the file.

OK
Enabled when the changes you requested in this dialog are to a file that has not been used in an analysis. Clicking this push button saves the changes.

Report Options

This dialog allows you to specify report options for a new file or to edit an existing one. A report options file can be created as an independent parameter file or included as part of the sample information file.



Report options

Contains the description of the current Report Options file. You may change the description if you wish.

If this is a new file, this field contains the description you specified as the default.

You can enter a new description or add to the existing one if desired. Be sure to use an intuitive name (one that characterizes the report options used) so that it can be located easily when needed.

Range: 50 alphanumeric characters

Replace

Allows you to replace the values in the current analysis conditions file with those from an existing file. A dialog is displayed so that you may select the desired file. Click **OK**; the values are copied into the new file automatically.

Show report title

Enables you to enter a title for your report.

If this is a new file, the title you specified as the default is displayed.

You can accept the default title or enter a new one. You can enter up to 50 alphanumeric characters.

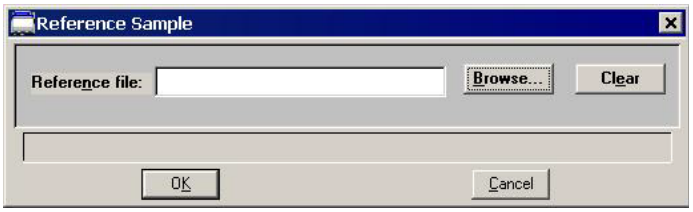
Show graphic

Select this option to have a graphic display above the report title. The graphic can be in a bitmap (bmp) or an enhanced metafile (emf) format. For example, you may wish to display your company logo.

Click **Browse** to choose the graphic, then use the **Height** and **Width** fields to specify a size. This image can be edited from the report window.

Reference

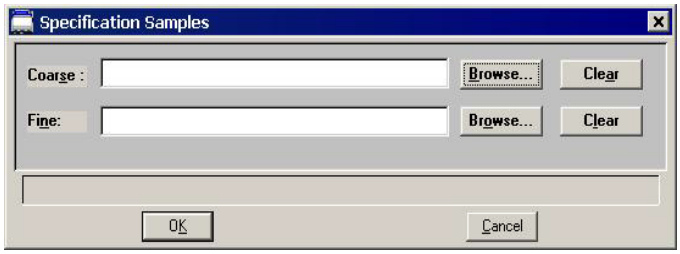
Displays the Reference Sample dialog so that you can specify a sample file with which to compare analysis results of the current sample; produces a Difference of Reference report.



- Click **Browse** to display the Reference Sample File Selection dialog.
- Choose the file you wish to use for the difference in reference calculation, then click **OK**.
- Use **Clear** to clear the field of its entry.

Specification

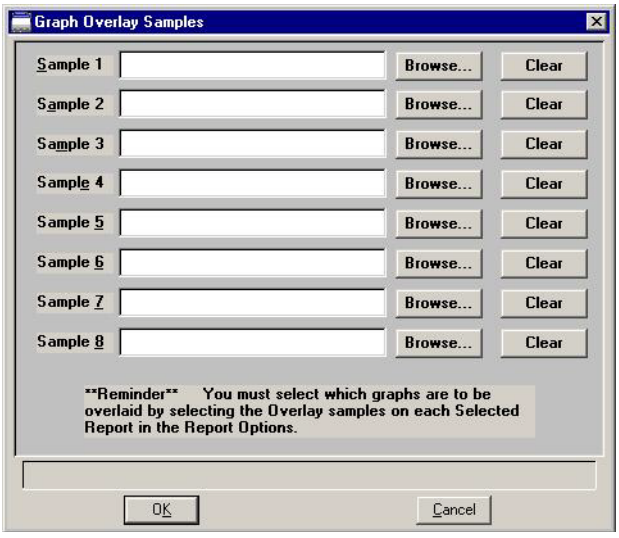
Displays the Specification Samples dialog so that you can specify the sample files to be used for the boundaries of the coarse and fine specifications; produces an Out of Specification report. Then you can quickly determine if the results of the current sample are within the specified boundaries.



- Click **Browse** to the right of each field to display the Specification Sample File dialog box containing a list of sample files from which to choose.
- Choose a file, then click **OK**.
- Use **Clear** to clear the field of its entry.

Overlays

Displays the Graph Overlay Samples dialog so that you can choose the sample files containing the data you wish to overlay onto a selected plot.

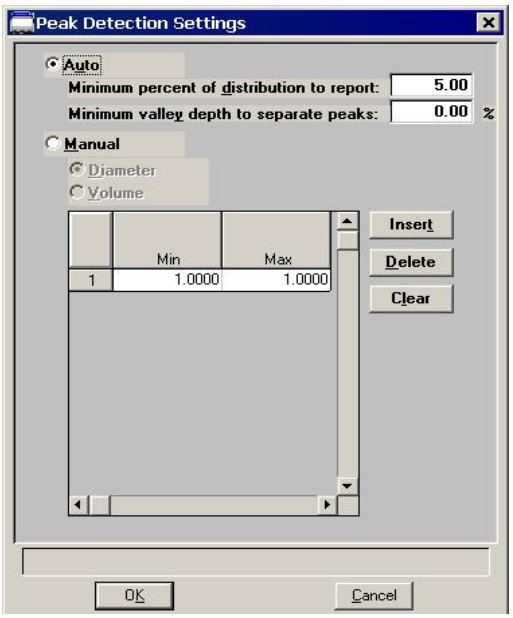


Click **Browse** to the right of the sample number field; choose the desired file, then **OK**.

You can select up to eight files. Refer to **Generating Overlays**, page **3-41** for step-by-step instructions on generating overlays.

Peaks

Displays the Peak Detection Settings dialog, allowing you to choose how peaks are detected.



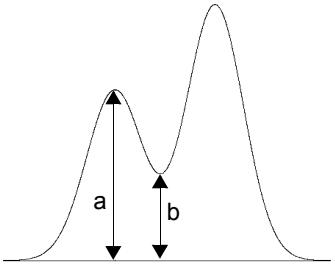
Auto

Select this option to have peaks detected automatically. When you select this option, the **Minimum distribution to report** and **Minimum valley depth to separate peaks** fields are enabled, allowing you to specify a threshold for the peak size.

The valley depth option enables you to specify a threshold for resolving multiple peaks. Valley depth is calculated as:

$$\frac{a-b}{a} \times 100\%$$

where a = the smaller peak
b = lowest point between the two peaks



If the depth is greater than the value you enter as the minimum, the two peaks are treated as separate; otherwise, they are treated as one peak.

Manual

This option enables you to define the peaks by **Diameter** or **Volume**. Use the table to enter the minimum and maximum values for each peak to be detected.

Test

Use this drop-down list to specify which test (analysis) you wish to have a report generated for.

Reports to Generate

Contains a list of available reports.

Select reports by double-clicking on the desired report(s). Alternatively, you can highlight the desired report and press the **Spacebar**. A report is selected when it is preceded with a check mark (✓). Refer to **Report Examples**, page **7-28** for examples of some of the reports generated by the analysis program.

Reports are deselected in the same manner. Most reports can be edited by highlighting the desired report and clicking **Edit**.

You can also generate Statistical Process Control (SPC) reports using the options on the Reports menu.

Edit

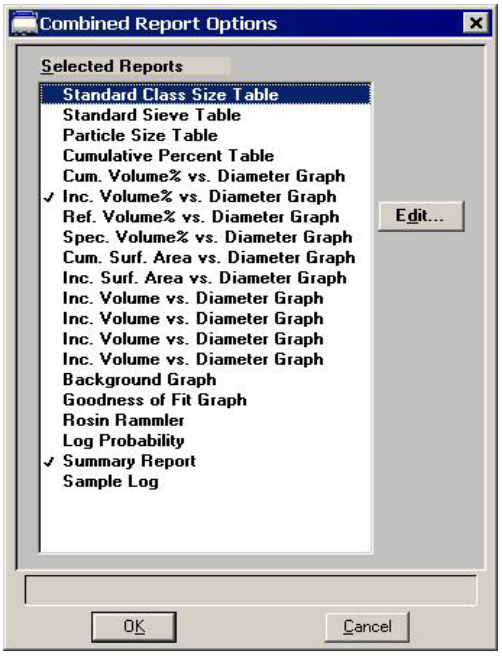
Allows you to edit values of the selected report.

This push button is disabled for the following reports; they cannot be edited:

- Rosin Rammler
- Log Probability
- Sample Log

Combined Report

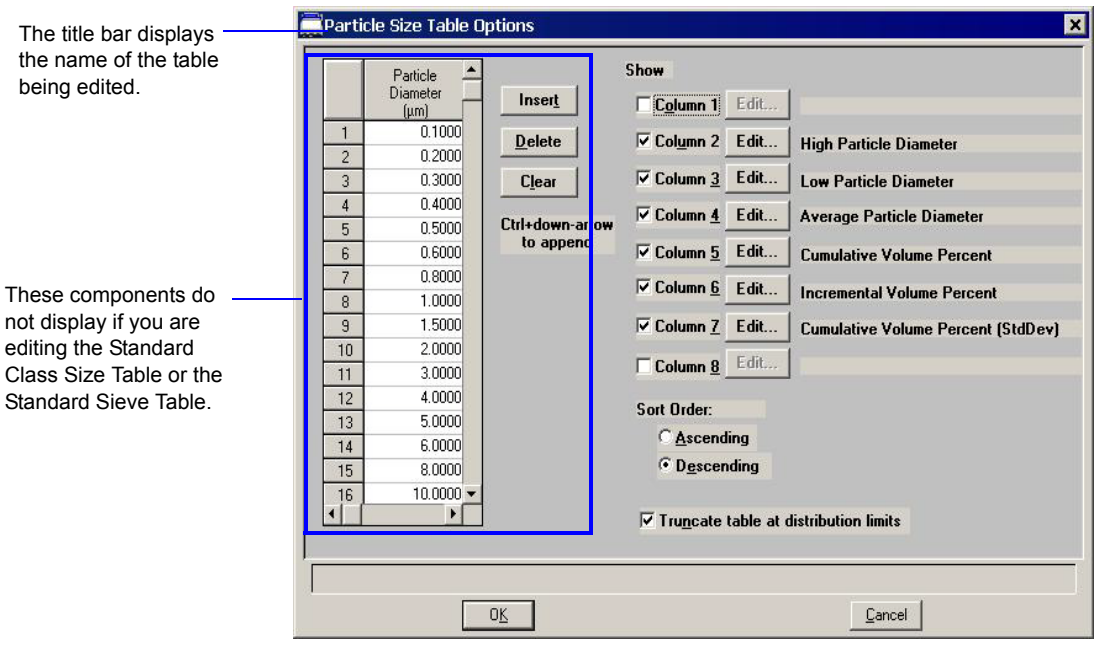
Select the Combined Report to edit; the Combined Report Options dialog is displayed.



The list of reports for the Combined Report is almost identical (the Combined report, of course, is not included in this list) to the list of reports generated in the normal manner. The difference is that the reports generated from the selections on this dialog contain no page breaks or headings. And, unless too many are selected, all reports display on one page.

Tabular Reports

Select a table to edit; a dialog similar to this one is displayed.



The Standard Class Size Table and the Standard Sieve Table are fixed and, therefore, do not contain a table nor push buttons.

- The Standard Class Size Table is fixed based on 40 classes per decade (refer to **Appendix F,** for data reduction information).
- The Standard Sieve Table is fixed based on the sieves you specify (refer to **Sieve Table**, page **8-11**).

Table

Enter the values at which you wish the data to be reported (or accept the defaults).

A table is not included on the dialogs for the Standard Class Size Table and the Standard Sieve Table.

Insert

Inserts a point above the selected point.

Use **Ctrl** ↑ to add points at the beginning of the table and **Ctrl** ↓ to add points at the end of the table.

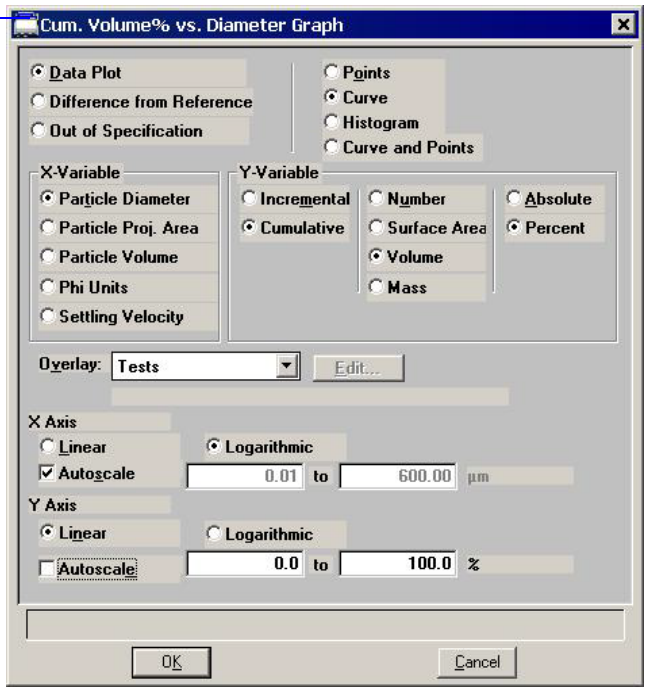
This push button is not included on the dialogs for the Standard Class Size Table and the Standard Sieve Table.

Delete	Deletes the selected point. This push button is not included on the dialogs for the Standard Class Size Table and the Standard Sieve Table.
Clear	Clears all but the one required point from the table. This push button is not included on the dialogs for the Standard Class Size Table and the Standard Sieve Table.
Column [n]	These options enable you to choose the type of data to display in your table. Click the corresponding **Edit** push button to choose and edit the variable.
Sort Order	Choose whether you wish to have points collected in an ascending or descending order.
Truncate table at distribution limits	Select this option to have the table shortened to the limits of the distribution.

Graphical Reports

There are 10 generic graphs included in the analysis software. These graphs can be tailored in many configurations using the graph options dialog displayed when you click **Edit**.

The title bar displays the name of the graph being edited.



Data Plot
Difference from Reference
Out of Specification

From this group, choose the type of plot desired.

If you select **Difference from Reference** or **Out of Specification**, be sure to click the related push button on the Report Options dialog to choose the file(s).

Points
Curve
Histogram
Curve and Points

Enables you to choose the manner in which to have data plotted.

X-Variable

Enables you to choose the x-axis variable.

Y-Variable

Enables you to choose the y-axis variable and the manner in which it is to be plotted; make a selection from each column.

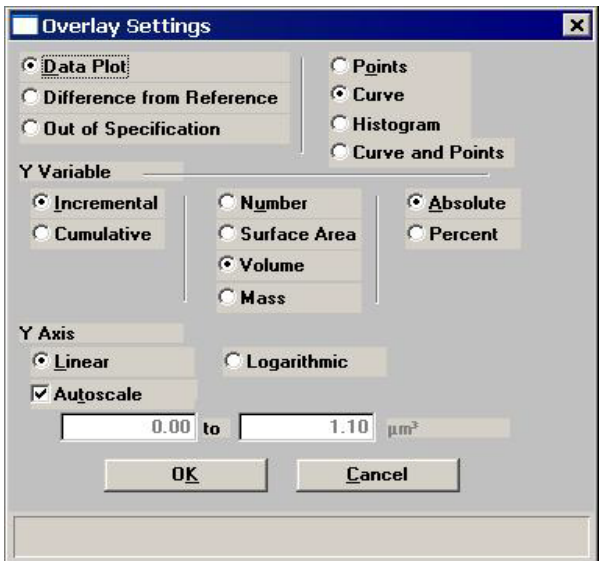
Overlay Click on the down arrow to display the types of overlays available.

Samples Overlays the current curve with the same type of curve from multiple sample files. Click **Overlays** on the Report Options dialog to choose the sample file(s) containing the desired curves.

Tests Overlays the same type of curve from all tests performed with this file.

Plot Overlays a different variable with the selected variable (the one you are currently editing). Use the **Edit** button to specify details.

Edit Enabled when you choose **Plot** as the type of overlay allowing you to choose the overlay variable and specify details for the variable; the Overlay Settings dialog is displayed.



X Axis
Y Axis Allows you to choose between a Linear or Logarithmic scale as well as autoscale options.

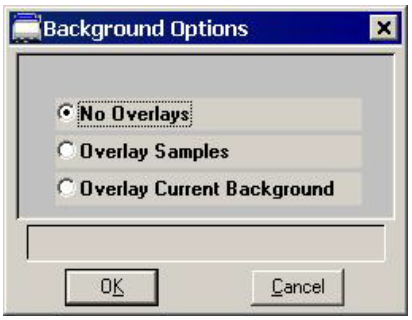
Autoscale

Select this option to have the X- and/or Y-axis scaled automatically. Both axes begin at zero; the highest values collected during analysis are the ending points.

If you deselect this option, the adjacent fields become enabled so that you may specify a range. Valid ranges are displayed in the information bar when the field is selected.

Background Graph

Select Background to edit; the Background Options dialog is displayed.



No Overlays

Reports the background of this sample analysis only.

Overlay Samples

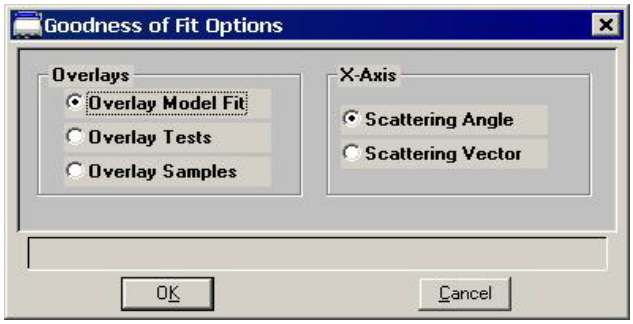
Enables you to overlay the background of this sample analysis with the background(s) of other analyses. Click **Overlays** on the Report Options dialog to choose the sample file(s).

Overlay Current Background

Enables you to overlay the background of this sample analysis with the current stored background of the analyzer.

Goodness of Fit Graph

Select Goodness of Fit Graph to edit; the Goodness of Fit Options dialog is displayed.



Overlay Model Fit — Overlays the collected intensity data of this sample with the model fit.

Overlay Tests — Enables you to overlay the collected intensity data for all analyses (tests) used with this sample file.

Overlay Samples — Enables you to overlay the collected intensity data of this sample with that of another sample (or multiple samples). Click **Overlays** on the Report Options dialog to choose the sample file(s).

X-Axis — Enables you to specify the X-axis variable.

Rosin Rammler

The Rosin Rammler report depicts the collected data as applied to the Rosin Rammler[1] theory; this report cannot be edited.

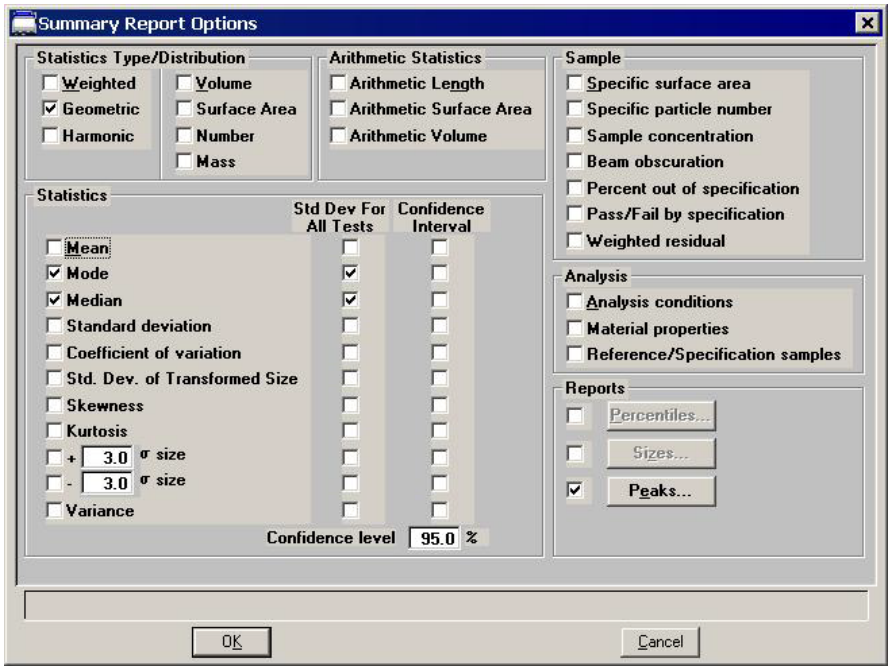
1 Rosin, P. and Rammler, E., *J. Inst. Fuel*, 7, 20 (1933)

Log Probability Report

The Log Probability Report provides a comparison of the collected data to that of a log-normal distribution; this report cannot be edited.

Summary Report

Select the Summary Report to edit; the Summary Report Options dialog is displayed.



The Summary Report provides a condensed listing of analysis statistics and data results.

Statistics Type/Distribution — Choose the type of statistics and distribution you wish to report.

Arithmetic Statistics — Choose the arithmetic statistics you wish to include in the report.

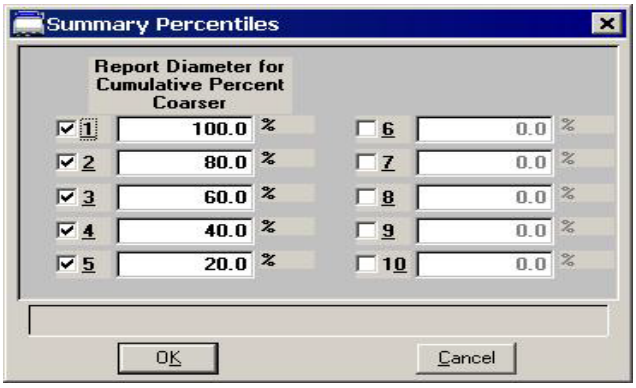
Statistics — Select the variables you wish to include in the report.

Sample — Choose the sample parameters you wish to include in the report.

Analysis Select the analysis parameters you wish to include in the report.

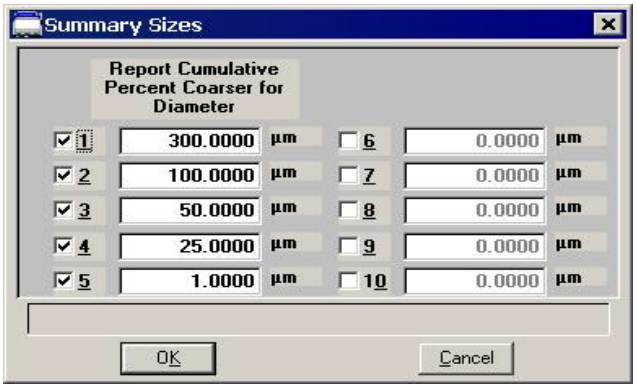
Reports Choose the type of distribution(s) you wish to report.

Percentiles Displays the Summary Percentiles dialog.



This dialog allows you to report the particle diameter (or radius) corresponding to each specified coarser (or finer) percentile. You can enter up to 10 values in any order. If you enter zero (0.00), a blank line is shown on the report.

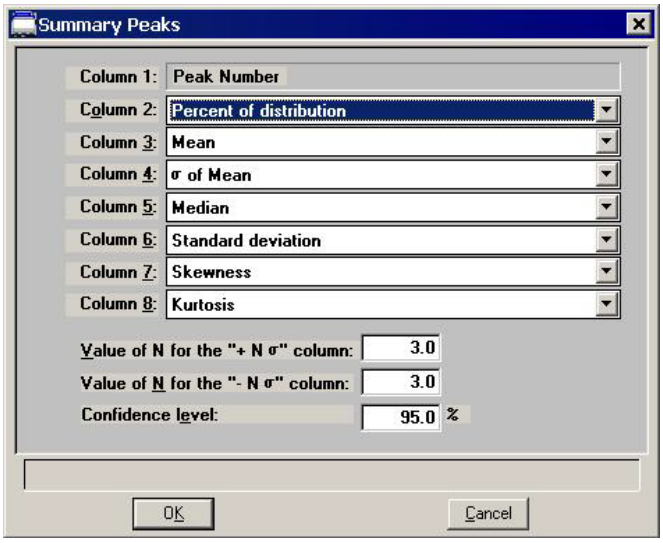
Sizes Displays the Summary Sizes dialog.



This dialog allows you to report the cumulative percent (or fraction) coarse (or finer) for each specified diameter (volume). You can enter up to 10 values in any order. If you enter zero (0.00), a blank line is shown on the report.

Peaks

Displays the Summary Peaks dialog.



This dialog enables you to specify the types of data to display in the columns of the peak table. Column 1 is fixed and cannot be edited.

Sample Log Report

The Sample Log report provides the following statistics:

- manual control operations performed during analysis
- information entered using on the sample file editor
- warnings and/or errors that occurred during analysis

Collected/Entered Data

This dialog displays only when your option presentation is selected as **Advanced**. Depending on the type of data selected on the Sample Information screen, this dialog may display as **Collected Data** or **Entered Data**.

Collected Data

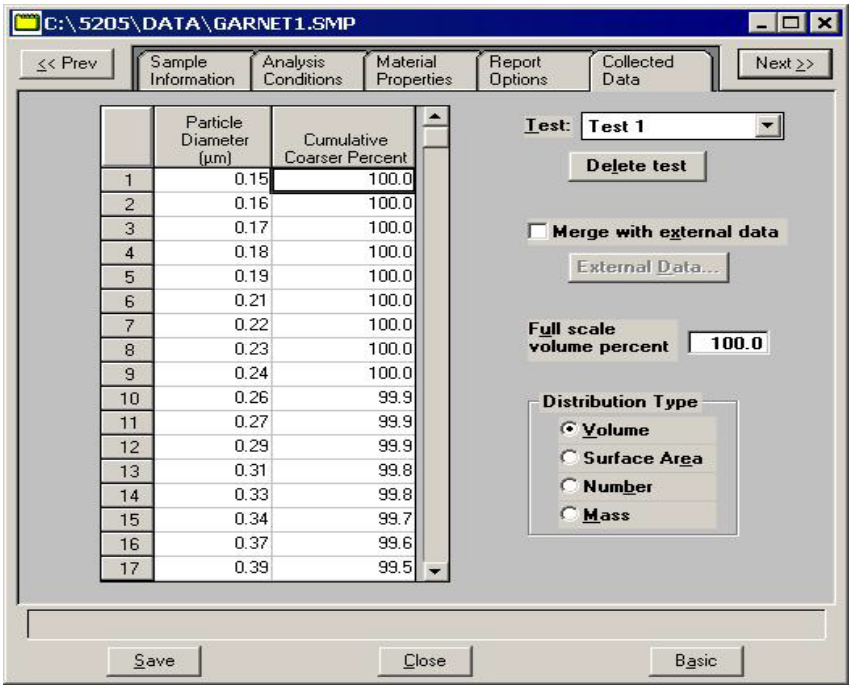


Table — Displays the data points collected for the current test. If this is a new file, the table will contain invalid data.

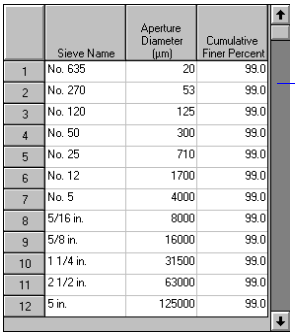
Test — Displays the current test for this sample file. If you wish to view data for another test, click on the down arrow to select the desired test. If this is a new file, this field is disabled.

Delete test — Allows you to delete the test in the **Test** field if desired. This push button is disabled if this is a new file.

Merge with external data — Select this option to merge data collected by manual methods with the data collected from the current test.

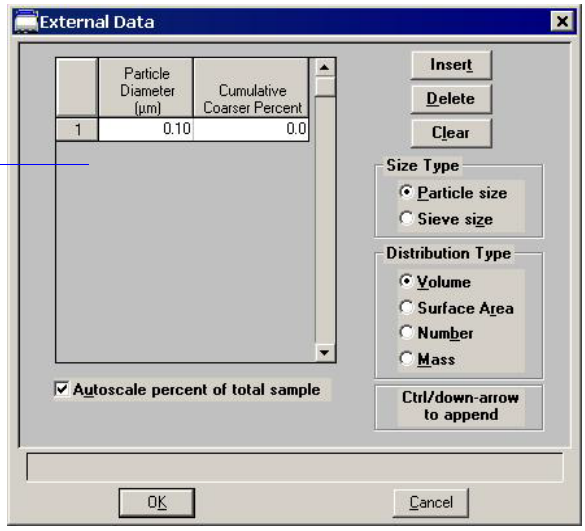
External Data

Enabled when you select **Merge with external data**. Displays the External Data dialog so that you can enter the data you wish to have merged.



	Sieve Name	Aperture Diameter (µm)	Cumulative Finer Percent
1	No. 635	20	99.0
2	No. 270	53	99.0
3	No. 120	125	99.0
4	No. 50	300	99.0
5	No. 25	710	99.0
6	No. 12	1700	99.0
7	No. 5	4000	99.0
8	5/16 in.	8000	99.0
9	5/8 in.	16000	99.0
10	1 1/4 in.	31500	99.0
11	2 1/2 in.	63000	99.0
12	5 in.	125000	99.0

This type of table displays if you choose **Sieve size** for the size type.



Insert Inserts a row so that you can enter pertinent data.

Delete Deletes the selected row.

Clear Clears the entire table of all but the one required entry.

These push buttons are disabled for the Sieve table. Sieve sizes are specified by selecting Options > Data presentation > Sieve table.

Size Type Allows you to choose the type of data you wish to merge.

Particle size allows you to enter the particle diameter as well as the cumulative percent for the sample.

Sieve size allows you to enter the percent passed through each specified sieve.

Distribution type Specify the type of external data you plan to merge.

Autoscale percent of total sample

When this option is selected, the overlapping regions of the collected data and the merged data are used to rescale the collected data so that the regions match.

When this option is deselected, the percentages you enter for the merged data are used and the nonoverlapping portion of the collected data is scaled to be the percent passing through the smallest sieve.

Full scale mass percent

Specify the weight percent of the sample actually analyzed by the Saturn analyzer versus the percent that is manually analyzed. The data are scaled accordingly.

Use this option if you analyzed part of the sample by another method but you do not wish to merge those results with the reports for the current test.

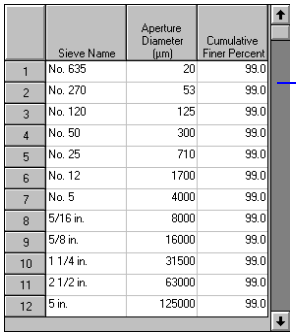
This field is disabled if **Merge with external data** is selected.

Distribution Type

Enables you to choose the manner in which data are presented.

Entered Data

You cannot enter data if the analysis program is being used for offline data manipulation on a computer other than the one controlling the analyzer.



	Sieve Name	Aperture Diameter (µm)	Cumulative Finer Percent
1	No. 635	20	99.0
2	No. 270	53	99.0
3	No. 120	125	99.0
4	No. 50	300	99.0
5	No. 25	710	99.0
6	No. 12	1700	99.0
7	No. 5	4000	99.0
8	5/16 in.	8000	99.0
9	5/8 in.	16000	99.0
10	1 1/4 in.	31500	99.0
11	2 1/2 in.	63000	99.0
12	5 in.	125000	99.0

This type of table displays if you choose **Sieve size** for the size type.

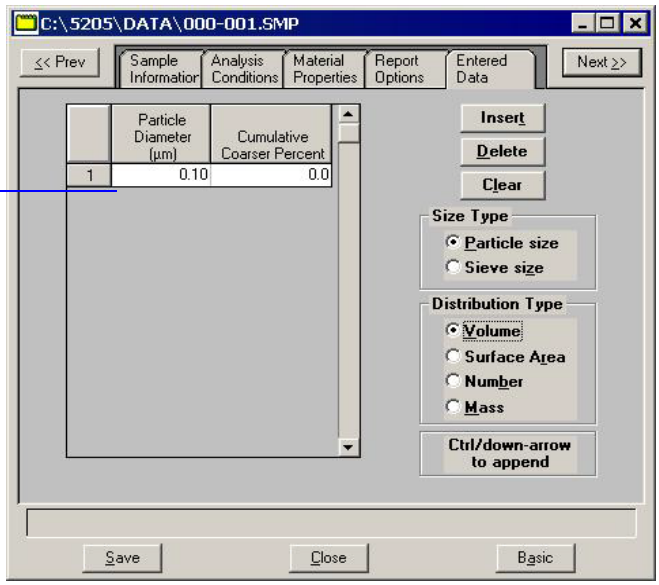


Table — Enter pertinent data.

Insert
Delete
Clear — The functions for these push buttons are the same as explained in the previous section.

Size Type — Allows you to specify the type of size data.

Particle size allows you to enter the particle diameter as well as the cumulative percent for the sample.

Sieve size allows you to enter the percent passed through each specified sieve.

Distribution Type — Specify the type of data you wish to enter.

Save

Save enables you to save any changes you have made to the file in the active window. The file is saved under its current name.

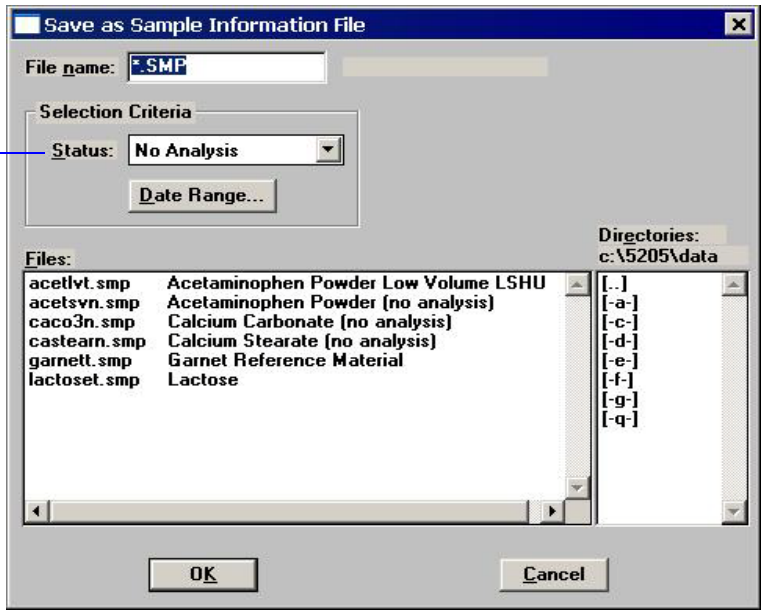
Save As

Save As enables you to:

- save a sample or parameter file in the active window under a different name. This option is useful for making a duplicate copy of a file that you can modify as desired without changing the original one. The original file remains open when you use this function, so be sure to open the new file before making any changes.
- save a subset (parameter) of the sample file in the active window as a standalone parameter file. For example, select Analysis Conditions from the **Save As** menu to create a standalone parameter file of the analysis conditions portion of the active sample file.

When you select **Save As**, a dialog similar to the one shown below is displayed.

The status list is not shown for parameter files.



File name	Choose one of the following options: • Enter a name of up to eight characters for the new file. • Select a file from the **Files** list box. If you select an existing file as the new name, the data contained in that file are overwritten with the new data.
Status **Date Range** **Files** **Directories**	Refer to **Selecting Files**, page **2-15** for an explanation of these items. Status does not display for parameter files.

Save All

Save All enables you to save all open files under their current names. This option provides a faster way to save all open files at one time and avoids having to perform a Save operation on each individual file.

Close

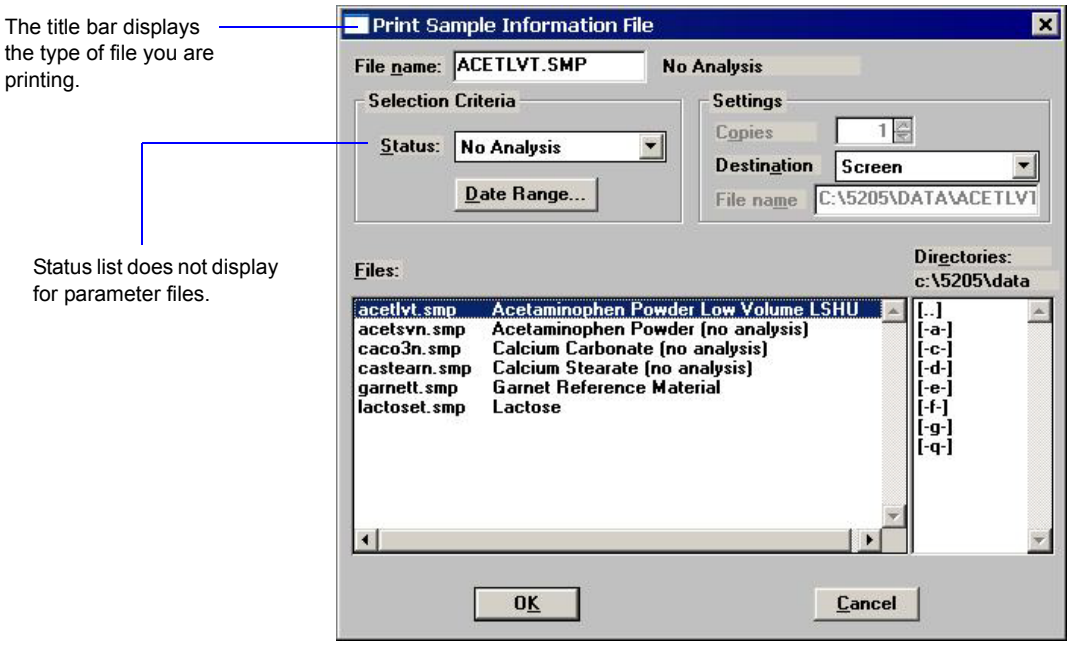
Close enables you to close the file in the active window. You will be prompted to save before closing if the file contains changes that have not been saved.

Close All

Close All enables you to close all open files under their current names. You will be prompted to save before closing for each file containing changes that have not been saved.

Print

Print enables you to print the entire contents of a sample or parameter file. For example, if you choose to print the contents of an analysis conditions file, you will receive the parameters used for all analysis conditions associated with the file. The print dialog is common to all file types. The title bar will display the type of file you are printing.



File name
The name of the file you select from the Files: list box is copied to this field.

Status
Date Range
Files
Directories
Refer to **Selecting Files**, page **2-15** for an explanation of these items.

Status does not display for parameter files.

Copies
Enabled when **Printer** is selected as the print destination. You may print up to four copies.

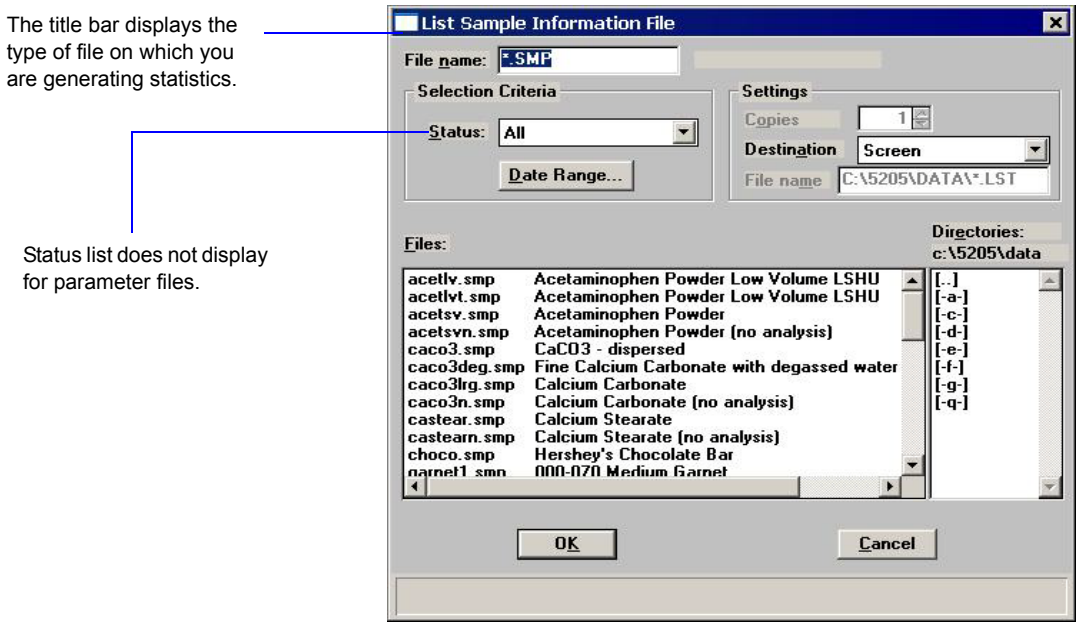
Destination	Contains a drop-down list of available print destinations. If you select **Screen** or **Printer**, the requested file is sent to that specified destination If you select **File**, the tabular reports of the requested file are converted to a text file which can be viewed with a text editor or other text file manipulation tool. You also must enter a name in the **File name** field.
File name	Enabled when you select **File** as the destination. A default name is displayed in the field; a new one may be entered if desired.

List

List enables you to generate a listing of the following information on a selected sample or parameter file:

- File name
- Date the file was created (or edited)
- Time the file was created (or edited)
- File identification
- File status

The List dialog is common to all file types. The title bar displays the type of file on which you have requested a list.



File name

If you select only one file from the **Files** list, the name is copied to this field. If multiple files are selected, the last one selected displays in this field.

You can list statistics for multiple files by holding down **Ctrl** while making your selections. If no files are selected, a list is generated for all files listed in the **Files** window.

Status
Date Range
Files
Directories

Refer to **Selecting Files**, page **2-15** for an explanation of these items.

Status does not display for parameter files.

Copies Enabled when **Printer** is selected. You may print up to four copies.

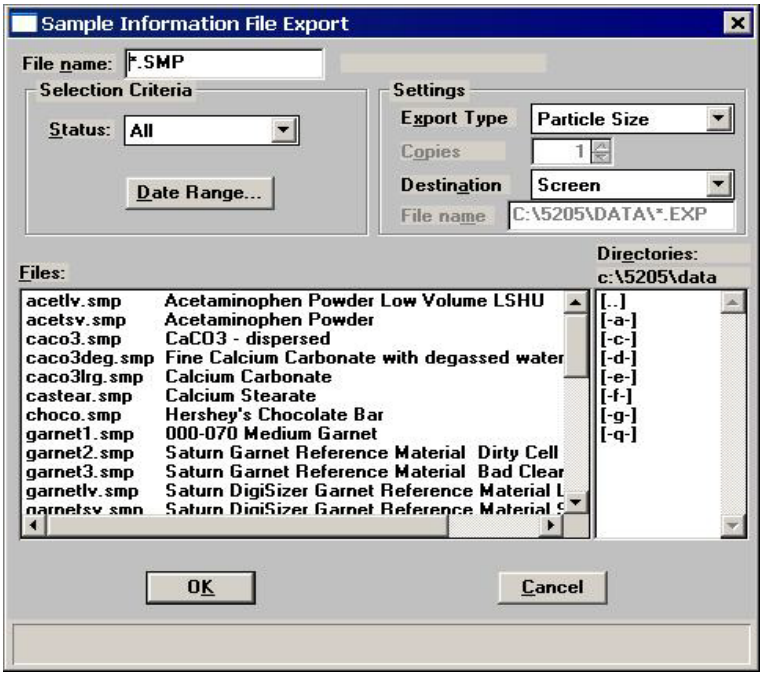
Destination Contains a drop-down list of available print destination.

Choices: Screen, Printer, File

File name Enabled when you select **File** as the destination. A default name is displayed in the field; a new one may be entered if desired.

Export

Export allows you to copy the particle size distribution data or the intensity data in a sample information file and reformat it in ASCII format. The ASCII data can then be imported into other applications (such as spreadsheets) accepting ASCII format. The data are exported in a comma-delimited format. Refer to **Appendix H**, page **H-1** for the exporting format. You may select multiple files by holding down **Ctrl** and clicking the left mouse button once on each file.



File name — Contains the name of the file you select to export.

Status
Date Range
Files
Directories — Refer to **Selecting Files**, page **2-15** for an explanation of these items.

Export Type — Drop-down list containing the types of data export available.

Choose **Particle Size** to generate particle distribution data.

Choose **Intensity** to generate the light intensity vs. scattering angle data, as well as the background.

Copies — Enabled when **Printer** is selected; you may print up to four copies.

Destination	Contains a drop-down list of the available print destinations. *Choices: Screen, Printer, File*
File name	Enabled when you select **File** as the destination. A default name is displayed in the field; a new one may be entered if desired.

Exit

Exit enables you to exit the Saturn DigiSizer analysis program. Even if an analysis is in progress, it will continue until completion; analysis data are collected and stored in the analyzer's memory.

- If a window containing a modified file is open, you are given the opportunity to save the modifications before exiting.
- If deconvolution (calculations) is in progress, the following message is displayed:

> **2458- An analyzer is performing a critical operation. Wait a few moments before exiting the application.**
>
> **OK**

You cannot exit the DigiSizer program while a critical operation is in progress. Click **OK** to close the dialog, wait a few minutes, and try again.

- If an analysis is in progress, the following message is displayed:

> **2459- An instrument is busy. A delay in restarting this application could result in loss of new data. Continue with program exit?**
>
> **Yes** **No**

Yes exits the analysis program
No allows the analysis program to remain active and the analysis to finish.

Although data are stored in the analyzer when you exit the program during analysis, they are not saved in the file until the program is restarted. At that time the data are saved automatically. If a power failure occurs in the interim and you do not have an Uninterruptible Power Supply (UPS) installed, loss of data will result.

If the MasterTech is being used, the current analysis continues until it is finished; subsequent analyses are postponed and resumed when the analysis program is restarted.

- If a report window is open, the following message is displayed.

> **A report is currently printing. Exiting the application now will cancel the report. Continue with termination?**
>
> **Yes** **No**

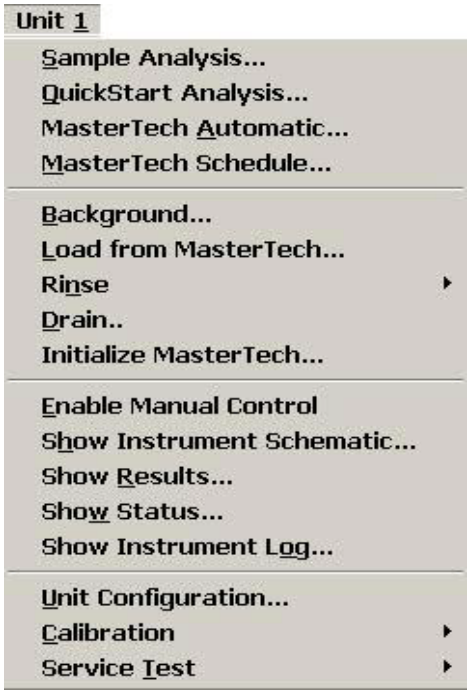
Yes closes the report window and the analysis program.
No leaves the analysis program active and the report window open.

6. UNIT MENU

The Unit menu contains the options for the operations which can be performed with the Saturn DigiSizer. The main menu will contain a Unit menu for each attached analyzer. For example, if you have two attached analyzers, the main menu contains two Unit menus. For convenience and quick recognition, the status displays associated with each unit are displayed in different colors. The unit number and the serial number also are displayed in the title bar of the operational windows. This feature is especially helpful when you have more than one analyzer attached to the same computer.

This menu does not appear on the menu bar if the analysis program is being used for offline data manipulation.

Description



Listed below are brief descriptions of the Unit menu options. Detailed descriptions are found later in this chapter.

Sample Analysis Use this mode of operation to perform single sample analyses. This option is disabled if analyses are being performed in another mode. Page 6-4.

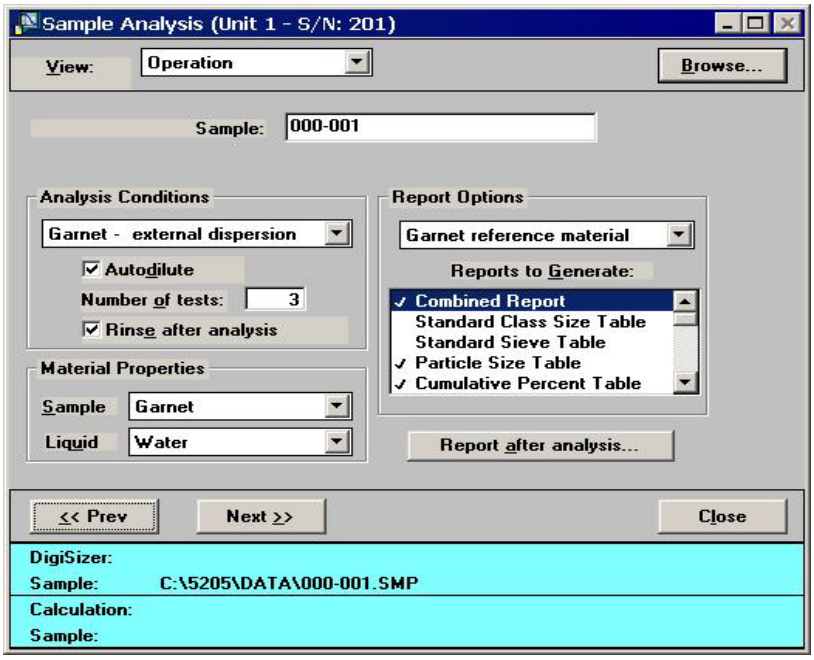
QuickStart Analysis	Use this mode of operation to perform successive sample analyses. Page **6-10**.
MasterTech Automatic	Use this mode of operation to analyze a series of samples of the same type with the same analysis conditions. Sample files are created automatically. Enabled only if a MasterTech is installed. Page **6-15**.
MasterTech Schedule	Use this mode of operation to analyze a series of samples which may be different in size and shape and, consequently, require different analysis conditions. Enabled only if a MasterTech is installed. Page **6-18**.
Background	Allows you to perform a background measurement. Page **6-22**.
Load from MasterTech	Allows you to load a sample from the MasterTech into the analyzer. Page **6-25**.
Rinse	Allows you to perform a rinse operation on the DigiSizer, MasterTech, or the MasterTech and the DigiSizer. Page **6-26**.
Drain	Allows you to drain liquid from the Saturn DigiSizer system. Page **6-31**.
Initialize MasterTech	Allows you to start the MasterTech or realign the MasterTech turntable. Page **6-31**.
Enable Manual Control	Allows you to control the system manually. Page **6-32**.
Show Instrument Schematic	Displays a schematic of the analyzer. Page **6-40**.
Show Results	Allows you to have results displayed as data are collected when performing multiple analyses. Page **6-41**.
Show Status	Displays the status window of the operation in progress. Page **6-41**.

Show Instrument Log	Displays a log of recent analyses, calibrations, and error messages. Page **6-42**.
Unit Configuration	Displays the configuration of the analyzer. Page **6-44**.
Calibration	Enables you to perform calibration functions. This option is enabled only with the direction of a Micromeritics service representative. Page **6-46**
Service Test	Enables you to perform certain troubleshooting procedures. This option is enabled only with the direction of a Micromeritics service representative. Page **6-46**

Sample Analysis

Use this mode of operation to perform up to eight tests (analyses) on a single sample. When you select this option from the Unit menu, the Sample Analysis dialog is displayed with all fields disabled (greyed out) and the Unit [n] Start Analysis dialog positioned on top. This allows you to select an existing sample file for your analysis or to create a new one.

After a sample file has been designated, the Sample Analysis dialog is displayed. The fields now contain the values for the selected file or, if creating a new file, the specified defaults. Use the Sample Analysis dialog to edit sample parameters.



View

Allows you to view one of the following in the current window:

- the current operation
- the instrument schematic (refer to **Show Instrument Schematic**, page **6-40** for additional information)
- the instrument log (refer to **Show Instrument Log**, page **6-42** for additional information)
- two selected report pages from the most recently analyzed sample

Browse

Displays the Open Sample Information dialog allowing you to select a different sample file for your analysis.

Sample

Contains the description of the current sample file.

If this is a new file, this field contains the next sequenced file description based on the format you specified in Sample defaults.

You can enter a new description or add to the existing one if desired.

Range: 50 alphanumeric characters

Analysis Conditions

Contains the name of the Analysis Conditions file for the current sample file.

If this is a new file, this field contains the Analysis Conditions file you specified as the default.

The drop-down list contains a list of predefined analysis conditions files, some of which were included with the analysis program.

- Click on the down arrow to choose a different file.
- This list is disabled if the file you selected has been used in an analysis.

Autodilute

Allows monitoring of the sample's concentration and adds liquid as needed until the appropriate concentration is attained before analysis and data collection begin.

Number of tests

Enter the number of analyses you wish to perform using this sample file; you can perform up to eight tests with each file.

Rinse after analysis

Allows rinsing of the cell, the tubing, and the reservoir after each analysis. We recommend this option remain selected. If you deselect this option and rinses are not performed after analysis, inaccurate results may be obtained on subsequent analyses.

Material Properties
Sample
Liquid

Displays the type of sample and dispersing liquid associated with the analysis conditions file you selected from the **Analysis Conditions** drop-down list.

If this is a new file, these fields display the specified defaults.

Click on the down arrow(s) to choose a different Particle (sample) or dispersing liquid.

If your sample material or dispersing liquid is not included in the list, you will have to cancel the current operation and open the sample information file in the Advanced format to add it (see **Material Properties**, page **5-15**).

Report Options

Contains the name of the Report Options file for the current sample file.

If this is a new file, this field contains the Report Options file you specified as the default.

The drop-down list contains a list of predefined report options files, some of which were included with the analysis program.

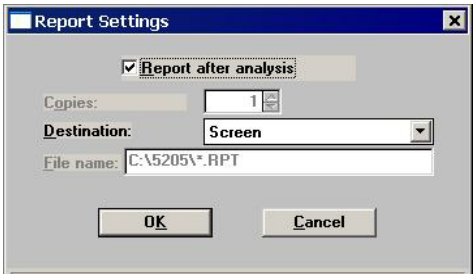
Click on the down arrow to choose a different file.

Reports to Generate

Displays a list of available reports. To select a report: Double-click on the desired report, or highlight the report and press the **Spacebar**. Selected reports are preceded with a check mark (✓). Reports are deselected in the same manner.

Report after analysis

Displays the Report Settings dialog so that you can specify report output requirements.



Select the option presented on this dialog to have reports generated automatically after each analysis.

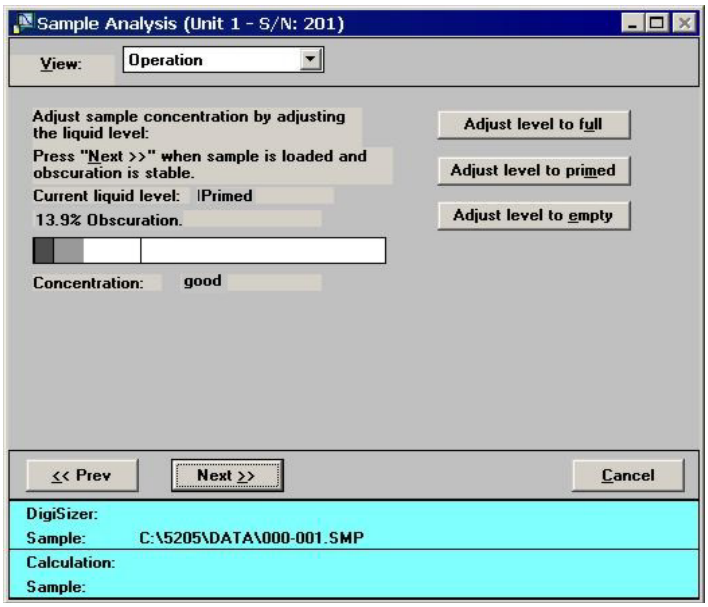
Number of Reports — Enter the number of reports you wish to have printed. You can print up to four copies when **Printer** is selected as the destination.

Destination — This drop-down list presents four print destinations:

Choices: Screen, Printer, File

File name — Enabled when **File** is selected as the destination, allowing you to enter a name (or accept the default).

Select **Next** on this window to save selections and advance to the next view of the Sample Analysis dialog.



This view of the window shows beam obscuration of the sample as it is being loaded. Add only enough sample to achieve the proper range for your material, using the following guidelines:

Sample Type (micrometers)	Beam Obscuration
Less than 0.1	4%
0.1 to 1	5% to 10%
1 to 10	10% to 20%
10 to 100	20% to 30%
100 to 1000	30% to 45%

Adjust level to full	Allows you to fill the reservoir with analysis liquid.
Adjust level to primed	Allows you to add enough analysis liquid to reach a primed state.
Adjust level to empty	Empties the reservoir of analysis liquid.

These push buttons are also used to adjust the beam obscuration to the appropriate range for your sample as it is being added to the reservoir:

- If the beam obscuration is too high (indicating high concentration), use **Adjust level to full** or **Adjust level to primed** to add liquid. Do not try to adjust a high obscuration if you have chosen **Autodilute**. The Saturn DigiSizer system will adjust the concentration automatically until the correct beam obscuration is achieved.
- If the beam obscuration is too low (indicating low concentration), continue to add sample. If the reservoir is too full, you can use any of these push buttons to adjust the liquid level to allow room for added sample.

Refer to Appendix B, page B-1 for additional information on sample dispersion and sample concentration.

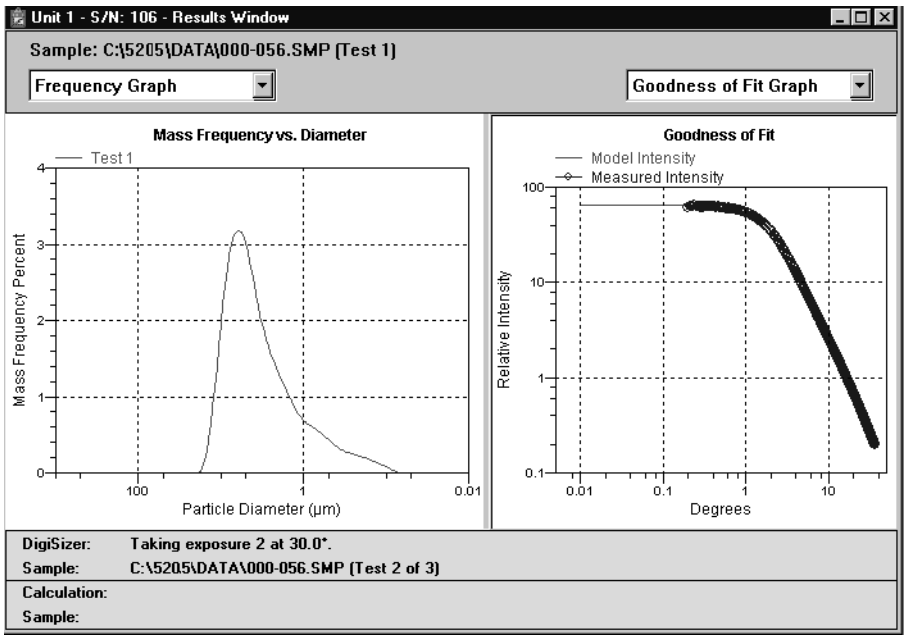
When the concentration is in the recommended range, select **Next** to begin data collection. A status view of the Sample Analysis window is then displayed.

This view of the window displays:

- the identification of the sample file
- an estimated time remaining on the analysis
- the current test number
- the current beam angle

A more specific status of the sample is shown in the status area at the bottom of the window. After each test requested of the sample file is complete, data reduction for the test begins; simultaneously, the next test begins.

The next view of the window contains the results of the current test.



The results window contains two panes. Each pane has a drop-down list (positioned just above the pane) containing the report options specified in the sample file.

In these panes, you can:

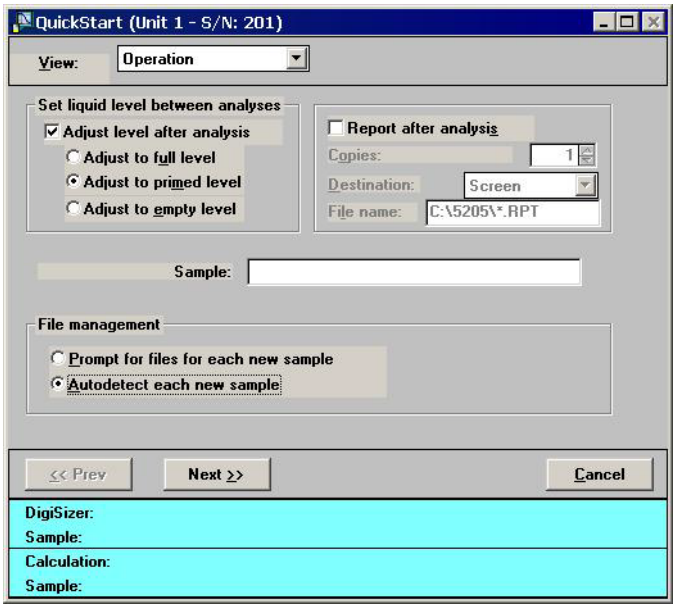
- **Show results**
  Select a report from the drop-down list to display its results in the pane. Scroll bars are provided in panes where tables are displayed so that you can scroll through the data.

- **Resize the pane**
  Point to the center vertical border (separating the panes); when the cursor turns into a four-way arrow, drag the border in the direction desired.

- **Edit tables and graphs**
  Right-click in the graph (or table) to display a list of editing options. These options are explained in detail in **Shortcut Menus**, page **7-23**.

QuickStart

Use this mode of operation to analyze a series of samples of the same type which contain the same analysis conditions. You can request to have sample files created automatically or you can choose a sample file for each sample. When you select this option from the Unit menu, the QuickStart dialog is displayed.



Set liquid level between analyses

Allows you to adjust the liquid level in the reservoir before the sample is loaded.

Choices: *Adjust to full level, Adjust to primed level, Adjust to empty level*

Adjust to full level fills the reservoir with the dispersing liquid. Choose this level for undispersed, powdered samples; if a maximum amount of liquid is desired; or if bubble problems are anticipated.

Adjust to primed level fills the reservoir with just enough dispersant to enable circulation. Choose this level for highly concentrated samples.

Adjust to empty level empties the reservoir of all dispersant, allowing you to pour a previously dispersed sample into the reservoir. Choose this level for samples already at the proper concentration.

Report after analysis Allows you to have a report(s) generated automatically after each analysis.

Copies Enter the number of reports you wish to have printed. You can print up to four copies when **Printer** is selected as the destination.

Destination This drop-down list presents four print destinations:

Choices: Screen, Printer, File

File name Enabled when **File** is selected as the destination, allowing you to enter a name (or accept the default).

Sample Contains the default identification string specified in sample defaults; you can enter a new name if desired. Be sure to include the $ symbol if you wish to have the sample file number included as part of the description.

File management Presents two choices for creating file names:

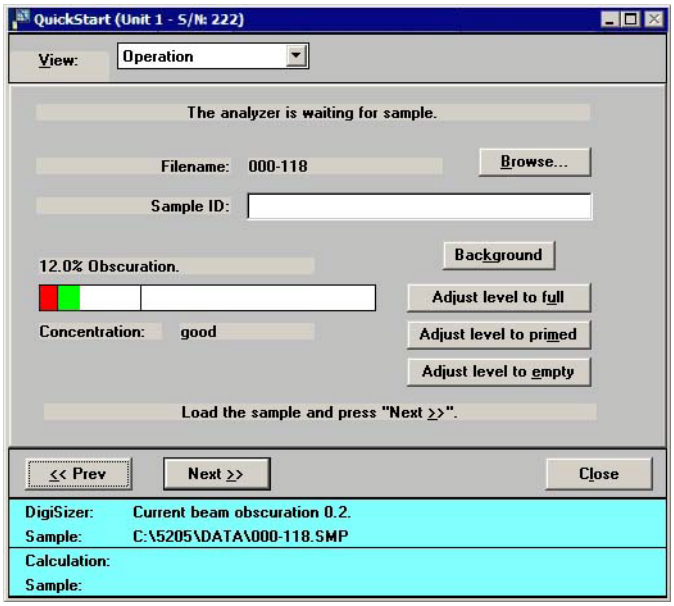
Prompt for files for each new sample: the analyzer pauses before each analysis so that you can choose a sample file.

Autodetect each new sample: new files are created sequentially and automatically for each analysis. Numbering sequence is based on the specified default. The description sequence is also based on the default unless you specify a different string in the **Sample** field on this dialog.

If you use this method, be sure that **Rinse after analysis** is selected in Sample defaults. Otherwise, the previous sample will not be rinsed from the reservoir; however, the system will detect its presence and analyze it repeatedly.

Select **Next**; a window indicating **Adjusting liquid level is** displayed. You can suspend or skip this procedure by selecting the respective push button. After the liquid has been adjusted, one of two screens is displayed (depending on which file management method you choose):

- If you choose **Prompt for files for each new sample**, this view of the QuickStart dialog is displayed before each analysis.



Filename — Displays the next sequenced file number as specified in sample defaults. Click **Browse** to select a different file.

Browse — Displays a dialog so that you may select the sample file you wish to use with this analysis. If you do not choose a new file, specified defaults for all parameters will be used.

Sample ID — Displays the description of the file you choose for the analysis. You can edit the description if desired.

Background — Enables you to perform a background before proceeding with analysis. The background is performed using the analysis liquid and the flow rate specified in the sample defaults. When the background has finished, a report is generated (if selected on previous screen) and the current window is again displayed.

Adjust level to full
Adjust level to primed
Adjust level to empty

These push buttons allow you to adjust the beam obscuration to the appropriate range for your sample as it is being added to the reservoir:

- If the beam obscuration is too high (indicating high concentration), use **Adjust level to full** or **Adjust level to primed** to add liquid. Do not try to adjust a high obscuration if you have chosen **Autodilute**. The Saturn DigiSizer system will adjust the concentration automatically until the correct beam obscuration is achieved.

- If the beam obscuration is too low (indicating low concentration), continue to add sample. If the reservoir is too full, you can use any of these push buttons to adjust the liquid level to allow room for added sample.

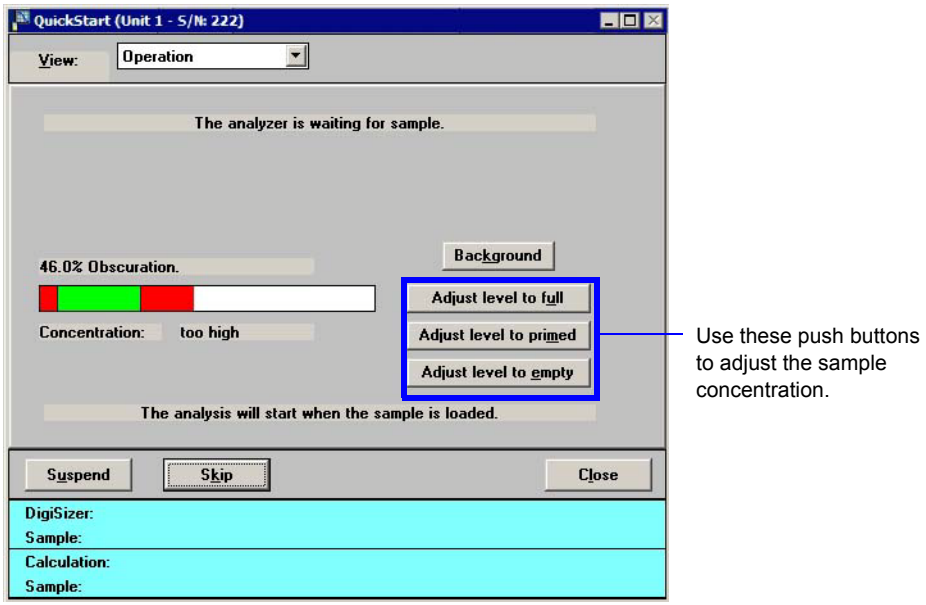
After all selections have been made, begin adding your sample to the reservoir. Observe the beam obscuration of the sample as it is being added. When the concentration is in the recommended range for the type of sample you are analyzing (refer to the following guidelines), select **Next** to begin data collection.

Sample Type (micrometers)	Beam Obscuration
Less than 0.1	4%
0.1 to 1	5% to 10%
1 to 10	10% to 20%
10 to 100	20% to 30%
100 to 1000	30% to 45%

The beam obscuration range can also be manually entered using the **Maximum** and **Minimum** fields on the Analysis conditions dialog.

After all analyses have finished, click **Cancel** to close the dialog.

- If you choose **Autodetect each new sample**, this view of the QuickStart dialog is displayed:



After you add your sample to the reservoir, its presence is detected and the remainder of the analysis proceeds automatically. The obscuration must exceed the minimum recommended obscuration on the Analysis conditions window for the analysis to start automatically. If you wish to use a lower obscuration, load the sample and click **Skip** to start the analysis. After the current sample is analyzed, this window is again displayed prompting you to add the next sample.

A **Background** push button is also provided on this dialog, allowing you to perform a background measurement between analyses.

After all analyses have finished, click **Cancel** to close the dialog.

Regardless of which file management method you choose, a status view of the Sample Analysis window is then displayed. This view of the window displays:

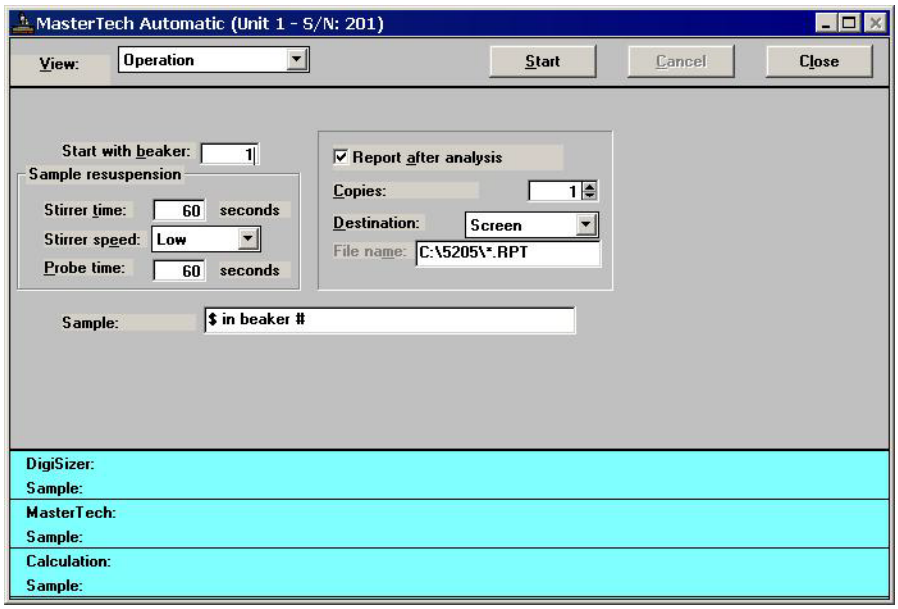
- the identification of the sample file
- an estimated time remaining on the analysis
- the current test number
- the location of the beam angle

A more specific status of the sample is shown in the status area at the bottom of the window. After each test requested of this sample file is complete, data reduction for the test begins; simultaneously, the next test begins. After all tests and rinses (if requested) are finished, the previous window is displayed.

MasterTech Automatic

This option is functional only if you have a MasterTech connected to your analyzer.

Use this mode of operation to analyze a series of samples of the same type which contains the same analysis conditions; sample files are created automatically. When you select this option from the Unit menu, the MasterTech Automatic dialog is displayed.



Start with beaker

Enter the position number of the beaker containing the first sample to be analyzed.

This field is disabled if an analysis is in progress.

Sample resuspension

This group box is used to enter resuspension parameters.

Samples tend to settle in the beaker while waiting for analysis, especially if samples are prepared ahead of time, as in most cases when using a MasterTech. The options in this group box allow you to program the MasterTech stirrer and probe to redisperse the sample before analysis.

All fields in this group box are disabled if an analysis is in progress.

Stirrer time — Enter the number of seconds you wish to have the stirrer operate during resuspension.

Stirrer speed — Choose the stirrer speed.

Coarse materials and less-stable dispersions may require more high-speed stirring time than finer materials.

Probe time — Enter how long to have the ultrasonic probe operate during resuspension.

Report Settings — This group box is used to designate report output.

These options are disabled if analyses are in progress.

Report after analysis — Select to have a report generated automatically after each analysis.

Number of Reports — Enter the number of reports you wish to have printed. You can print up to four copies when you select **Printer** as the destination.

Destination — This drop-down list presents four print destinations:

Choices: Screen, Printer, File

File name — Enabled when **File** is selected as the destination; enter a name (or accept the default).

Sample — Contains the default identification string specified in sample defaults; you can enter a new name if desired. Be sure to include the $ symbol if you wish to have the sample file number included as part of the description.

You can also include the beaker number containing the sample in the sample identification by entering the number symbol (#) within the name you specify. For example, **Sample in beaker #**.

Start — Begins the analysis. This push button changes to after analysis begins which (if clicked) will stop the analysis.

Cancel

Displays a dialog allowing you to choose which operation(s) you wish to cancel. Disabled options indicate that an operation of that type is not in progress and, therefore, cannot be canceled.

Cancel the MasterTech preparation cancels the sample currently being prepared by the MasterTech as well as all subsequent samples. It does not cancel any analysis that may be in progress.

Cancel the MasterTech load operation cancels the loading of the next sample as well as all subsequent samples. It does not cancel any analysis that may be in progress.

Cancel the analysis cancels the current analysis only; you may continue with other analyses if desired.

Close

Closes the dialog. This push button is disabled if an automatic operation is in progress.

This window contains separate status windows for the DigiSizer and the MasterTech. Each status window contains its own **Skip** and **Suspend** push buttons allowing you to perform either or both of these actions on the DigiSizer, the MasterTech, or both. Also displayed just above the status window for the analyzer is the progress of the analysis.

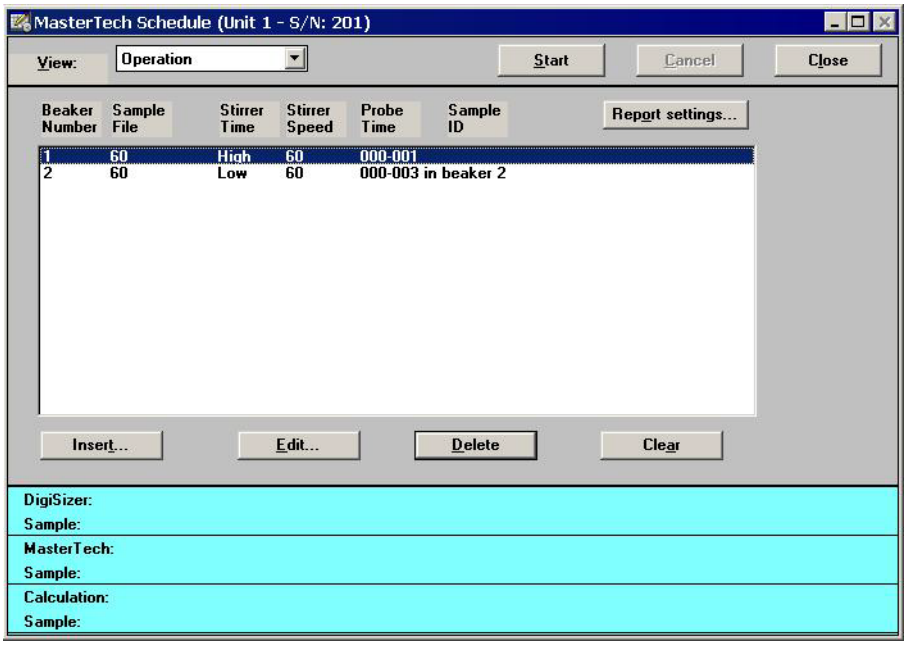
MasterTech Schedule

This option is functional only if you have a MasterTech connected to your analyzer.

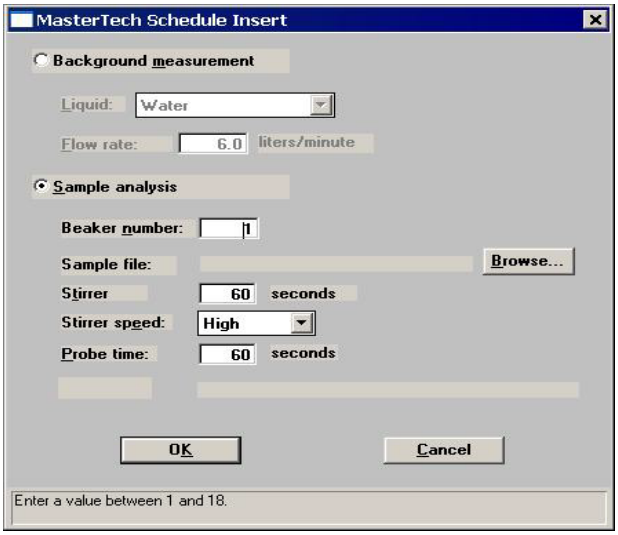
Use this mode of operation to:

- Analyze a series of samples which may be different in size and shape and, consequently, require different analysis conditions
- Analyze samples and measure a background alternately

When you select this option from the Unit menu, the MasterTech Schedule is displayed.



Insert Displays the MasterTech Schedule Insert dialog so that you can select the sample files you wish to use for scheduled analyses.



If you have a sample file selected in the **Sample File** window, the new file is inserted before the selected file; otherwise it is inserted at the end of the list.

Background measurement

Inserts a background measurement.

Select the liquid you wish to use from the **Liquid** drop-down list. Then enter a value in the **Flow rate** field; typically, 6 is sufficient.

Sample analysis

Allows you to schedule a sample analysis.

Beaker number
Enter the beaker number containing the sample.

Sample file
Displays the description of the selected sample file. Click **Browse** to choose the sample file.

Stirrer time
Enter the number of seconds to have the stirrer operate during resuspension.

Stirrer speed
Choose the stirrer speed.

Coarse materials and less-stable dispersions may require more high-speed stirring time than finer materials.

Probe time
Enter how long you wish to have the ultrasonic probe operate during resuspension.

Edit

Displays the MasterTech Schedule Edit dialog so that you can edit the sample file or dispersion conditions.

This dialog is identical to the MasterTech Schedule Insert dialog explained on page 6-19.

Delete

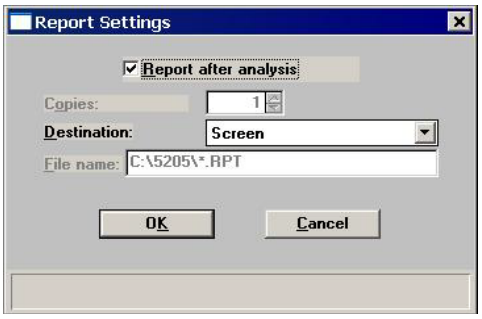
Removes the selected item from the list. This push button is disabled if nothing is selected.

Clear

Removes all of the files listed in the window. The files do not have to be selected.

Report Settings

Allows you to choose report output options. When you click on this push button, the Report Settings dialog is displayed.



Report After Analysis

Select to have a report generated automatically after each analysis.

Number of Reports

Enter the number of reports you wish to have printed. You can print up to four copies when you select **Printer** as the destination.

Destination

This drop-down list presents four print destinations:

Choices: Screen, Printer, File

File name

Enabled when File is selected as the destination; enter a name (or accept the default).

Cancel

Displays a dialog allowing you to choose which operation(s) you wish to cancel. Disabled options indicate that an operation of that type is not in progress and, therefore, cannot be canceled.

Cancel the MasterTech preparation cancels the sample currently being prepared by the MasterTech as well as all subsequent samples. It does not cancel any analysis that may be in progress.

Cancel the MasterTech load operation cancels the loading of the next sample as well as all subsequent samples. It does not cancel any analysis that may be in progress.

Cancel the analysis cancels the current analysis only; other scheduled operations will continue.

Close

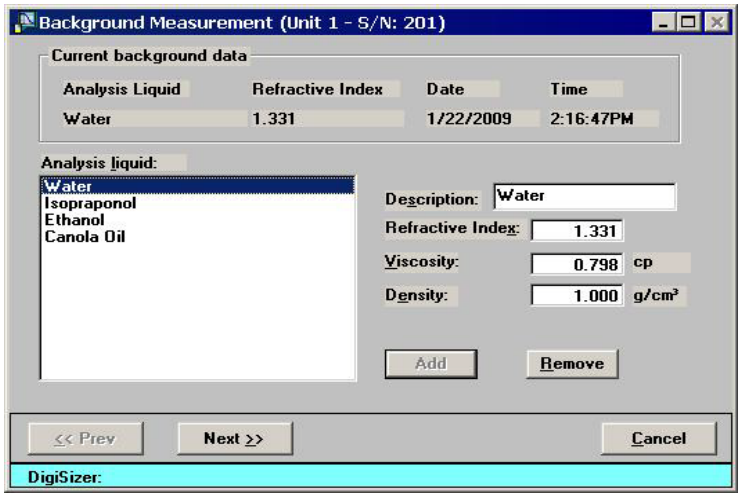
Closes the dialog. This push button is disabled if an automatic operation is in progress.

This window contains separate status windows for the DigiSizer and the MasterTech. Each window contains its own **Skip** and **Suspend** push buttons allowing you to perform either or both of these actions on the DigiSizer, the MasterTech, or both. Also displayed just above the status window for the analyzer is the progress of the analysis.

Background

Before you can perform an analysis, you must have a background measurement for data collection. It is not necessary to measure a background for each analysis. Micromeritics recommends that you perform a background measurement at the change of each shift or if you change dispersing agents. You may perform up to eight measurements; however, you can save and use only the last one. Refer to **Appendix I**, page I-1 for a discussion and illustrations on background quality.

When you select **Unit > Background**, the Background Measurement dialog is displayed.



Current background data

Displays the following information for the last background measured for this unit:

- the analysis liquid and its refractive index
- the date and time of the last background

Analysis liquid

Displays a list of analysis liquids. Select the liquid you wish to use for the measurement; its properties are displayed automatically in the fields to the right of the list. You can also add new liquids to the list using the **Add** push button (described below).

Description

Displays the name of the selected analysis liquid. This field is also used to add new liquids to the list.

Refractive Index
Viscosity
Density

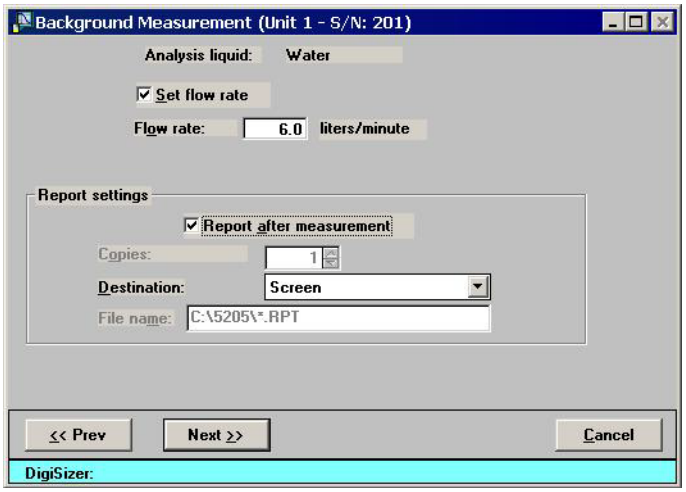
Display the properties of the selected analysis liquid. These fields are also used to enter properties of an analysis liquid that you wish to add to the list.

Add Adds a new analysis liquid to the list.

Enter the name of the liquid you wish to add in the **Description** field, its properties in the **Refractive Index**, **Viscosity**, and **Density** fields; then click **Add**.

Delete Deletes the selected analysis liquid from the list.

Select **Next** on this dialog to display the next window for the Background Measurement. This view allows you to enter the flow rate for the measurement and specify report output options.



Analysis Liquid Displays the liquid being used for the background measurement.

Set flow rate Select to enter the flow rate; typically, 6 liters per minute is sufficient.

Flow rate Enter the desired flow rate; disabled if **Set flow rate** is not selected.

Report after measurement Select to have a report generated automatically after each measurement.

Copies Enter the number of reports you wish to have printed. You can print up to four copies when you select **Printer** as the destination.

Destination This drop-down list presents four print destinations:

Choices: Screen, Printer, File

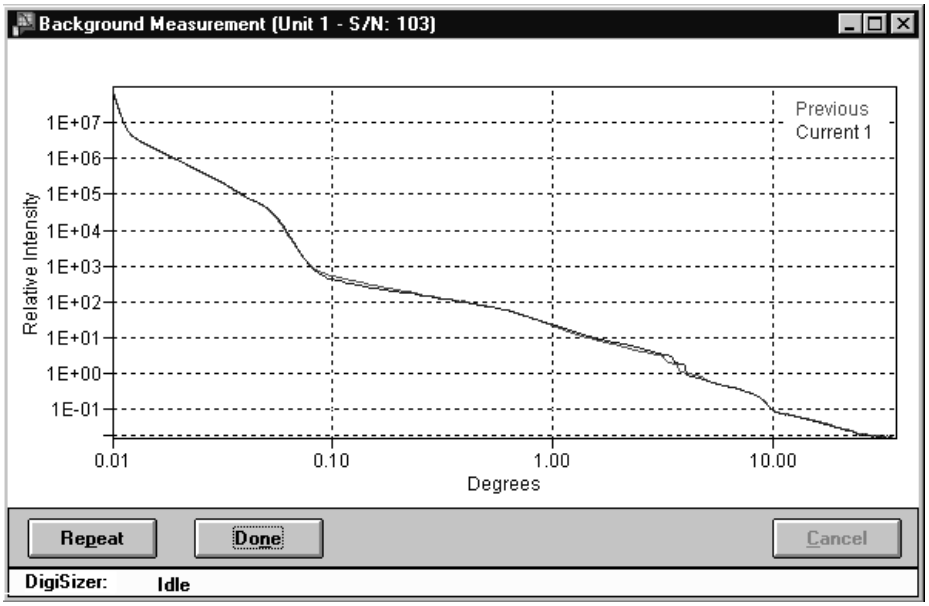
Graphical data cannot be generated to a **File**. If you wish to have a printout of the background graph, print to the screen and then copy as a metafile.

File name Not applicable to background measurements.

Click **Next** to begin the background measurement; a status view of the Background Measurement window is then displayed. This view of the window displays:

- the analysis liquid being used for the background measurement
- an estimated time remaining on the measurement
- the current beam angle

The status window at the bottom of the dialog shows a more specific status. After the background measurement is finished, the completed background measurement is displayed.



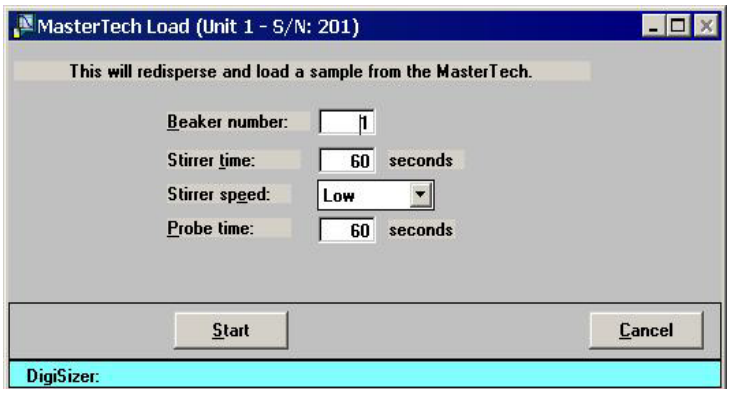
Repeat Select to perform another measurement. This push button becomes disabled after eight measurements. Refer to **Appendix I**, page **I-1** for information on determining a suitable background.

Done Saves the last measured background and closes the dialog.

Load from MasterTech

This option is functional only if you have a MasterTech connected to your analyzer.

This option allows you to manually redisperse a sample then transfer it to the DigiSizer for analysis. The MasterTech Load dialog is displayed.



Beaker number

Enter the position number of the beaker containing the sample you wish to load.

Range: 1 to 18

Stirrer time

Enter the number of seconds to have the stirrer operate during resuspension.

Stirrer speed

Choose the stirrer speed.

Coarse materials and less-stable dispersions may require more high-speed stirring time than finer materials.

Probe time

Enter how long you wish to have the ultrasonic probe operate during resuspension.

Coarse materials and less-stable dispersions may require more stirring time than finer materials.

Start

Begins the load operation; a message is displayed indicating a load operation is in progress. After the sample has been loaded, the dialog closes.

Cancel

Cancels the load operation and closes the dialog.

Rinse

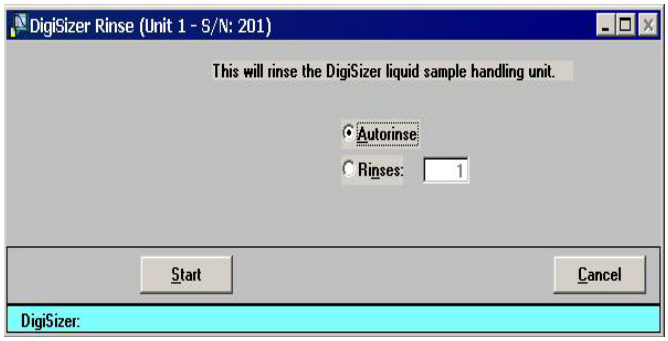
This option is disabled if analyses are in progress.

A rinse operation should be performed to rinse away any contaminants from the analysis cell, reservoir, and tubing which may have remained from a previous analysis.

When you select **Unit [n] > Rinse**, three choices are available:

- **DigiSizer** - rinses the analysis cell, reservoir, and tubing of the DigiSizer.
- **MasterTech** - rinses the MasterTech tubing. Disabled if a MasterTech is not connected to the DigiSizer.
- **MasterTech Then DigiSizer** - rinses the MasterTech tubing, then the analysis cell, reservoir, and tubing of the DigiSizer. Disabled if a MasterTech is not connected to the DigiSizer.

DigiSizer



Rinse Cycles

Select **Autorinse** to have the system determine how many rinses to perform in order to reach a beam obscuration of 0.1 or less.

If your analysis and rinse liquids are the same, rinsing stops when:

- No significant decrease in beam obscuration is attained twice in a row, displaying an error message. (**Appendix A** lists actions for the displayed error message.)
- The system has performed 10 rinses and was unable to attain 0.1 or less; an error message is displayed. (**Appendix A** lists actions for the displayed error message.)

Rinse Cycles

(continued)

If your analysis and rinse liquids are different, rinsing stops when:

- Successive rinses show no significant decrease in beam obscuration. If the beam obscuration is greater than 1.0, an error message is displayed. (**Appendix A** lists actions for the displayed error message.) If the beam obscuration is less than 1.0, it is assumed to be due to the difference in liquids and operation continues.
- The system has performed 10 rinses and was unable to attain a beam obscuration of less than 0.1, displaying an error message. (**Appendix A** lists actions for the displayed error message.)

Select **Rinses** to specify an exact number of rinses to perform.

Start

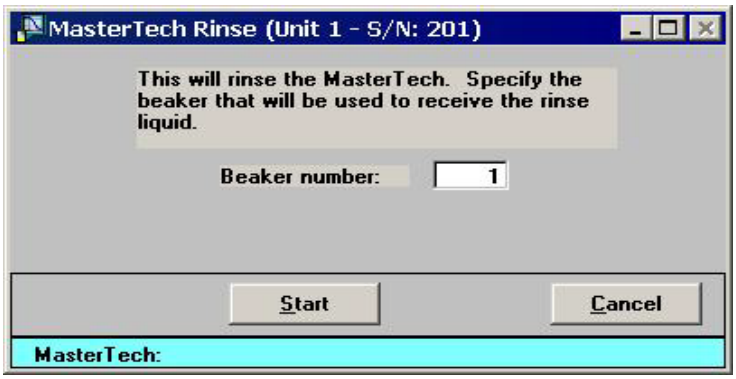
Begins the rinse operation; a message is displayed indicating a rinse operation is in progress. When rinsing is complete, the dialog closes.

Cancel

Cancels the rinse operation and closes the dialog.

MasterTech

This option is functional only if you have a MasterTech connected to your analyzer.



Beaker number

Enter the position number of the beaker you wish to rinse into. Be sure the beaker contains a small amount (approximately 10 mL) of liquid; otherwise, its presence may not be detected by the MasterTech.

Range: 1 to 18

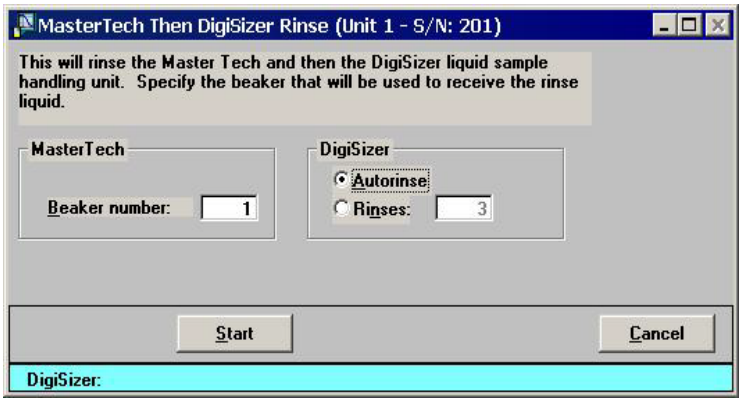
Start

Begins the rinse operation; a message is displayed indicating a rinse operation is in progress. When rinsing is complete, the dialog closes.

MasterTech Then DigiSizer

This option is functional only if you have a MasterTech connected to your analyzer.

Select **MasterTech then DigiSizer**; the MasterTech Then DigiSizer Rinse dialog is displayed.



MasterTech Group Box

Enter the position number of the beaker you wish to rinse into. Be sure the beaker contains a small amount (approximately 10 mL) of liquid; otherwise, its presence may not be detected by the MasterTech.

DigiSizer Group Box

Select **Autorinse** to have the system determine how many rinses to perform in order to reach a beam obscuration of 0.1 or less.

If your analysis and rinse liquids are the same, rinsing stops when:

- No significant decrease in beam obscuration is attained twice in a row, displaying an error message.
- The system has performed 10 rinses and was unable to attain 0.1 or less; an error message is displayed.

DigiSizer Group Box

(continued)

If your analysis and rinse liquids are different, rinsing stops when:

- Successive rinses show no significant decrease in beam obscuration. If the beam obscuration is greater than 1.0, an error message is displayed. If the beam obscuration is less than 1.0, it is assumed to be due to the difference in liquids and operation continues.
- The system has performed 10 rinses and was unable to attain a beam obscuration of less than 0.1, displaying an error message.

Select **Rinses** to specify an exact number of rinses to perform.

Start

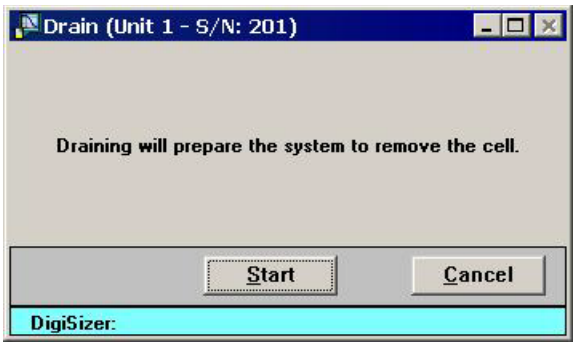
Begins the rinse operation; a message is displayed indicating a rinse operation is in progress. When rinsing is complete, the dialog closes.

Cancel

Cancels the rinse operation and closes the dialog.

Drain

Select this option to drain the Saturn DigiSizer system of all liquid. This operation must be performed before the sample cell can be removed; otherwise, the sample compartment will be flooded with liquid. This operation also moves the rotation arm out of the way so that the sample cell is accessed easily.



Start Begins the draining process; when all liquid has been drained from the system, the dialog closes automatically.

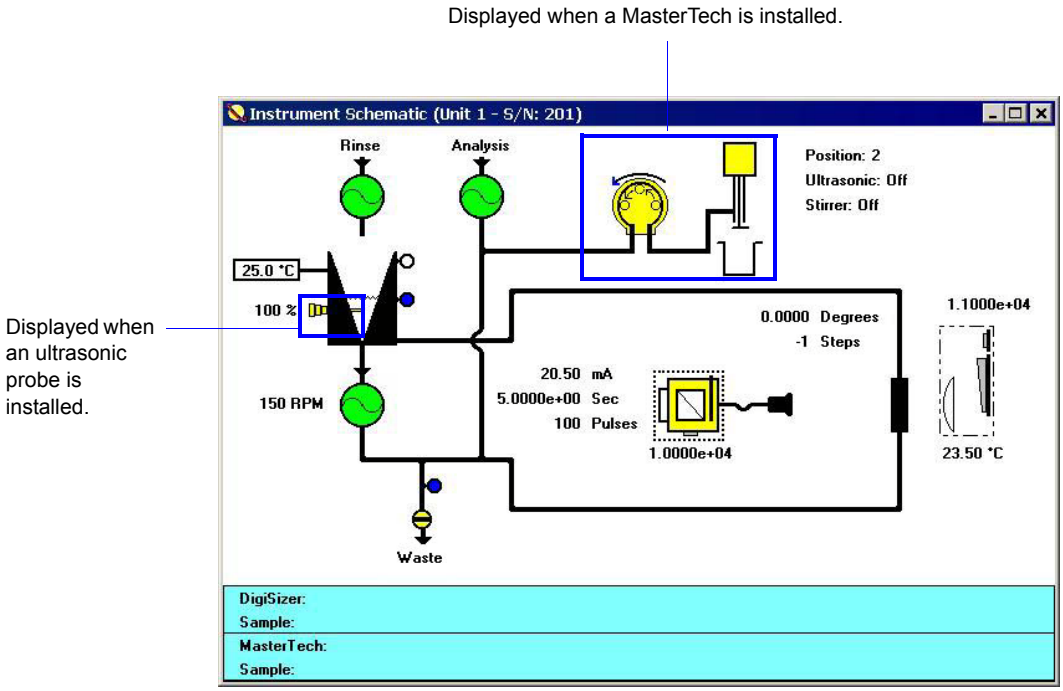
Initialize MasterTech

Select this option to align the MasterTech tray or if you wish to perform manual operations with the MasterTech. When the MasterTech is initialized, the tray is aligned so that beaker #1 is in the starting position.

Start Begins initialization; when initialization is complete, the dialog closes automatically.

Enable Manual Control

Select this option to control your system manually. If the instrument schematic is not displayed, select **Show Instrument Schematic**. This illustration shows a schematic of the DigiSizer with the standard liquid sample handler installed.



When you enable manual control, the symbols for valves and pumps change color on the screen to indicate manual operation.

- Valves: Closed = Yellow Open = Green
- Pumps: Off = Yellow On = Green *

*The analysis pump displays as light green when operating at high speed, and dark green when operating at low speed.

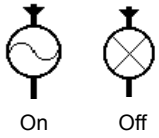
Use the mouse pointer or the **Tab** key to select schematic components. A component is selected when it is surrounded by a dotted line.

Each component that can be manually controlled has a shortcut menu displaying the operations available for that particular component. These menus may be accessed by right-clicking on the desired component, or by using the shortcut keys, **Shift + F9**.

You can turn pumps on and off, as well as open and close valves by using one of the following methods:

- access the shortcut menu and select the appropriate action
- double-click on the pump (or valve) symbol
- select the pump (or valve) symbol and press the **Spacebar**

Circulating pump

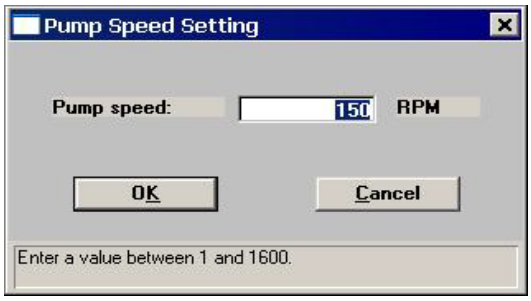


Pumps the sample and dispersing liquid through the analysis system. The direction of the flow of liquid is fixed as indicated by the arrow just above the pump.

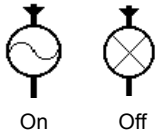
Colors: *Green = On*
Yellow = Off

Actions: *On, Off, Set Speed*

The speed at which the pump is operating is displayed to the left of the pump symbol. To specify a different speed, select **Set speed**; the Pump Speed Setting dialog is displayed:



Rinse pump



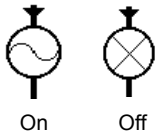
Pumps the rinse liquid into the reservoir. The direction flow of the liquid is fixed as indicated by the arrow just above the pump.

Colors: *Green = On*
Yellow = Off

Actions: *On, Off*

If your DigiSizer has the Low-volume liquid sample handler installed, the rinse pump does not display. The Low-volume liquid sample handler uses the analysis liquid for the rinsing operation.

Analysis liquid pump

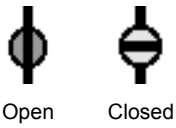


Pumps analysis liquid into the reservoir.

Colors: *Green (light) = On at high speed*
Green (dark) = On at low speed
Yellow = Off

Actions: *High, Low, Off*

Waste Valve



When open, allows the sample and analysis liquid to be flushed from the system.

Colors: *Green = Open*
Yellow = Closed

Actions: *Open, Close*

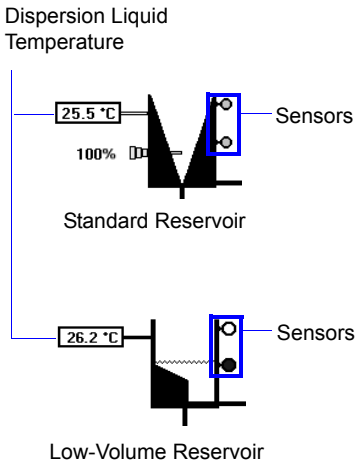
Liquid level sensor

Detects the liquid level of the associated component. Two sensors are located on the reservoir, one for the primed level and one for the full level. One sensor is located on the Waste valve.

Colors: *Blue = Liquid sensed*
Gray = No liquid sensed

Actions: *None available; display component only*

Reservoir

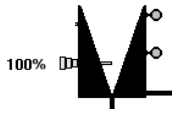


Holds the dispersed sample.

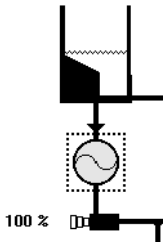
The temperature of the dispersion liquid is displayed to the left of the reservoir.

The reservoir has two liquid level sensors; one for the primed level and one for the full level.

Ultrasonic Probe



The probe is displayed in this position when using the standard sample handler.



The probe is displayed in this position when using the low-volume sample handler.

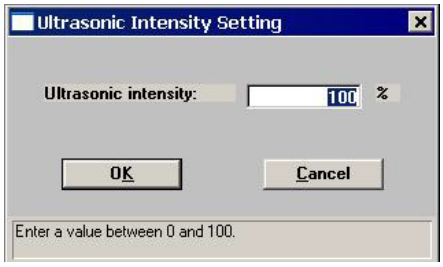
Typically, an optional ultrasonic probe is installed to maintain sample dispersion. The percentage of power being generated is shown to the left of the probe.

Colors: *Green = On*
Yellow = Off

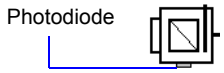
Actions: *Probe On, Probe Off, Set Probe Intensity*

Colors are not displayed and actions are unavailable if an ultrasonic probe is not installed.

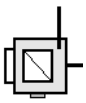
Select **Set probe intensity** to edit the ultrasonic power; the Ultrasonic Intensity Setting dialog is displayed.



Laser assembly



Filter in position



Filter out of position

The exposure parameters, drive current, pulse time, and number of pulses are displayed to the left of the laser assembly. The light dose for the photodiode is shown directly below the photodiode.

Colors: **Laser Assembly**
Yellow = Manual control enabled
Green = Exposure in process
Red = Laser is on

Photodiode
Grey = Idle
Blue = Exposure in process

Actions: *Filter In, Filter Out, Expose, Stop Exposure, Display*

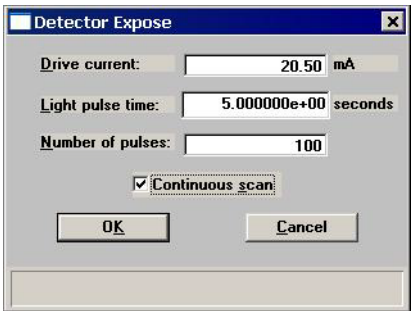
Error conditions associated with the laser assembly are displayed on the schematic in red with yellow text. **Appendix A** provides causes and actions for these error messages.

The filter controls the light coming from the laser. Select **Filter in** to have the laser intensity absorbed by a factor of approximately 7,200.

Laser assembly

(continued)

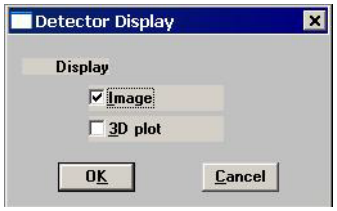
Select **Expose** to specify detector exposure values; the Detector Expose dialog is displayed.



Continuous scan allows successive exposures to be taken using the same conditions.

Stop Exposure stops the continuous scan as well as any exposure that may be in progress.

Display displays the Detector Display dialog allowing you to select a format in which to view an image of the raw data.



Choose **Image** to view the data in a bitmap format and **3D plot** to view the data in a 3-dimensional format. If you choose both options, two windows are opened. After you click **OK**, a Display window is shown. All subsequent exposures will be shown in the windows.

Each time an exposure is taken, it is displayed in the window as long as the window remains open. This window contains six push buttons:

Snap
Makes a duplicate copy of the entire window and its contents. The duplicate copy does not contain a push button and does not get updated with future images.

Print
Prints the contents of the window to the specified printer.

Copy
Copies the contents of the window to the clipboard.

Laser assembly

(continued)

Save
Saves the image to an IMG file for future retrieval.

Load
Loads a previously saved image (IMG file) into the window.

Close
Closes the display window.

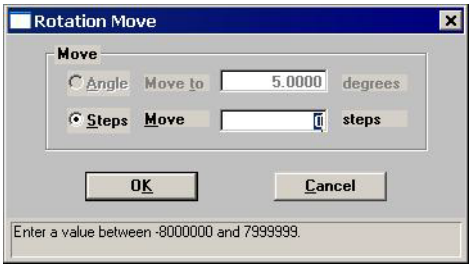
Rotation arm

The arm position is displayed in degrees and steps above the component image.

Colors: *None*

Actions: *Move, Set Reference Angle*

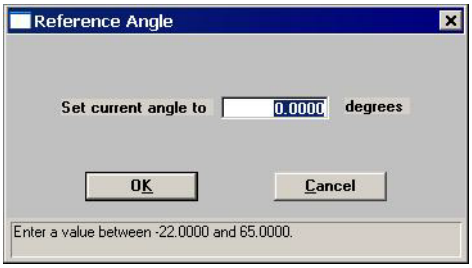
Select **Move** to change the arm position; the Rotation Move dialog is displayed.



Angle Move to moves the arm to the specified beam angle.

Steps Move moves the arm the specified number of steps from the current position. There are approximately 78,507 steps per degree.

Select **Set Reference Angle** to specify the current position of the rotation arm; the Reference Angle dialog is displayed.



CCD and beam photodiode

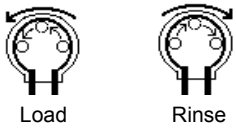
The light dose of the last exposure is displayed directly above the component image.

Colors: *Grey = No exposure in process*
Blue = Exposure in process

Actions: *None available; display component only*

Error messages are displayed in red with yellow text. Refer to **Appendix A** for causes and actions.

MasterTech pump



Displayed only when a MasterTech is installed. Flow direction is indicated by the direction of the arrows between the rollers and the one above the pump.

Colors: *Green = On*
Yellow = Off

Actions: *On, Off, Flow Direction Rinse,*
Flow Direction Load

Flow Direction Rinse pumps the rinse liquid to the MasterTech to rinse the MasterTech tubing of any sample which may have remained from a previous analysis.

Flow Direction Load sends the sample to the Saturn DigiSizer analyzer for analysis.

MasterTech arm

Displayed when a beaker is in position.

Colors: **Arm**
Yellow = manual control enabled

Probe
Green = On
Black = Off

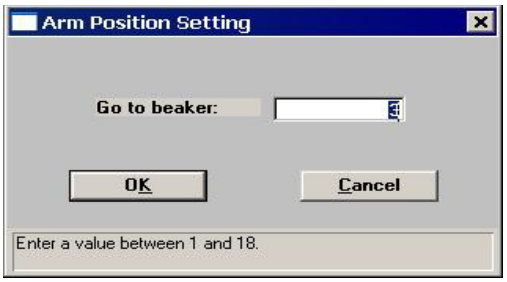
Stirrer
Black = Off
Green = On, low speed
Blue = On, high speed

MasterTech arm

(continued)

Actions: *Move Arm Up, Move Arm Down*
Ultrasonic On, Ultrasonic Off
Stirrer on, Stirrer off
Stirrer Speed Fast, Stirrer Speed Slow
Move to Beaker
Initialize
Self Test

Move to Beaker allows you to specify the position of the beaker to which you wish to move the arm.

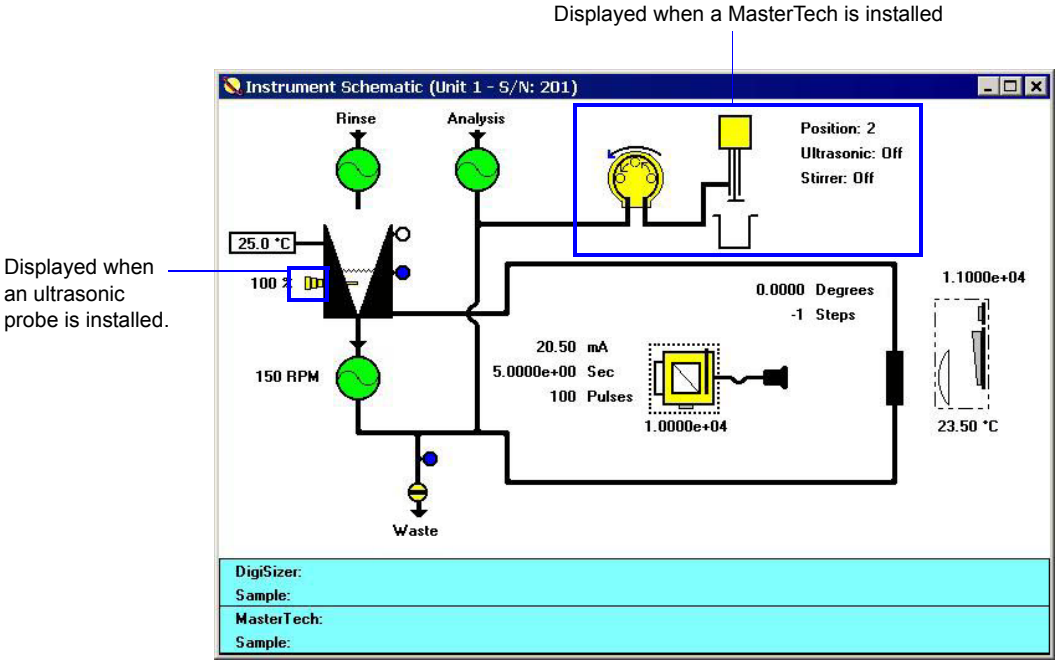


Initialize aligns the MasterTech tray so that Beaker #1 is in the starting position.

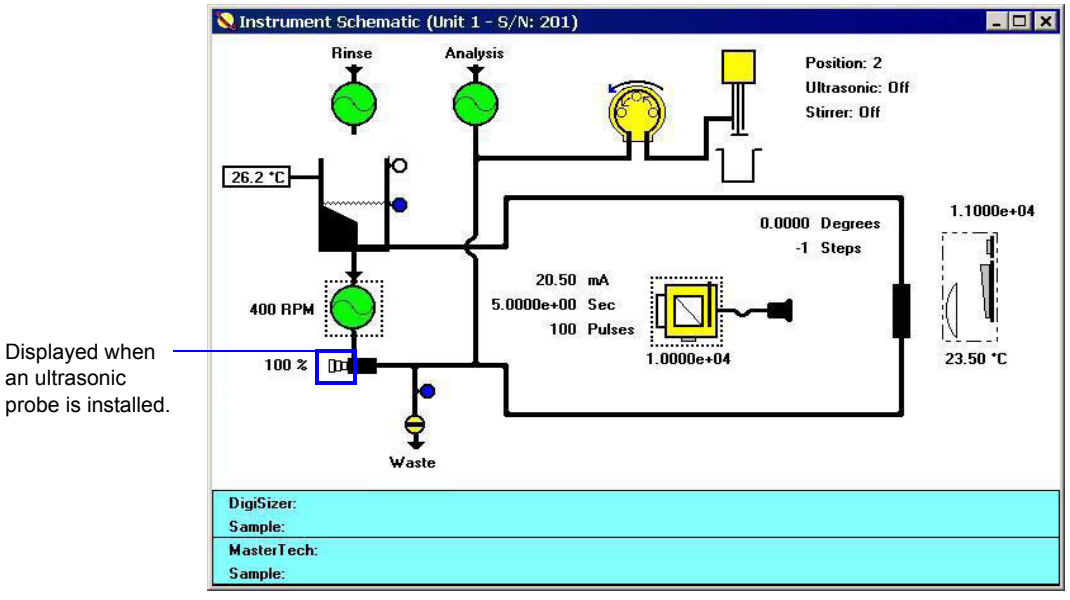
Self Test verifies that all components of the MasterTech are working properly.

Show Instrument Schematic

Select this option to display a schematic of the Saturn DigiSizer. Refer to the previous section for an explanation of the components displayed on the instrument schematic.



Schematic of Saturn DigiSizer with the Standard liquid sample handler installed.



Schematic of Saturn DigiSizer with the Low-volume liquid sample handler installed.

Even when manual control is not enabled, you still can determine the state of the valves and pumps by color.

- Valves: Closed = White Open = Green
- Pumps: Off = White On = Green *

If you wish to change the state of a valve or pump, you must enable manual control.

Show Results

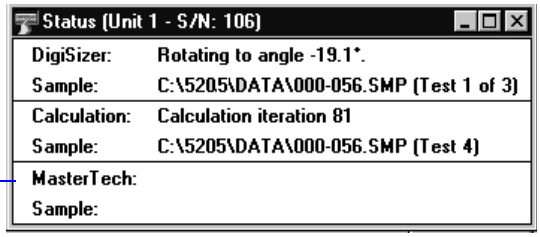
Choose this option to have results displayed as data are collected for multiple analyses.

Show Status

A status window is shown across the bottom of all operational dialogs. The Show Status option enables you to show only the status window of the operational dialog. If you have a MasterTech installed, its status is also included.

If you have two instruments attached to your computer, the status bar for each instrument is displayed in a different color.

Displays when a MasterTech is attached to the analyzer.

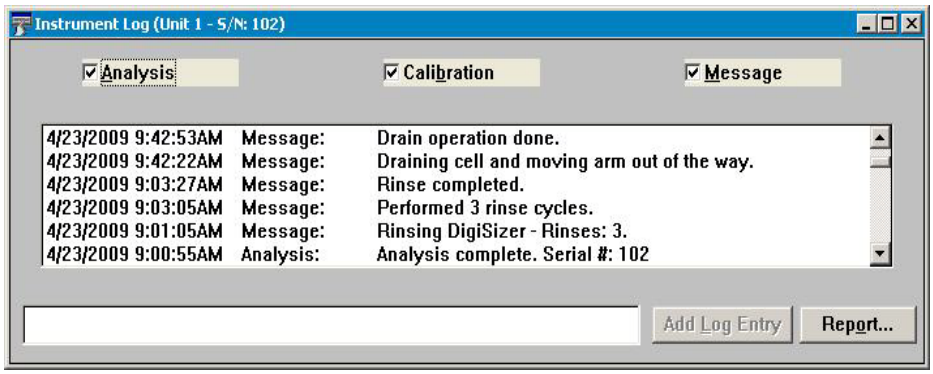


You may wish to use this option if:

- You have an automatic operation in progress and you decide to edit a sample file, for example. This way, you can monitor the status of your operation while performing another task.
- You have two units attached to your computer. You can select **Show Status** on each unit menu and have the status for all units displayed at one time.

Show Instrument Log

Displays a log of recent analyses, calibrations, and errors or messages. By default, this information is logged for a 7-day period for analyses and a 30-day period for messages and calibrations. You may change the time for which this information is retained in the Unit section of the WIN5205.INI file.



You can choose what you wish to display in the window by selecting only the desired item(s). For example, select only the Calibration check box to display only calibration information.

Analysis
Calibration
Messages

These options allow you to choose which entries are displayed in the window.

Add Log Entry

Enables you to make an entry in the instrument log that cannot be recorded automatically through the application software. For example, you may change the port filter. The field adjacent to the push button allows you to enter the operation; the push button is enabled when you make an entry in the field, allowing you to add the entry.

Report

Allows you to generate the log contents to a specified destination; the Log Report Settings dialog is displayed.

Report

(continued)

Use the **Start Date** field to specify the date at which to start the printout. You can specify a date using one of the following methods:

- Highlight the field (or press **F2)** to clear the field and type in the desired date.
- Double-click in the field (or press **F4**) to display a calendar to choose a date.
- Press **F3** to insert the current date.

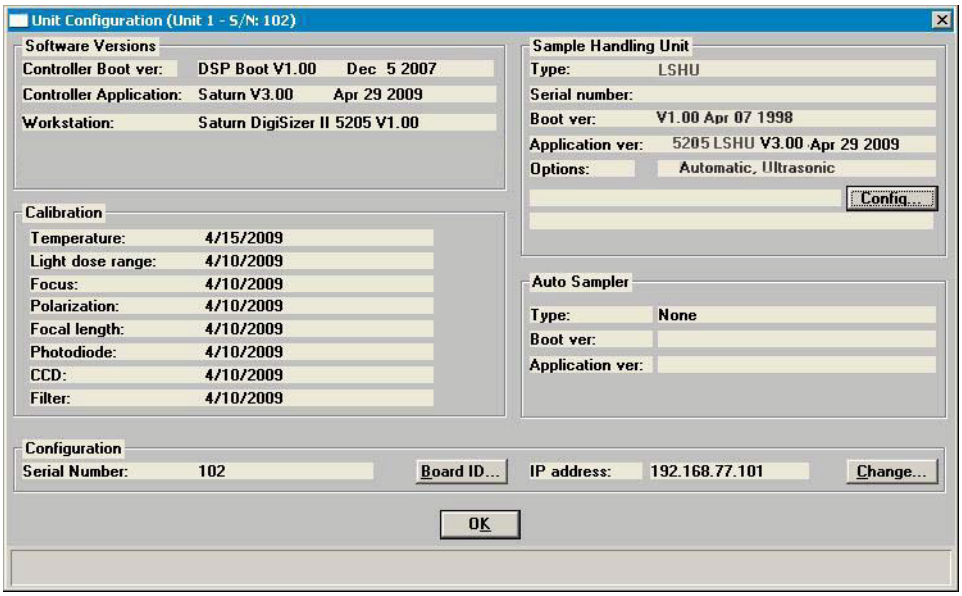
Enter the number of copies desired in the **Copies** field; you may print up to four. This field is disabled if you are printing to a **File** or to the **Screen**.

Choose the report destination from the drop-down list in the **Destination** field.

If you choose **File**, the **File name** field is enabled, allowing you to enter a name for the printed file (or you may accept the default).

Unit Configuration

Select this option to display the software/hardware configurations for the Saturn DigiSizer system. When you select Unit Configuration from the Unit menu, the Unit Configuration dialog is displayed.

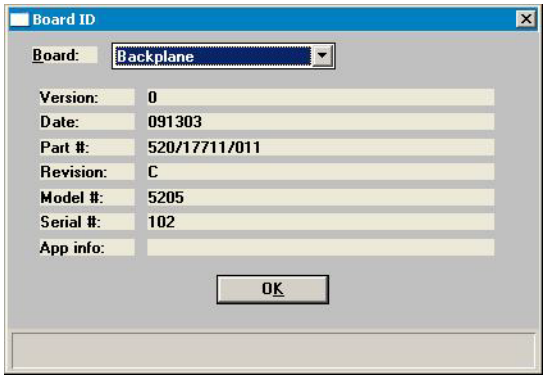


Software Versions Displays the software versions being used by the analyzer.

Calibration Displays calibration dates.

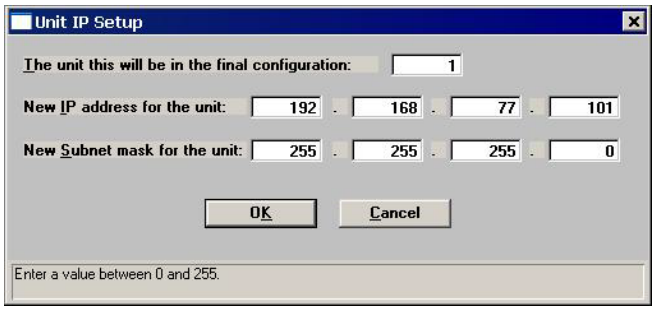
Configuration Displays the analyzer's serial number and the IP address.

Board ID Displays the Board ID dialog so that you can view the statistics of the board contained in the requested slot of the computer.



Change

Displays the Unit IP Setup dialog,



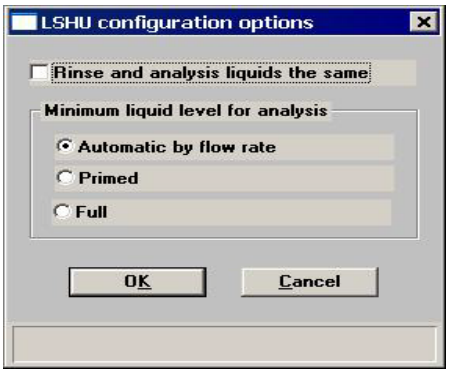
This dialog shows the IP address and Subnet mask that were assigned during installation. Do not edit these fields unless directed by a Micromeritics service representative.

Sample Handling Unit

Displays the type of sampling unit being used, its serial number, software versions, and installed options. This group box also lets you know if your analysis liquid and dispersing liquid are the same or different.

Config

Displays the LSHU configuration options dialog so that you can specify whether the rinse and analysis liquids are to be the same or different.



The options on this dialog enable you to specify when the rinse and analysis liquids are to be different, and the minimum liquid level for analysis. Typically, **Automatic by Flow rate** is sufficient for most analyses. This choice runs at a primed level for flow rates up to 12 L/minute.

Auto Sampler

Displays the type of autosampler being used (if any) and its software versions.

Calibration

These calibrations, like the service tests, are enabled and performed only with the assistance of a trained Micromeritics service representative.

Service Test

Various service tests are included in the Saturn DigiSizer operating program. These tests can be enabled and performed only with the assistance of a trained Micromeritics service representative. These tests are designed to provide your service representative with instrument readouts, as well as to assist him in troubleshooting potential problems and, perhaps, eliminating unnecessary repair services. This service strategy allows you to conduct expert tests in less time than it would take to be trained in servicing the instrument properly.

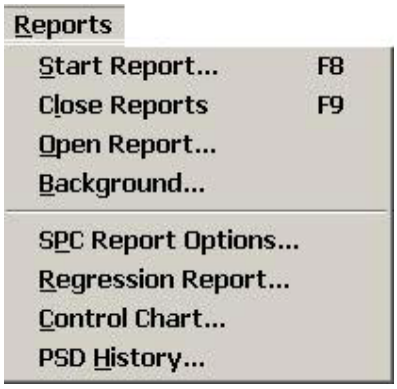
7. REPORTS MENU

The Reports menu contains options which allow you to initiate and close reports for:

- Sample analyses
- Background information
- Statistical process control
- Historical particle size distribution

This chapter describes the options contained on the Reports menu, the type of reports available, and examples of some of the reports available.

Description



Listed below are brief descriptions of the options contained on the Reports menu. Detailed descriptions follow this section.

Start Report — Allows you to generate a report on a completed sample analysis. Page 7-3.

Close Reports — Closes all open report window(s). Page 7-5.

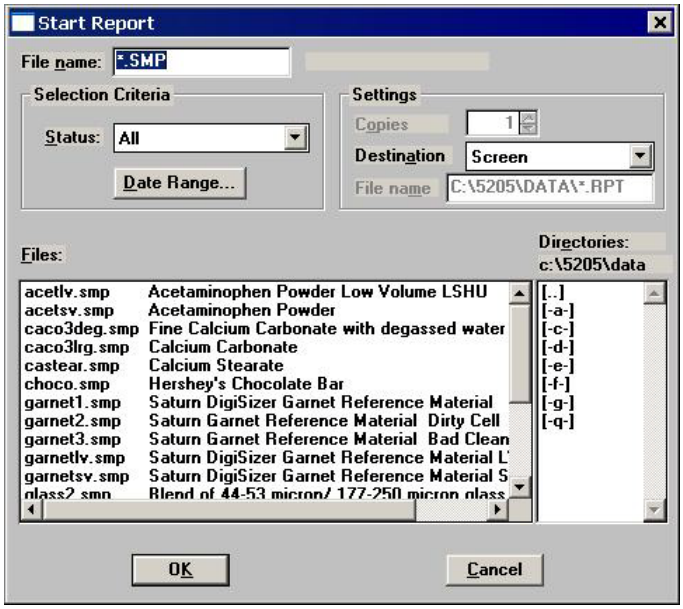
Open Report — Enables you to open a report that was saved from the report window. Page 7-5.

Background — Initiates a report on the current background for the selected unit. Page 7-6.

SPC Report Options	Allows you to specify the sample data to be included in SPC reports. Page 7-7.
Regression Report	Allows you to generate a regression report. Page 7-10.
Control Chart	Allows you to generate a control chart report. Page 7-13.
PSD History	Allows you to generate a particle size distribution history report. Page 7-17.

Start Report

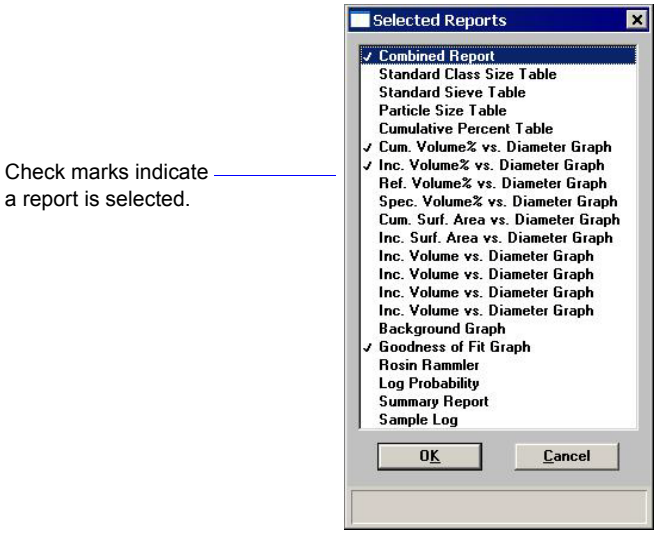
Select this option to generate a report on a sample analysis; the Start Report dialog is displayed.



File name

Displays the name of the file you select from the list. If you select multiple files, the last one selected is displayed. If you have a sample file open, its name defaults to this field.

- For multiple files, the reports specified in each sample file are printed to the output destination.
- For a single file, the Selected Reports dialog containing the available reports is displayed.



File name

(continued)

This dialog allows you to confirm or edit the selection of the reports you wish to generate.

Select (or deselect) reports by double-clicking on the desired report (reports are selected when they are preceded with a check mark). Alternatively, you can highlight the report and press the **Spacebar**.

Status

This drop-down list determines the type of sample files displayed in the **Files** list.

Choices: All, Analyzing, Complete, Entered

Refer to **Table 2-2. File Status and Description**, page **2-16** for a definition of the status types.

Date Range

Use this push button to specify a range of dates in which to display sample files. Refer to **Selecting Files**, page **2-16** for a description of this push button.

Copies

Enabled when the **Printer** destination is chosen, allowing you to print up to four copies of the selected reports.

Destination

Displays a drop-down list of output destinations.

Choices: File, Printer, Screen

If you select **Printer**, requested reports are printed to the selected printer.

If you select **Screen**, many options are available for report manipulation. Refer to **Onscreen Reports**, page **7-20** for manipulation methods of onscreen reports.

If you select **File**, the tabular reports of the requested file are converted to a text file which can be viewed with a text editor or other text file manipulation tool. Graphical data cannot be generated to a **File**.

File name

Enabled when you select **File** as the destination, enabling you to enter a name, or you may accept the default.

Files list box	Displays a list of the available sample files for the choice shown in the **Status** field and within the specified range of dates.
Directories	Displays a list of available drives and directories. The drive and directory last accessed is displayed immediately above the **Directories** list window.

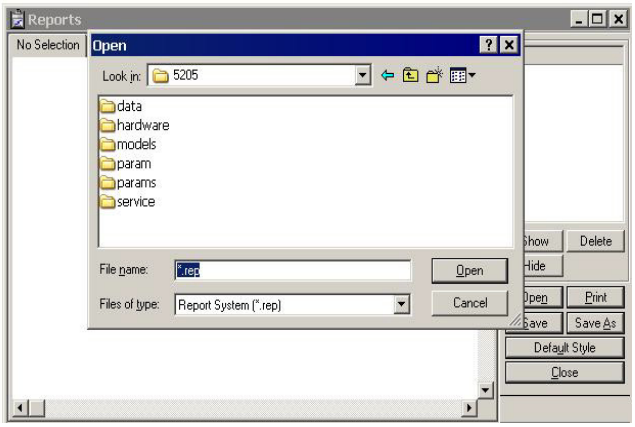
Close Reports

This option enables you to close all open report windows at one time. This avoids having to select close on each report window. This option is unavailable if reports are being generated.

Open Report

This option enables you to open a report that was saved from the Report window; the Report window opens with an Open dialog positioned on top.

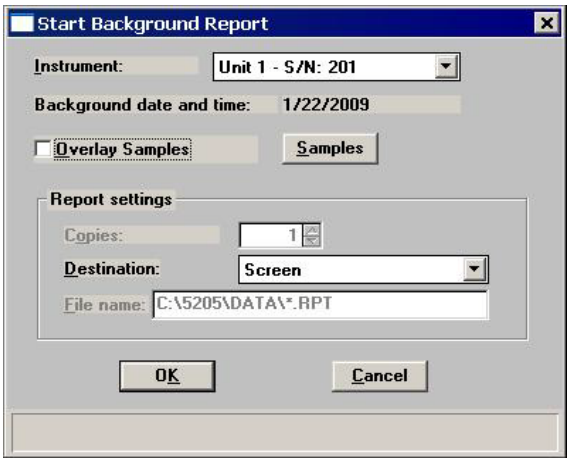
Report window



After you navigate to the desired directory, select your file, and click **Open**, your report is displayed in the Report window.

Background

This option allows you to generate a report on an instrument's background measurement. When you select **Reports > Background**, the Start Background Report dialog is displayed.



Instrument — Displays a drop-down list of the attached instruments, allowing you to choose the instrument on which to have a background report generated.

Background date and time — Displays the date and time the current background was performed on the selected instrument.

Overlay Samples — Choose this option to overlay the background for a sample (or multiple samples) with the current background. Click **Samples** to choose the desired file(s).

Copies — Enabled when the **Printer** destination is chosen, allowing you to print up to four copies of the selected report.

Destination — Displays a drop-down list of output destinations.

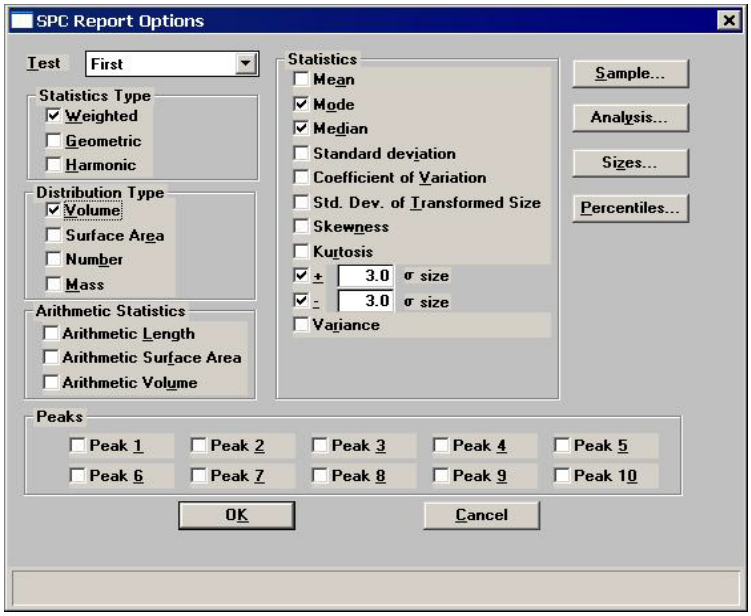
Choices: Screen, Printer, File

If you choose **File**, the **File name** field is enabled so that you can enter a name (or you can accept the default name).

SPC Report Options

This option enables you to select the data that are to be reported in Regression and Control Chart reports. For efficiency, it is best to select only the variables you actually intend to use. All variables selected must be computed for each sample file used in an SPC report. These archived values are used in all future reports unless you have selected **Recalculate archived SPC results** on the individual report dialog.

When you select SPC Report Options, the SPC Report Options dialog is displayed.



Test

This drop-down list contains analysis choices for SPC calculations.

Last reports statistics for the last analysis performed.

First reports statistics for the first analysis performed.

Average reports an average based on all tests in the selected sample file(s).

Statistics Type

Allows you to choose the type of statistics for which the SPC variables are to be calculated.

Distribution Type

Allows you to choose the type of distribution data for which the SPC variables are to be calculated.

Arithmetic Statistics

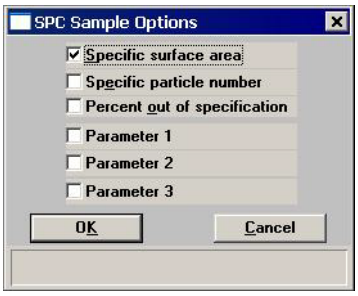
Allows you to choose the type of arithmetic statistics for which the SPC variables are to be calculated.

Statistics

Displays a list of the variables available for SPC reporting; you may choose as many as you wish.

Sample

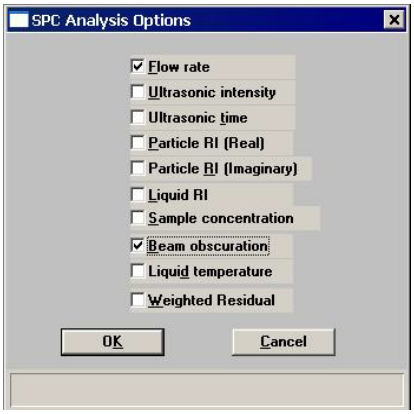
Displays the Sample SPC Options dialog, allowing you to select the sample parameters you wish to have reported.



Specific parameters can be designated for the fields labeled **Parameter [n]**. Refer to **Sample Defaults**, page 8-8 for additional information.

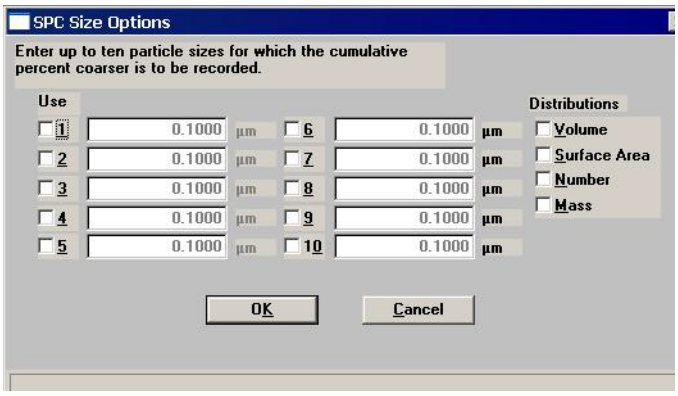
Analysis

Displays the SPC Analysis Conditions Options dialog, allowing you to select the analysis conditions you wish to have reported.



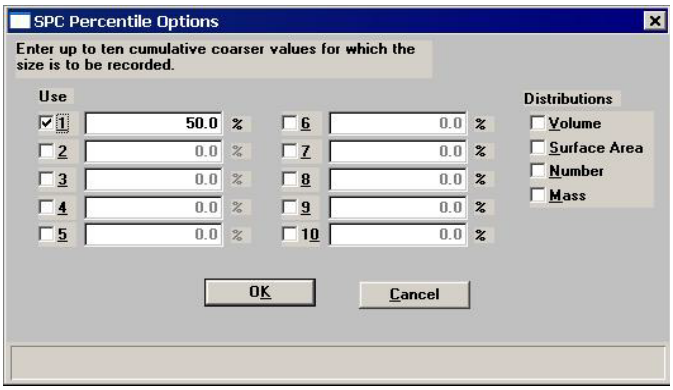
Sizes

Displays the SPC Size Options dialog, allowing you to specify up to 10 sizes and 3 distribution types at which the cumulative percent finer (or coarser, depending on the selection for data presentation) is to be reported.



Percentiles

Displays the SPC Percentile Options dialog, allowing you to specify the percentiles and distribution types for which the cumulative percent finer (or coarser, depending on the selection for data presentation) is to be reported.

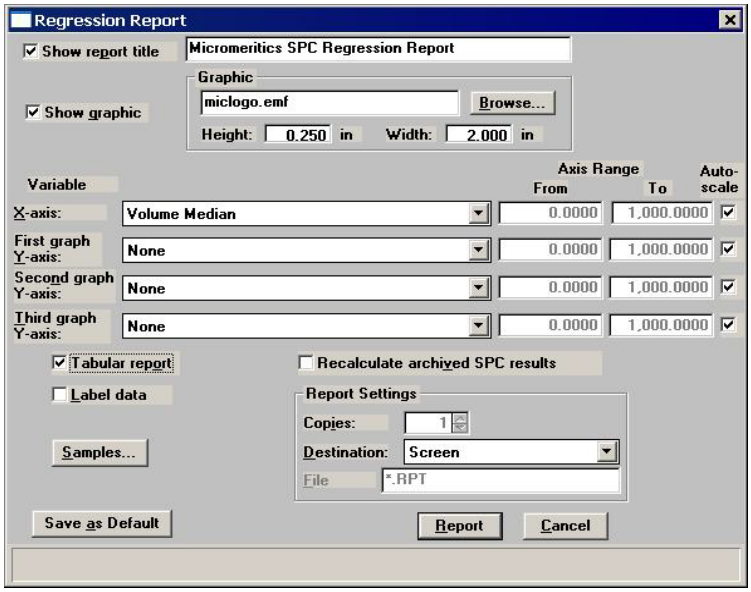


Peaks

Allows you to choose the peaks to include in SPC calculations; you can include up to 10 peaks.

Regression Report

Select this option to generate a regression report. The regression report is used to determine the interdependency between two variables. Up to three dependent variables (Y-axis) may be plotted against a single independent variable (X-axis). The degree of correlation between the variables also is reported. The graphs for the regression report are scaled so that all three fit on a single page. If you choose less than three, the graphs are scaled to fill most of the page.



Show report title

Select this option to have a title display on your report. Accept the default or enter a new title.

Range: 40 characters.

If you deselect this option, a report title will not be shown.

Show graphic

Select this option to have a graphic display above your report title. For example, you may wish to display your company logo. The graphic must be a bitmap (bmp) or enhanced meta-file (emf).

Click **Browse** to choose the file; use the **Height** and **Width** fields to specify a size. This image can be edited in the report window (when printed to the screen), or removed if desired.

X- and Y-Axes Variable fields

Allows you to designate the X- and Y-axes variables. Click on the down arrow to display a list of variables. The variables in this list are the ones you specified in **SPC report options**.

With this option, you may plot the regression of up to three Y-axis variables against the X-axis variable. The X-axis specifies the independent variable for the regression, while the Y-axes provide the dependent variables.

Axis Range

Allows you to specify the beginning and ending values for the X- and Y-axis ranges. Data collected outside these ranges are not included in the plot. These fields are disabled if you choose **Autoscale**.

Autoscale

Allows you to have the X- and/or Y-axes scaled automatically. When scaled automatically, both axes begin at zero. The analysis program uses the highest values collected during analysis as the ending points.

Tabular report

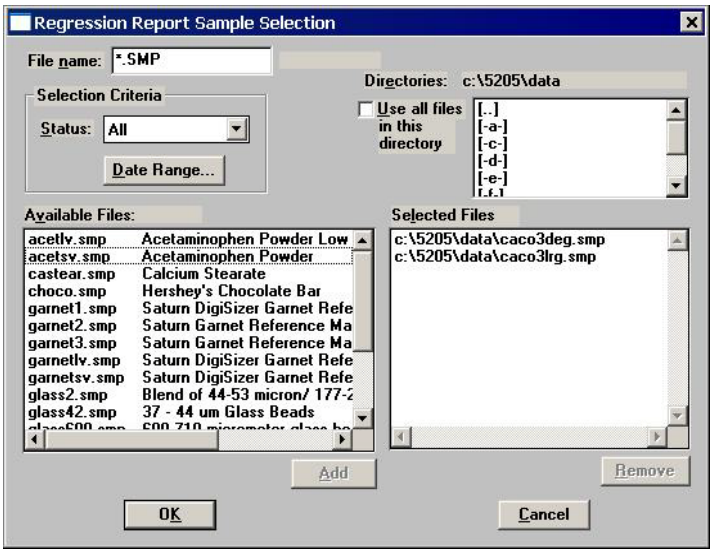
Allows you to generate tabular, as well as graphical, data of the included samples. A tabular report contains the numeric values contributed by each sample.

Label data

Allows you to label the points on the plot to correspond with the values in the sample files.

Samples

Displays the Regression Report Sample Selection dialog, allowing you to choose the sample files you wish to have reported.



Samples

(continued)

Select **Use all files in this Dir**. to include all files from the selected directory in the Regression report.

- Select the file and click **Add** to move a file from the **Files** list to the **Selected Files** list. Alternatively, you can simply double-click on the desired file(s). You can select multiple files by holding down **Ctrl** while making your selections.
- You can choose up to 200 sample files.
- Use **Delete** to delete a selected file from the **Selected Files** list and move it back to the Files: list.
- Use the **Status** drop-down list and/or **Dates** to limit the files displayed in the **Files** list.

Save as default

Saves the current definition of the report as the default.

Recalculate archived SPC results

Select this option to have archived SPC values recalculated. This ensures that any changes made to the SPC Report Options are included in the new report; however, it will lengthen the time required to generate the report.

Copies

Enabled when the **Printer** destination is chosen. This option allows you to print up to four copies of the selected reports.

Destination

Contains destination options for report output.

Choices: File, Printer, Screen

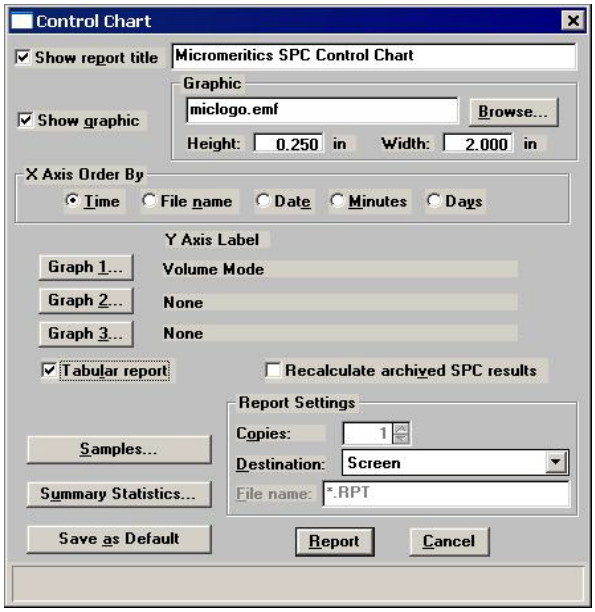
If you choose **File**, enter a name in the **File name** field. Remember, only tabular data can be generated to a file.

Report

Generates the report.

Control Chart

This option enables you to generate a control chart report which plots the changes in a statistic.



Show report title

Select this option to have a title display on your report. Accept the default or enter a new title.

Range: 40 characters.

Deselect this option to omit the report title.

Show graphic

Select this option to have a graphic display above your report title. For example, you may wish to display your company logo. The graphic must be a bitmap (bmp) or enhanced meta-file (emf).

Click **Browse** to choose the file; use the **Height** and **Width** fields to specify a size. This image can be edited in the report window (when printed to the screen), or removed if desired.

X-axis Order By

Enables you to choose the order in which X-axis statistics are placed. You can have them placed by **Time**, **File name**, **Date**, **Minutes**, or **Days**.

Time places the files on the graph at numerical points in the order of the date/time the files are analyzed.

File name places the files on the graph at numerical points in alphanumeric order.

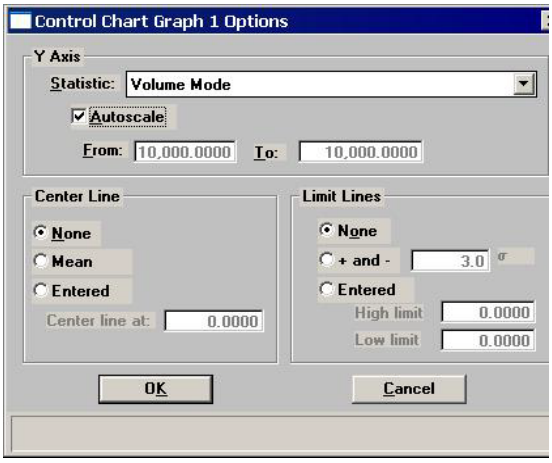
Date places the files on the graph at points representing the actual date/time the files are analyzed.

Minutes places the files on the graph at points representing the minutes that have elapsed from the first file placed on the list, which is the earliest-analyzed file.

Days places the files on the graph at points representing the number of days that have elapsed from the first file placed on the list, which is the earliest-analyzed file.

Graph [n]

Displays the Control Chart Graph [n] Options dialog, allowing you to define the Y-axis of each graph.



Statistic

This drop-down list displays the SPC variables selected on the SPC Report Options dialog. The variable you choose will be plotted against time.

Autoscale

Allows you to have the Y-axis scaled automatically. If you wish to specify a range, deselect this option and enter ranges in the **From** and **To** fields.

Center Line

Displays placement options for the variable's optional value. Choose **Entered** to specify placement of the line.

Limit Lines

Displays the options available for limiting lines. You can have the lines placed at some multiple of the standard deviation (σ) or at specified positions (**Entered**).

Tabular report

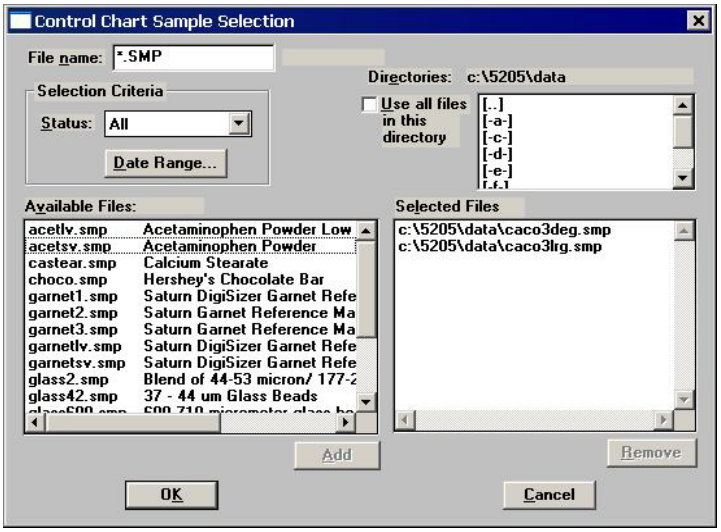
Allows you to generate tabular, as well as graphical, data of the included samples. A tabular report contains the numeric values contributed by each sample.

Recalculate archived SPC results

Select this option to have archived SPC values recomputed. This ensures that any changes made to the SPC Report Options are included in the new report. It also lengthens the time required to generate the report.

Samples

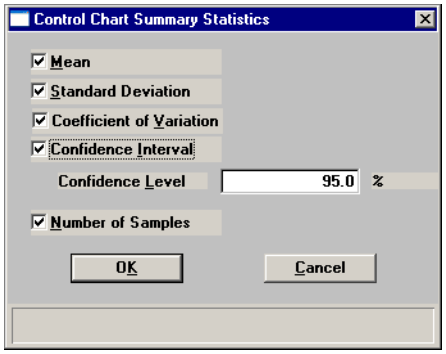
Displays the Control Chart Sample Selection dialog, allowing you to choose the sample files on which you wish to report.



This dialog functions in the same manner as the Regression Report Sample Selection dialog (refer to **Regression Report**, page **7-10**).

Summary Statistics

Allows you to select the statistics to display in the report.



Coefficient of Variation is the Standard Deviation divided by the Mean.

Confidence Interval of the mean value (shown on the same line below the graph on the report). When you select this option, the **Confidence Level** field is enabled allowing you to enter the percentage.

Select **Number of Samples** to have the number of samples analyzed included in the report.

Save as default

Saves the current definition of the report as the default.

Copies

Enabled when the **Printer** is chosen. This option allows you to print up to four copies of the selected reports.

Destination

Contains destination options for report output.

Choices: File, Printer, Screen

If you choose **File**, enter a name in the File name field. Remember, only tabular data can be generated to a file.

Report

Generates the report.

PSD History

This option enables you to report a sequence of full particle size distribution graphs.

Show report title

Select this option to have a title display on your report. Accept the default or enter a new title.

Deselect this option to omit the report title.

Range: 40 characters

Show graphic

Select this option to have a graphic display above your report title. For example, you may wish to display your company logo. The graphic must be a bitmap (bmp) or enhanced meta-file (emf).

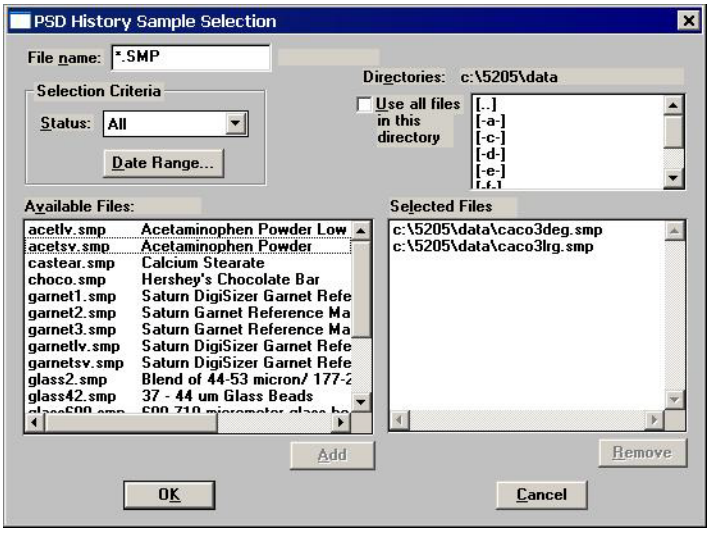
Click **Browse** to choose the file; use the **Height** and **Width** fields to specify a size. This image can be edited in the report window (when printed to the screen), or removed if desired.

X-xis Order By

Enables you to choose the order in which X-axis statistics are placed. You can have them placed by **Time**, **File name**, **Date**, **Minutes**, or **Days**. Refer to page 7-14 for explanation of these options.

Samples

Displays the PSD History Sample Selection dialog, allowing you to choose the sample files on which you wish to report.



This dialog functions in the same manner as the Regression Report Sample Selection dialog (refer to **Regression Report**, page **7-10**).

Save as default

Saves the current definition of the report as the default.

Copies

Enabled when the **Printer** destination is chosen. This option allows you to print up to four copies of the selected reports.

Destination

Contains destination options for report output.

Choices: File, Printer, Screen

If you choose **File**, enter a name in the **File name** field. Remember, only tabular data can be generated to a file.

Report

Generates the report.

Printed Reports

Header

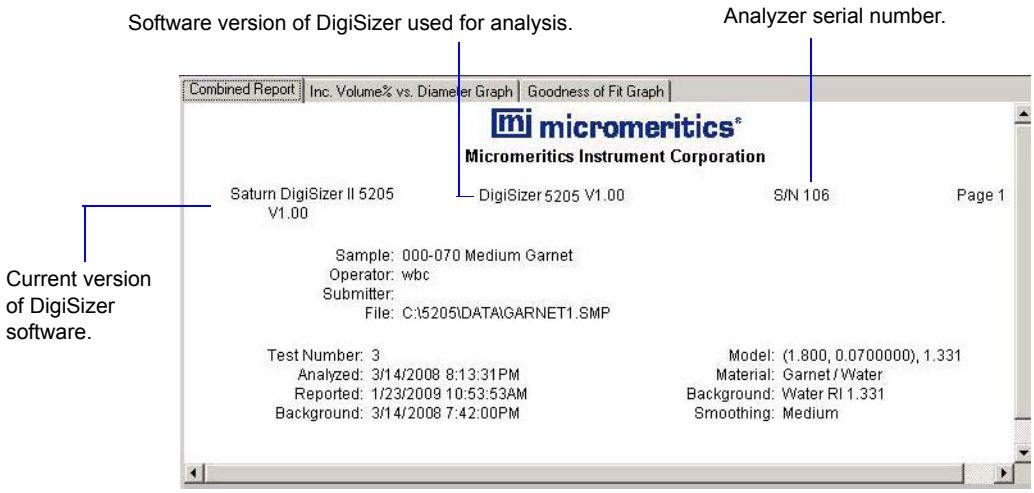
All printed reports (either to the screen or to a printer) contain a header displaying file statistics.

- Tabular and graphical reports contain sample and instrument statistics such as date and time of analysis, analysis conditions, background data, and so forth.

  Headers also contain notes of any changes to the sample file which occur after analysis.

- Summary report headers contain the same type of information displayed in tabular and graphical reports with the exception of notes.

- SPC report headers display the current date as well as the range of dates of the samples you select to have reported.

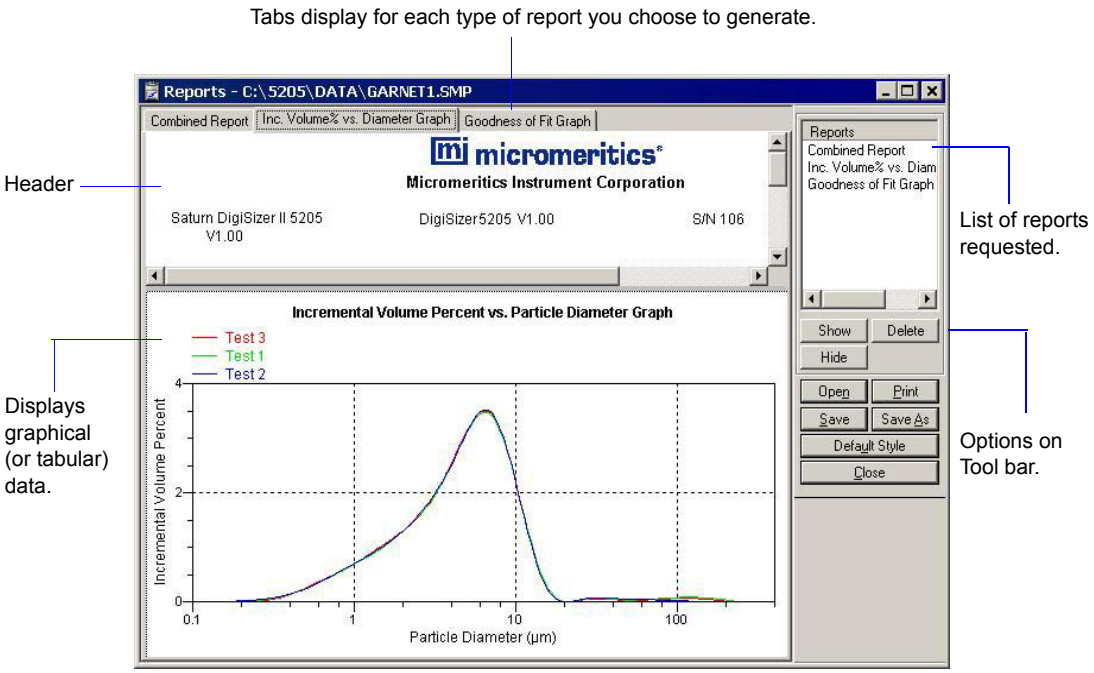


Onscreen Reports

The report window containing onscreen reports provides many options for customizing and manipulating reports:

- a tool bar
- shortcut menus
- zoom feature
- axis cross hairs

When reports are printed to the screen, they are printed in a window like the one shown below. Each requested report is listed in the Reports window on the tool bar; they are also indicated by selectable tabs across the top of the report header. To view a specific report, select its tab or select the report in the Reports window and click **Show**.



Tool Bar

Reports Contains a list of all requested reports.

Show Shows the selected report in the report window. If the report has been hidden, it and its associated tab will become visible.

Delete

Deletes the selected report. A deletion confirmation dialog is displayed since this function cannot be undone. The deleted report(s) will have to be regenerated if deleted in error.

Hide

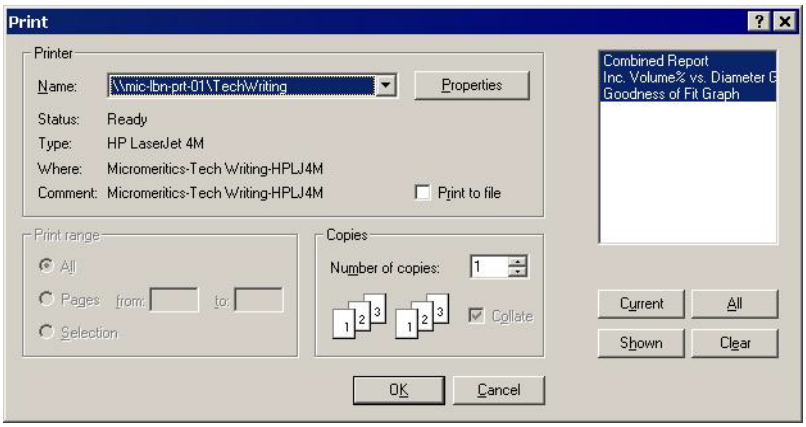
Hides (removes) the selected report from the report window. The report's associated tab is also removed.

Open

Allows you to open a previously saved report file.

Print

Displays a print dialog so that you can choose an appropriate printer for report output. A list of available reports is displayed in the window on the right side of the dialog.



For convenience in selecting reports to print, push buttons are provided beneath the report window. Or, you can make your selection by clicking on the desired reports.

Current
selects the report displayed in the report window.

Shown
selects only the shown reports; any unlighted reports indicate they are hidden. You can still select hidden reports from this window to print.

All
selects all reports, including those that may have been hidden.

Clear
clears all selections.

Save

Saves all reports of the currently open file in a report format using the same name as the sample file, only with an **rep** extension. If you wish to specify a name and/or specific reports to save, use the **Save as** push button.

Save as

Allows you to save all or specified reports from the currently open file. The push buttons displayed on this dialog perform in the same manner as the print dialog (explained above).

Reports can be saved in three different formats:

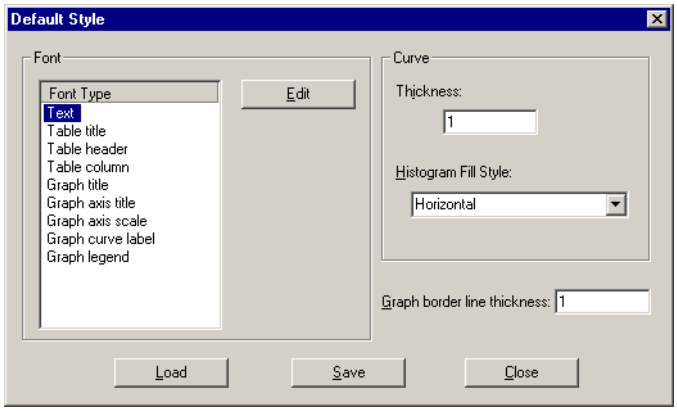
Report system (*.**rep**): Saved in a format which allows you to reopen the file using the **Open** push button on the Report window tool bar.

Spreadsheet (*.**xls**): Saved in a format which can be imported into most spreadsheet programs.

Ascii Text (*.**txt**): Saved in ASCII text which can be imported into programs accepting this type of file.

Default Style

Displays the Default Style dialog so that you can edit report defaults.



Fonts

Contains a list of report elements for which the font can be edited. Simply highlight the desired element and click **Edit**; a font dialog is displayed so that you can specify the desired font and attributes.

Curve

The items in this group box enable you to specify a thickness for report curves and, when using histograms, the type of fill to apply.

Graph border line thickness	Enables you to specify a thickness for the border of the graph.
Load	Loads the last *saved* defaults.
Save	Saves the changes as the defaults. If you do not click **Save**, the changes will apply to the current report set only. The next reports will revert to the defaults.
Close	Closes the dialog and applies the changes. If you clicked **Save**, the changes become the defaults. If you did not click **Save**, the changes apply to the current report only.

Close Closes the report window.

Shortcut Menus

Shortcut menus are accessed when you right-click on the tabular or graphical portion of a report.

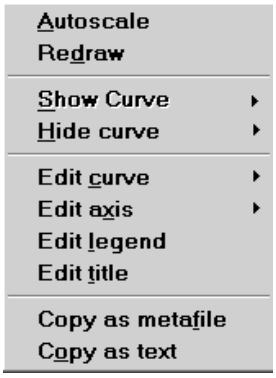
For Tabular Reports

Resize column Displays a dialog so that you can specify the width of the selected column (in inches).

Rename column Displays a dialog so that you can edit the name of the selected column. Use **Ctrl + Enter** to insert line feeds.

Move column	Allows you to move the location of the selected column to the left or to the right.
Align column	Enables you to right-align, left-align, or center the data in the selected column.
Hide column	Displays a list of all columns, enabling you to select the one you wish to hide.
Show column	Displays a list of all hidden columns, enabling you to select the one you wish to have shown again.
Column font	Displays a Font dialog, allowing you to change font attributes for the tabular data in the current report.
Header font	Displays a Font dialog, allowing you to change font attributes for column headers in the current report.
Edit title	Allows you to edit the table title and font.
Copy table as text	Enables you to copy the entire table (column headers and data) and then insert it into another program. Columns are tab-delimited, allowing easy alignment.

For Graphs



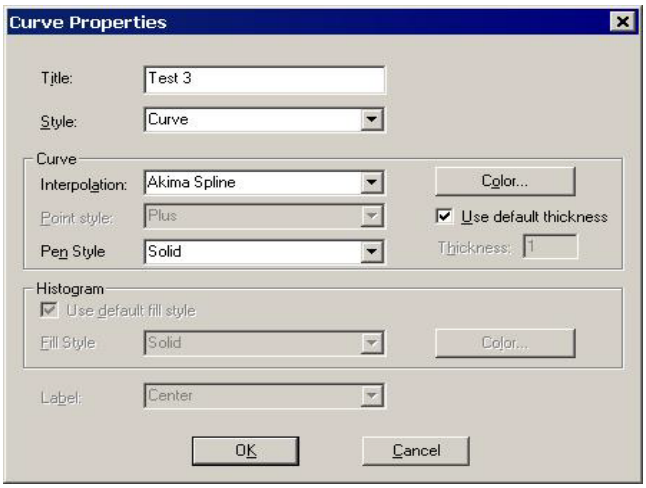
Autoscale Autoscales all axes of the graph. This function is useful for returning to a full view after having zoomed in.

Redraw Sets axis boundaries to its original view. You can also use this function to remove cross-hairs.

Show curve Allows you to show curves that have been hidden. This option is disabled (greyed) if no curves have been hidden.

Hide curve Allows you to hide (remove) unwanted curves.

Edit curve Displays the Curve Properties dialog, allowing you to edit curve properties.



Title — Displays the title of the curve you are editing.

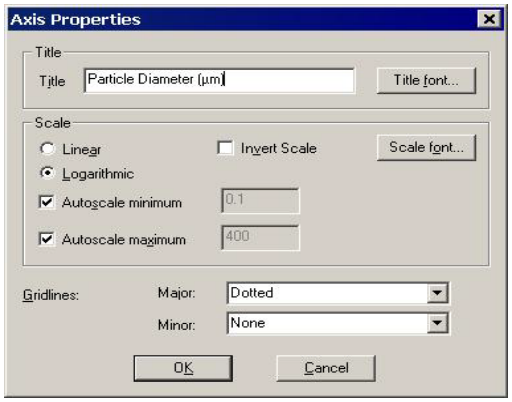
Style — Drop-down list containing styles in which collected data can be displayed.

Choices: Curve, Histogram, Points, Curve and Points

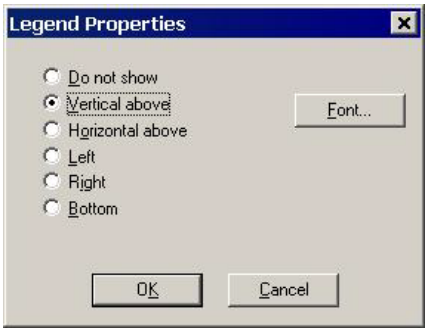
Curve group box — Contains options for curves and points. You can edit the curve interpolation, the style of curve and/or points, as well as the pen color. The options in this group box are disabled if **Histogram** is chosen in the **Style** drop-down list.

Histogram group box — Allows you to specify the type of fill as well as the color if **Histogram** is chosen as the style for collected data.

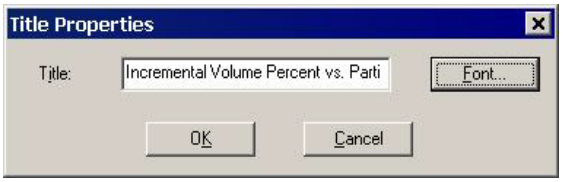
Edit axis — Displays the Axis Properties dialog, allowing you to edit axis properties.



Edit legend — Displays the Legend Properties dialog, allowing you to edit the placement of the legend.



Edit title Displays the Title Properties dialog, allowing you to edit the current graph's title and font.



Copy as metafile Copies the graph and places it on the clipboard, allowing you to paste it into other applications accepting Windows metafiles.

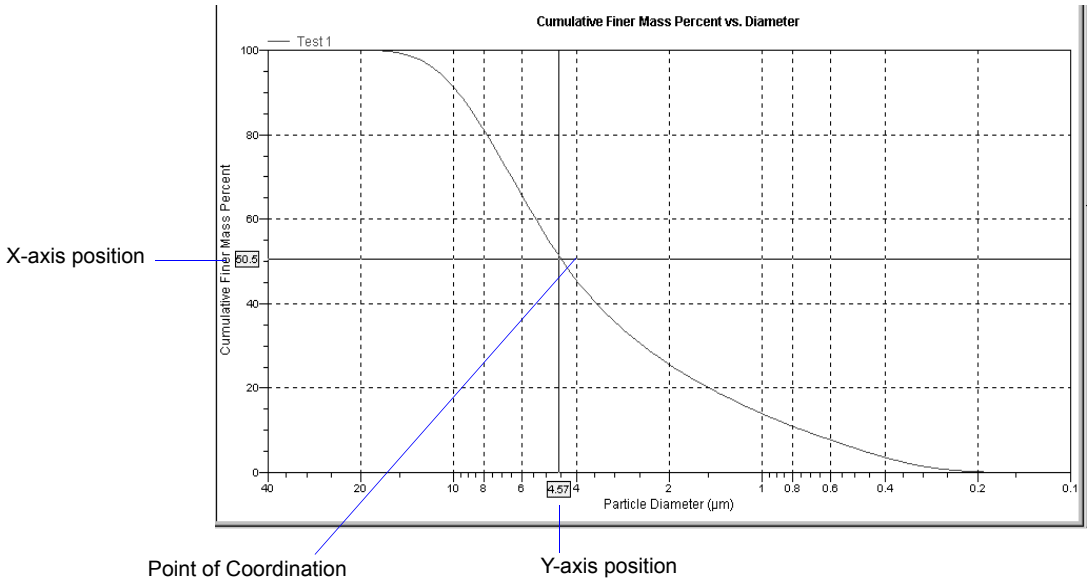
Copy as text Copies the data used to generate the graph as a series of tab-delimited columns of text.

Zoom Feature

A zoom feature is included with the report system so that you can zoom in to examine fine detail of the distribution. To use this feature, simply hold down the left mouse button and drag the mouse cursor (drawing a box) across the area you wish to view; then release the button. The enlarged area immediately fills the graph area. You can return to the normal view by right-clicking on the graph and selecting **Autoscale**.

Axis Cross Hair

A cross-hair function is available so that you can view axis coordinates. To use this feature, simply left-click in the desired area of the graph.



You can remove cross-hair lines and return to the normal view by right-clicking on the graph and selecting **Autoscale**, or clicking out of the graph area.

Report Examples

This section contains examples of the types of reports available using the Saturn DigiSizer analysis program.

Combined Report

The Combined report is a combination of all reports you select on the Combined Report options dialog. Reports are shown consecutively with no page breaks or headings.

Micromeritics Instrument Corporation

Saturn DigiSizer II 5205 V1.00 Saturn DigiSizer II 5205 V1.00 5200 LSHU V3.00 S/N 325 Page 1

Sample: Garnet Reference Material
Operator: CMS
Submitter: Micromeritics
File: C:\5205\DATA\EXAMPLES\GARNET.SMP

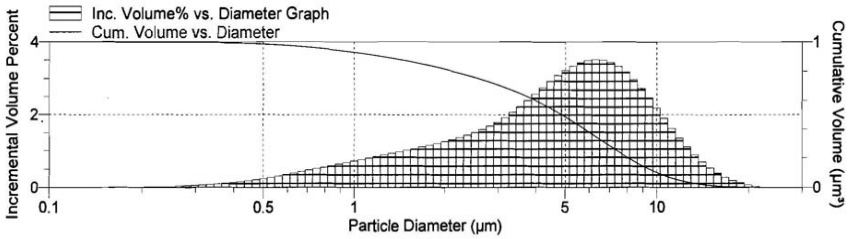
Test Number: 6
Analyzed: 6/26/2009 2:31:27PM
Reported: 7/10/2009 3:12:41PM
Background: 6/26/2009 1:48:07PM

Model: (1.800, 0.0700000), 1.331
Material: Garnet / Water
Background: Water RI 1.331
Smoothing: Medium

Comments: Internal dispersion; direct add.

Combined Report

Incremental Volume Percent vs. Particle Diameter Graph



Summary Report

Sample

Sample Concentration: 0.00263 %
Obscuration: 15.7 %
Out of Specs: 0.0 %
Specification Passed
Weighted Residual: 0.17 %

Weighted Statistics (Volume Distribution)

		Std Dev of 6			Std Dev of 6
Mean	5.346	0.224	Mode	6.307	0.000
Median	4.860	0.009			

Peaks: Weighted Statistics (Volume Distribution)

Peak Number	Percent of Dist.*	Percent of Dist. Std Dev of 6	Mean	Mean Std Dev of 6	Median	Median Std Dev of 6	Mode
1	100.0	0.2	5.346	0.011	4.860	0.009	6.307

* Peaks must comprise at least 5.00 % of the distribution.

Particle Size Table

Micromeritics Instrument Corporation

Saturn DigiSizer II 5205 V1.00 Saturn DigiSizer II 5205 V1.00 5200 LSHU V3.00 S/N 325 Page 2

Sample: Garnet Reference Material
Operator: CMS
Submitter: Micromeritics
File: C:\5205\DATA\EXAMPLES\GARNET.SMP

Test Number: 6
Analyzed: 6/26/2009 2:31:27PM
Reported: 7/10/2009 3:12:41PM
Background: 6/26/2009 1:48:07PM

Model: (1.800, 0.0700000), 1.331
Material: Garnet / Water
Background: Water RI 1.331
Smoothing: Medium

Comments: Internal dispersion; direct add.

Report by Size Table

Low Particle Diameter (µm)	Cumulative Volume Percent	Diff Ref.: Cumulative Volume Percent	Out of Spec: Cumulative Volume Percent	Low Particle Diameter (µm)	Cumulative Volume Percent	Diff Ref.: Cumulative Volume Percent	Out of Spec: Cumulative Volume Percent
12.000	4.7	0.1	0.0	4.800	50.7	0.1	0.0
10.000	10.2	0.4	0.0	3.900	60.8	0.0	0.0
8.000	20.7	0.2	0.0	3.000	70.6	0.0	0.0
6.700	31.0	0.1	0.0	2.100	80.0	-0.1	0.0
5.700	40.8	0.1	0.0	1.200	90.4	0.2	0.0

Volume Percent Table

Micromeritics Instrument Corporation

Saturn DigiSizer II 5205 V1.00 Saturn DigiSizer II 5205 V1.00 5200 LSHU V3.00 S/N 325 Page 3

Sample: Garnet Reference Material
Operator: CMS
Submitter: Micromeritics
File: C:\5205\DATA\EXAMPLES\GARNET.SMP

Test Number: 6
Analyzed: 6/26/2009 2:31:27PM
Reported: 7/10/2009 3:12:41PM
Background: 6/26/2009 1:48:07PM

Model: (1.800, 0.0700000), 1.331
Material: Garnet / Water
Background: Water RI 1.331
Smoothing: Medium

Comments: Internal dispersion; direct add.

Report by Volume Percent

Low Particle Diameter (µm)	Cumulative Volume Percent	Diff Ref.: Cumulative Volume Percent	Out of Spec: Cumulative Volume Percent	Low Particle Diameter (µm)	Cumulative Volume Percent	Diff Ref.: Cumulative Volume Percent	Out of Spec: Cumulative Volume Percent
10.054	10.0	0.4	0.0	1.230	90.0	0.3	0.0
4.860	50.0	0.1	0.0				

Cumulative Volume Percent vs. Particle Diameter

Micromeritics Instrument Corporation

Saturn DigiSizer II 5205 V1.00 Saturn DigiSizer II 5205 V1.00 5200 LSHU V3.00 S/N 325 Page 1

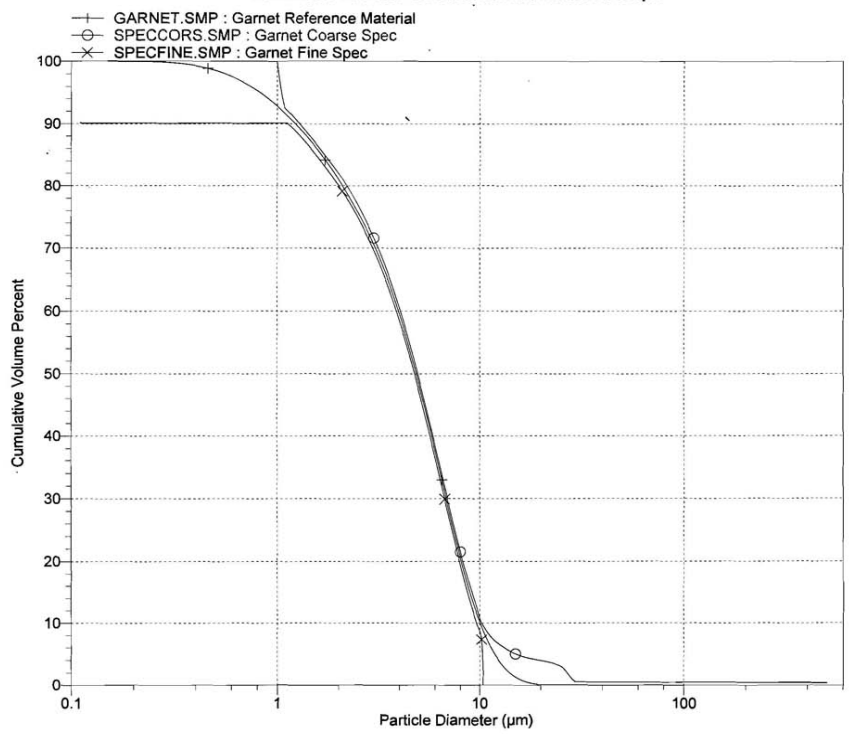
Sample: Garnet Reference Material
Operator: CMS
Submitter: Micromeritics
File: C:\5205\DATA\EXAMPLES\GARNET.SMP

Test Number: 6
Analyzed: 6/26/2009 2:31:27PM
Reported: 7/10/2009 3:12:41PM
Background: 6/26/2009 1:48:07PM

Model: (1.800, 0.0700000), 1.331
Material: Garnet / Water
Background: Water RI 1.331
Smoothing: Medium

Comments: Internal dispersion; direct add.

Cumulative Volume Percent vs. Particle Diameter Graph



Incremental Volume Percent vs. Particle Diameter

Micromeritics Instrument Corporation

Saturn DigiSizer II 5205 V1.00 Saturn DigiSizer II 5205 V1.00 5200 LSHU V3.00 S/N 325 Page 1

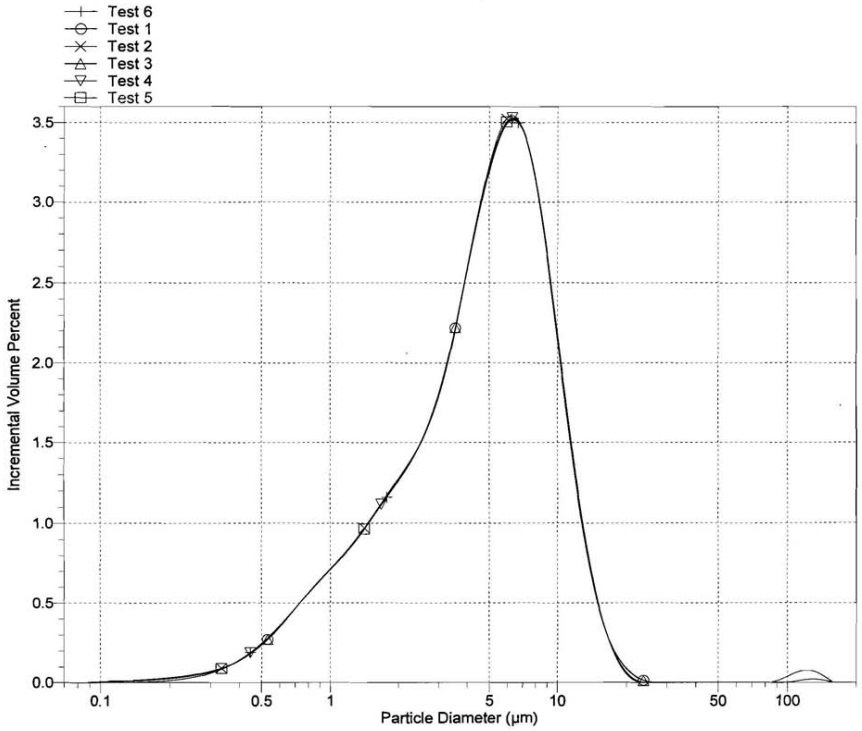
Sample: Garnet Reference Material
Operator: CMS
Submitter: Micromeritics
File: C:\5205\DATA\EXAMPLES\GARNET.SMP

Test Number: 6
Analyzed: 6/26/2009 2:31:27PM
Reported: 7/10/2009 3:12:42PM
Background: 6/26/2009 1:48:07PM

Model: (1.800, 0.0700000), 1.331
Material: Garnet / Water
Background: Water RI 1.331
Smoothing: Medium

Comments: Internal dispersion; direct add.

Incremental Volume Percent vs. Particle Diameter Graph



Difference from Reference

Micromeritics Instrument Corporation

Saturn DigiSizer II 5205 V1.00 Saturn DigiSizer II 5205 V1.00 5200 LSHU V3.00 S/N 325 Page 1

Sample: Garnet Reference Material
Operator: CMS
Submitter: Micromeritics
File: C:\5205\DATA\EXAMPLES\GARNET.SMP

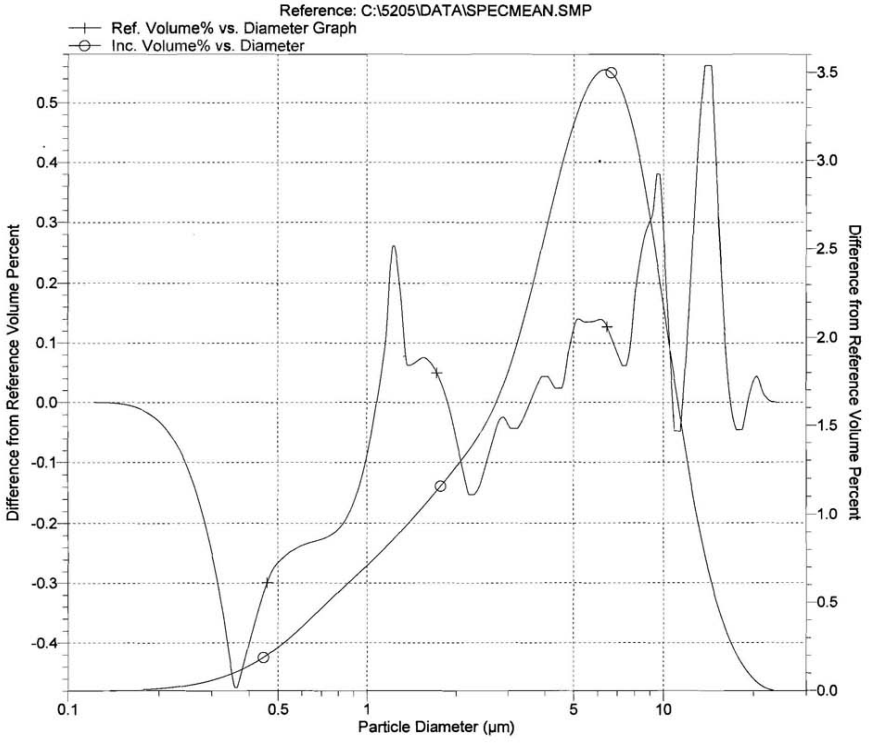
Test Number: 6
Analyzed: 6/26/2009 2:31:27PM
Reported: 7/10/2009 3:12:42PM
Background: 6/26/2009 1:48:07PM

Model: (1.800, 0.0700000), 1.331
Material: Garnet / Water
Background: Water RI 1.331
Smoothing: Medium

Comments: Internal dispersion; direct add.

Difference from Reference Volume Percent vs. Particle Diameter Graph

Reference: C:\5205\DATA\SPECMEAN.SMP



Out of Specification

Micromeritics Instrument Corporation

Saturn DigiSizer II 5205 V1.00 Saturn DigiSizer II 5205 V1.00 5200 LSHU V3.00 S/N 325 Page 1

Sample: Garnet Reference Material
Operator: CMS
Submitter: Micromeritics
File: C:\5205\DATA\EXAMPLES\GARNET.SMP

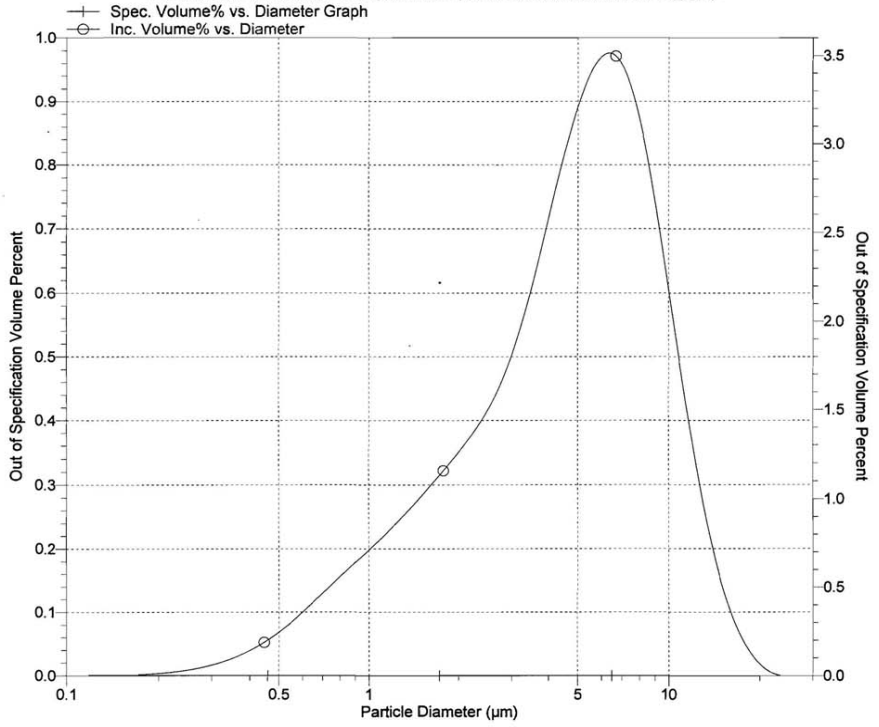
Test Number: 6
Analyzed: 6/26/2009 2:31:27PM
Reported: 7/10/2009 3:12:42PM
Background: 6/26/2009 1:48:07PM

Model: (1.800, 0.0700000), 1.331
Material: Garnet / Water
Background: Water RI 1.331
Smoothing: Medium

Comments: Internal dispersion; direct add.

Out of Specification Volume Percent vs. Particle Diameter Graph

Coarse: C:\5205\DATA\SPECCORS.SMP - Fine: C:\5205\DATA\SPECFINE.SMP



Background Report

Micromeritics Instrument Corporation

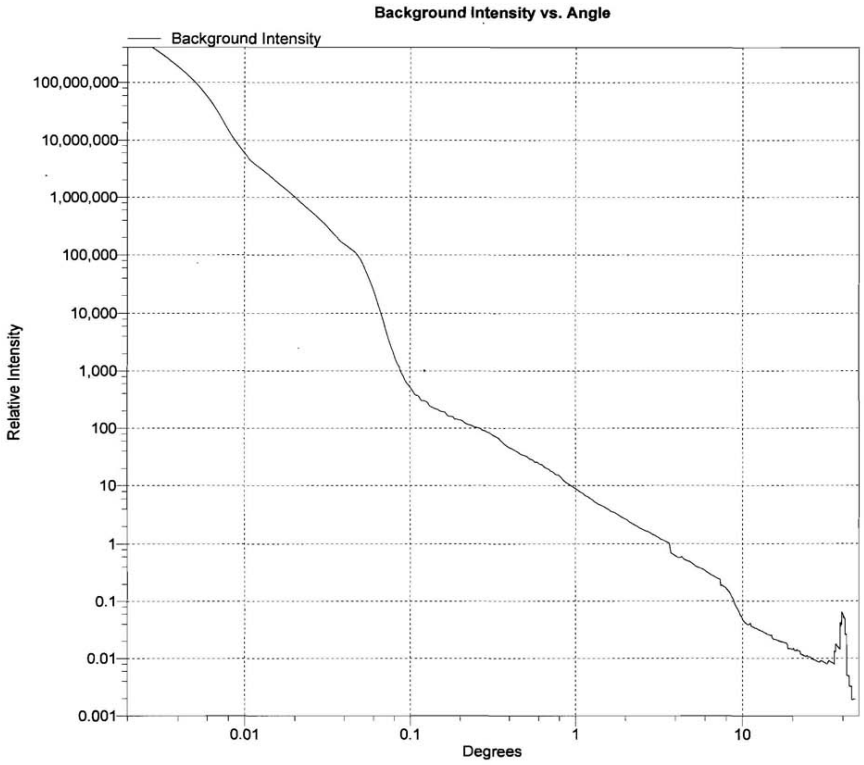
Saturn DigiSizer II 5205 V1.00 Saturn DigiSizer II 5205 V1.00 5200 LSHU V3.00 S/N 325 Page 1

Sample: Garnet Reference Material
Operator: CMS
Submitter: Micromeritics
File: C:\5205\DATA\EXAMPLES\GARNET.SMP

Test Number: 6
Analyzed: 6/26/2009 2:31:27PM
Reported: 7/10/2009 3:12:42PM
Background: 6/26/2009 1:48:07PM

Model: (1.800, 0.0700000), 1.331
Material: Garnet / Water
Background: Water RI 1.331
Smoothing: Medium

Comments: Internal dispersion; direct add.



Goodness of Fit

Micromeritics Instrument Corporation

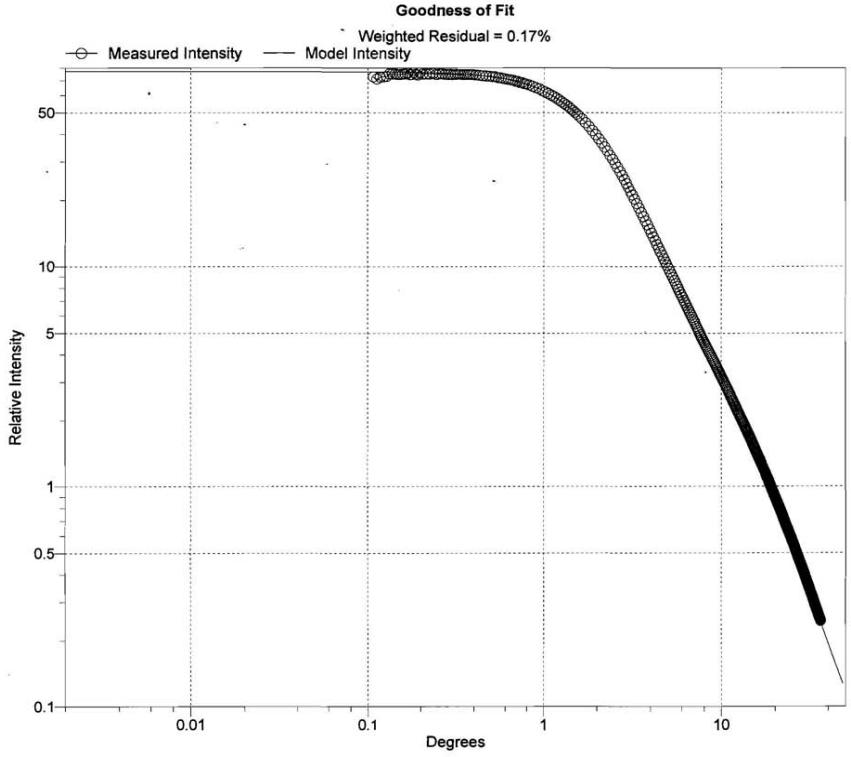
Saturn DigiSizer II 5205 V1.00 Saturn DigiSizer II 5205 V1.00 5200 LSHU V3.00 S/N 325 Page 1

Sample: Garnet Reference Material
Operator: CMS
Submitter: Micromeritics
File: C:\5205\DATA\EXAMPLES\GARNET.SMP

Test Number: 6
Analyzed: 6/26/2009 2:31:27PM
Reported: 7/10/2009 4:14:16PM
Background: 6/26/2009 1:48:07PM

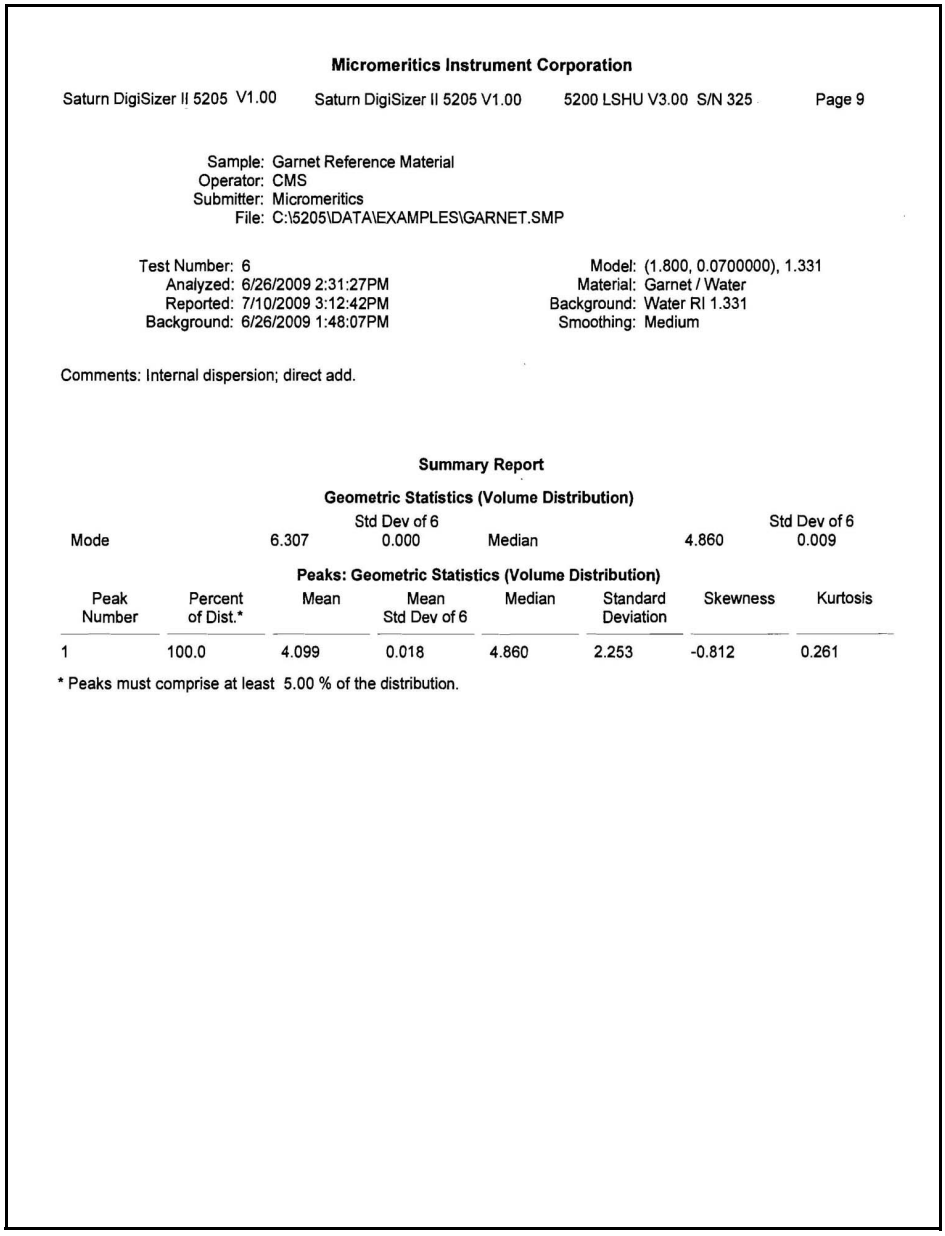
Model: (1.800, 0.0700000), 1.331
Material: Garnet / Water
Background: Water RI 1.331
Smoothing: Medium

Comments: Internal dispersion; direct add.



Summary

The Summary report allows you to choose the type of statistics to report; this one shows geometric statistics for volume distribution and peaks.



Micromeritics Instrument Corporation

Saturn DigiSizer II 5205 V1.00 Saturn DigiSizer II 5205 V1.00 5200 LSHU V3.00 S/N 325 Page 9

Sample: Garnet Reference Material
Operator: CMS
Submitter: Micromeritics
File: C:\5205\DATA\EXAMPLES\GARNET.SMP

Test Number: 6
Analyzed: 6/26/2009 2:31:27PM
Reported: 7/10/2009 3:12:42PM
Background: 6/26/2009 1:48:07PM

Model: (1.800, 0.0700000), 1.331
Material: Garnet / Water
Background: Water RI 1.331
Smoothing: Medium

Comments: Internal dispersion; direct add.

Summary Report

Geometric Statistics (Volume Distribution)

		Std Dev of 6			Std Dev of 6
Mode	6.307	0.000	Median	4.860	0.009

Peaks: Geometric Statistics (Volume Distribution)

Peak Number	Percent of Dist.*	Mean	Mean Std Dev of 6	Median	Standard Deviation	Skewness	Kurtosis
1	100.0	4.099	0.018	4.860	2.253	-0.812	0.261

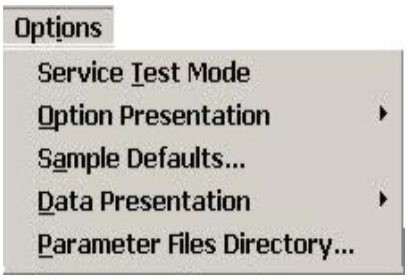
* Peaks must comprise at least 5.00 % of the distribution.

8. OPTIONS MENU

The Options menu contains commands that allow you to:

- Specify basic, restricted, or advanced mode
- Specify and edit sample file defaults
- Specify data presentation modes
- Change your parameter files directory

Description



Listed below are brief descriptions of the Options menu options. Detailed descriptions are found in subsequent sections.

Service Test Mode — Enables you to perform certain troubleshooting procedures. This option is available only under the direction of a Micromeritics service representative. Page **8-2**.

Option Presentation — Allows you to display the sample file dialog in the Basic, Advanced, or Restricted format. Page **8-3**.

Sample Defaults — Allows you to specify defaults for the parameters contained in the sample information file. Page **8-6**.

Data Presentation — Allows you to choose the way in which data are presented on the screen and in printed reports. Page **8-11**.

Parameter Files Directory — Allows you to specify a location for the parameter files when using the Basic mode. Page **8-12**.

Service Test Mode

Various service tests are included in the Saturn DigiSizer operating program. These tests can be performed only with the assistance of a trained Micromeritics service representative. When you select Service Test Mode from the Options menu, a dialog box prompting you to enter a password is displayed. This password is coded to change on a regular basis and, therefore, is known only by your service representative. You will not be able to perform these tests without their guidance. After Service Test Mode has been activated, the tests can be accessed from the Unit menu.

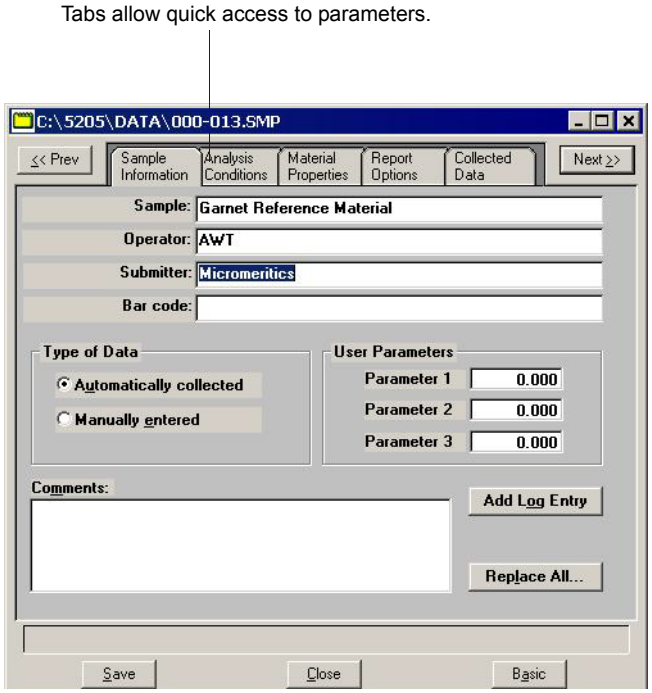
Option Presentation

The sample editing dialogs for the Saturn DigiSizer analysis program may be presented in three modes: Restricted, Basic, or Advanced. Each format displays sample information and menu options differently.

- **Advanced**: displays all parts of the sample information file in a tabbed dialog similar to that of an index card file.
- **Basic**: displays all parameters of the sample file in a single dialog.
- **Restricted**: displays in the same manner as the Basic format, except that some options are disabled.

Advanced

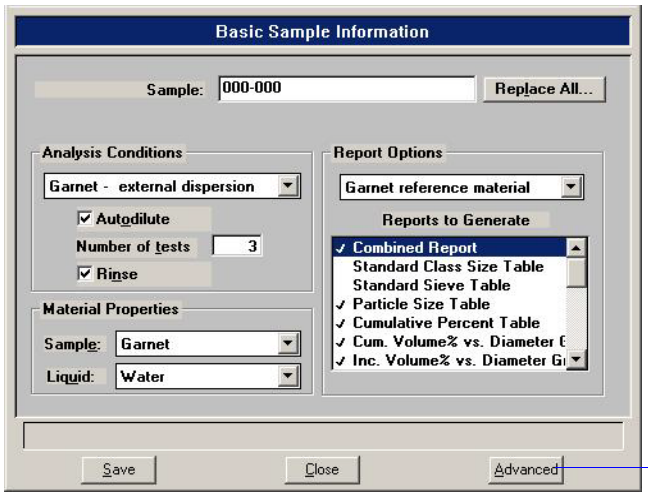
The Advanced format presents all parts of the sample information file in a tabbed dialog. Each tab opens its associated dialog.



The Advanced format is used to create customized sample files and edit values in parameter files. You can also switch to the Basic format, if desired, by clicking **Basic**. Refer to **Advanced**, page **5-8** for a detailed description of this dialog.

Basic

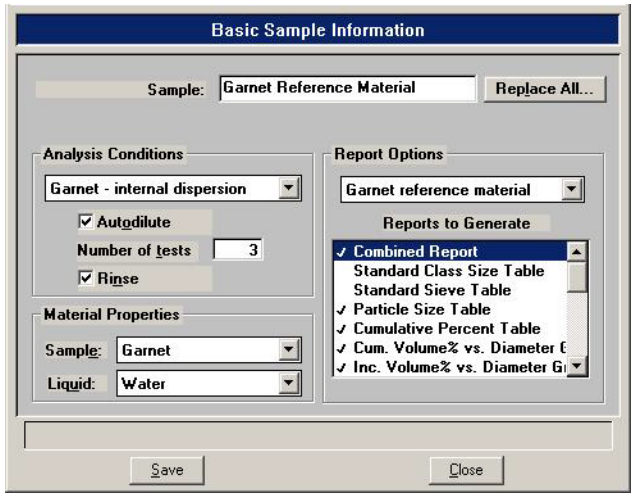
The Basic format presents the sample information file and its parameter files as a single dialog.



The Basic format is used to create sample information files using previously defined parameter files. You can easily switch to the Advanced format, if desired, by clicking **Advanced**. Refer to **Basic**, page **5-5** for a detailed description of this dialog.

Restricted

The **Restricted** format is identical to the Basic format, except that certain menu options are disabled, and you cannot switch to the Advanced format.



This format is password-protected and is typically used in laboratories where analysis conditions must remain constant, for example, in the pharmaceutical industry.

When you select Restricted, a dialog requesting a password is displayed:

Any password (up to 31 characters) can be used to enable the Restricted format. The same password, however, must be used to exit the Restricted format. For example, if you enter "password" to enable the Restricted format, then you must use "password" to exit. If you forget the password, open the system INI file and navigate to the **Private** section. The current password will be shown immediately following "OptionPresentationPassword." Make a note of the password, exit the INI file, and enter the password where requested. Do not attempt to delete the password in the INI file.

Sample Defaults

This option allows you to specify default parameters for sample information files.

Sample defaults are the values you see in the sample information editors when you create a new sample file. For efficiency, it is best to specify defaults for materials you most commonly analyze. You can always edit the values in the sample file when it is created. Sample defaults can be created using the Basic or Advanced format.

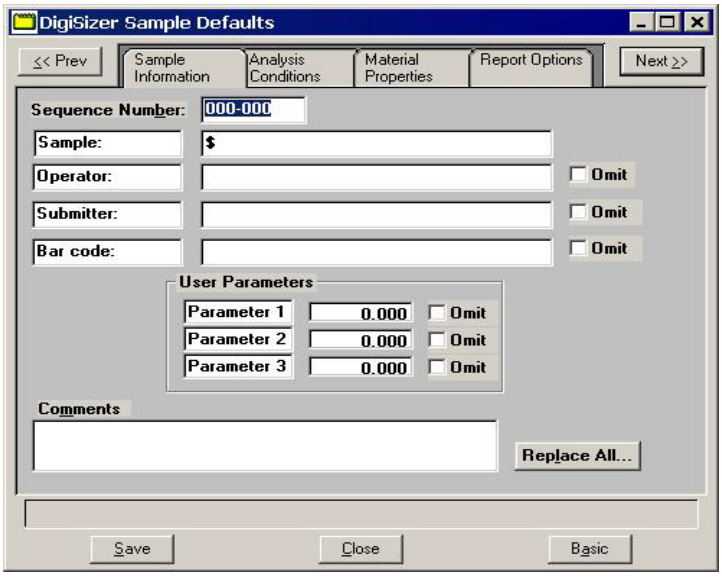
Advanced

The Advanced Sample Defaults dialog resembles a set of index cards. The values you specify in the parameter portions of the sample file (Analysis Conditions, Material Properties, and Report Options) are saved as the defaults for newly created parameter files.

For example, after specifying defaults for a sample file in the Advanced format:

- Select **File > Open > Sample Information**, then click **Yes** to create the file, and the defaults you specify display for all parameters.
- Select **File > Open > Analysis Conditions**, name and create the file, and the defaults you specify in the Analysis Conditions portion of the Advanced Sample Defaults dialog display in the fields

The DigiSizer Sample Defaults dialog is displayed in this manner for the Advanced format.



Sequence Number:

Specify a default sequence for the sample file name. The number you specify is incrementally sequenced each time you create a sample file. It is the number that appears in the **File name** field when you select **File > Open > Sample information**.

- Use numbers, letters, or other printable characters, such as dashes. At least three numbers must be included.
- Use up to eight characters.
- Do not use characters such as * or ?.

Sample

Allows you to enter an additional identification that provides more information than the sample file name alone.

In the field on the left, you can edit the prompt for **Sample**. For example, you may prefer to use **Test** or **Material**. The maximum number of characters is 20.

In the field on the right, you can specify a format for the sample identification.

- Use numbers, letters, or other printable characters, such as dashes.
- Maximum number of characters is 42, plus the $ symbol.
- Include the automatically generated file number as part of the identification by using the $ symbol where you want the sequence number to appear.

  For example, if the sequence number is 000-001, enter the sample identification as follows:

  Lab #25 - $

  The resulting sample identification for the first sample information file would be:

  Lab #25 - 000-001

  The sample identification for the second sample information file would be:

  Lab #25 - 000-002, and so on

Operator
Submitter
Bar code

These fields enable you to enter defaults for the operator, submitter, and bar code information.

The fields on the left can be edited to display a different label if desired.

The fields on the right allow you to specify default names or titles, and bar code information.

- Maximum number of characters for the fields on the left is 20.
- Maximum number of characters for the fields on the right is 42.
- Select **Omit** adjacent to any field you wish to omit from displaying on the sample information dialog.

User Parameters Group Box

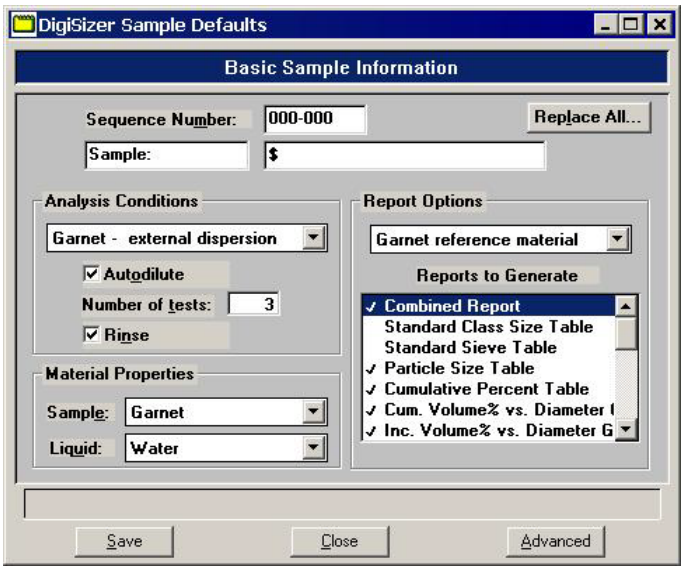
The fields in this group box are used specifically for SPC (Statistical Process Control) reporting. They are used to specify characteristics of either the sample or its manufacturing process.

For example, you may wish to report the relationship of the motor speed of a grinder used in the manufacturing process to the median diameter of the sample. In the parameter field on the left, enter Motor speed. In the field on the right, enter a default value (this value may be edited if desired in the sample information file). Once specified, these parameters display in the SPC Sample Options dialog (accessed through the SPC Calculations dialog).

Omit this item entirely from the sample information file by selecting **Omit**.

Basic

The DigiSizer Sample Defaults dialog is displayed in this manner for the Basic format.



Sequence Number

Allows you to specify a default sequence for the sample file number. The number you specify is incrementally sequenced each time you create a sample file. It is the number that appears in the **File name** field when you select **File > Open > Sample Information.**

- Use numbers, letters, or other printable characters, such as dashes. At least three numbers must be included.
- Use up to eight characters.
- Do not use characters such as * or ?.

Sample

Allows you to enter an additional identification that provides more information than the sample file name alone.

In the field on the left, you can edit the prompt for **Sample**. For example, you may prefer to use **Test** or **Material**. The maximum number of characters is 20.

Sample

(continued)

In the field on the right, you can specify a format for the sample identification.

- Use numbers, letters, or other printable characters, such as dashes.
- Maximum number of characters is 42, plus the $ symbol.
- Include the automatically generated file number as part of the identification by using the $ symbol where you want the sequence number to appear.

  For example, if the sequence number is 000-001, enter the sample identification as follows:

  Lab #25 - $

  The resulting sample identification for the first sample information file would be:

  Lab #25 - 000-001

  The sample identification for the second sample information file would be:

  Lab #25 - 000-002, and so on.

Analysis Conditions group box

This group box contains a drop-down list containing predefined analysis conditions files.

Also included in this group box are the **Autodilute**, **Number of Tests**, and **Rinse** options. Refer to **Analysis Conditions**, page **5-11** for additional information on these options.

Material properties group box

This group box contains two drop-down lists, one for **Sample** and one for **Liquid**. Samples and liquids can be added to the lists by switching to the Advanced format and using the Material Properties dialog.

Report Options group box

This group box contains a drop-down list of predefined report options files.

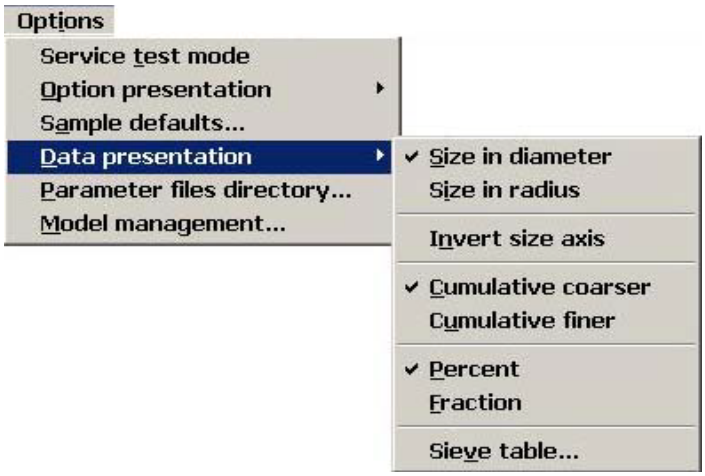
Also included in this group box is a list of available reports.

Save

Saves the specified defaults.

Data Presentation

The options on the Data presentation drop-down menu allow you to specify how you wish tabular and graphical data to display on screen and in printed reports.

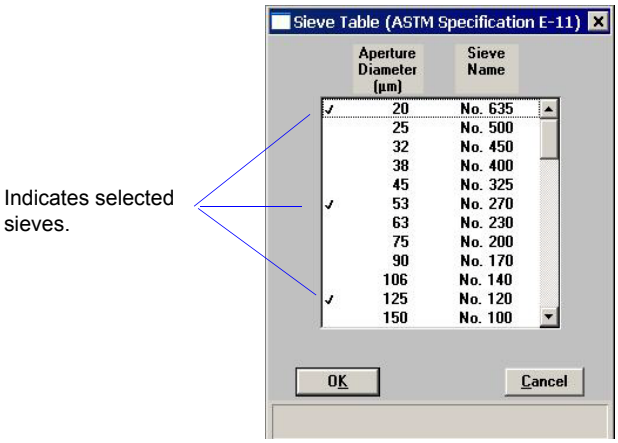


Size in diameter/radius
Invert size axis
Cumulative coarser/finer
Percent/Fraction

Provides options for displaying data on the screen and in printed reports. Selected options are preceded with a check mark.

Sieve Table

Displays the Sieve Table dialog so that you can specify default sieve sizes when presenting sieve data.

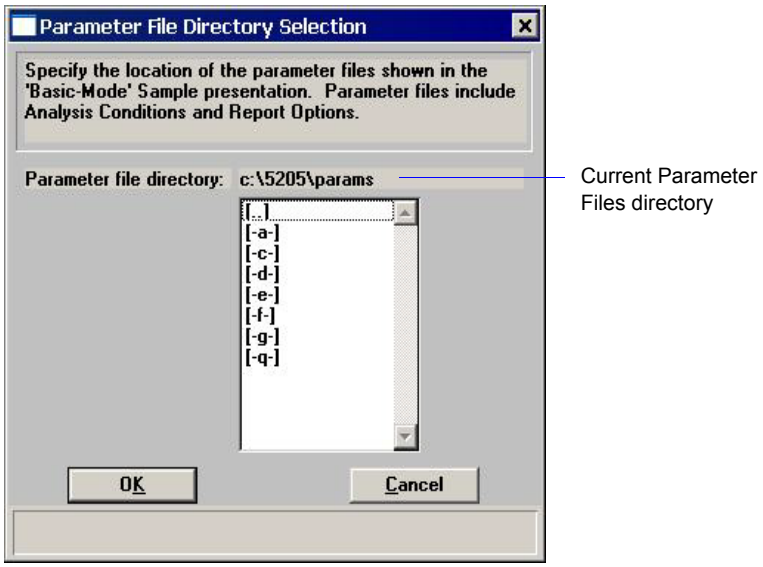


A sieve size is selected when it is preceded by a check mark.

Make your selections by double-clicking on the desired sieves, or highlight the sieve and press the **Spacebar**.

Parameter Files Directory

This option allows you to specify a location for the predefined Analysis conditions, Report options, and Material properties files displayed in the drop-down lists on the Basic Sample Information dialog. The current directory is displayed above the drives/directory window.



The directory specified here is the one you should use when creating parameter files to be included in the drop-down lists on the Basic and Restricted sample information dialogs. It is where the software goes to obtain the files for the drop-down lists.

The default directory is **params** and includes several parameter files supplied with the analysis program. If you specify a different directory, these files will not be included in the drop-down lists unless you copy (or move) them to the new directory. You should also be sure to save newly created parameter files to the changed directory.

If you wish to continue to use the **params** directory for parameter files, it will display as the default when saving parameter files.

9. TROUBLESHOOTING AND MAINTENANCE

The Saturn DigiSizer system has been designed to provide efficient, continuous service and requires very little maintenance. The few maintenance procedures recommended are simple, easy to perform, and require no tools. If any service beyond the scope presented in this chapter is required, you should contact your local trained service representative. You should never at any time attempt to remove any panels from the analyzer.

Troubleshooting

Most common operational problems are caused by improperly installed tubing, or a dirty sample cell. Always check these things first when expected analysis results are not obtained. Most operational problems are indicated by an error message on the monitor screen. **Appendix A** provides solutions for these message (see **Unnumbered Messages**, page **A-31**). Listed below are some troubleshooting tips when operational problems occur.

Table 9-1. Common Operational Problems

Problem	Action
No power to the analyzer	Ensure that the power cord is firmly plugged into the analyzer and the receptacle.
	Ensure that the ON/OFF switch is in the ON position.
	Ensure that the power source is energized.
	Check the fuse located in the power entrance located on the rear panel of the analyzer; replace if necessary. (Refer to **Replacing Fuses**, page **9-11**.)
	Ensure that the line voltage is correct for the analyzer's configuration.
	Make sure the Linear circuit breaker has not tripped. If the breaker has tripped (indicator button is extended), turn off the analyzer and wait for a few minutes. Reset the breaker and turn on the analyzer.

Problem	Action
No communication between the analyzer and the computer	Ensure that the ethernet cable is firmly seated at the analyzer and computer ethernet ports.
Time-out message during rinse or drain operation	Make sure the Analysis and/or Rinse containers contain liquid; if not; refill and resume operation.
	Check the rinse/analysis tubing to see if it is primed (fluid inside the tubing). If no fluid is present, inspect the tubing for a cut or worn spot; replace the tubing if necessary (refer to **Replacing the Tubing**, page **9-9**).
	Make sure a sample cell is installed. If a sample cell is not installed, the sample cell compartment will be filled with liquid. Remove the rubber mat from the sample cell compartment. Thoroughly dry the inside of the compartment and the mat. Replace the mat and install the sample cell (refer to Step 11 of **Cleaning the Optics**, page **9-4**).
	Check the tubing connections to the sample cell to make sure they are secure. If leaking, cancel the current operation. Thoroughly dry the inside of the sample compartment and tighten the tubing connections, then resume operation.
	Check the pumps and solenoid valves for proper operation. Access the instrument schematic and enable manual control. Turn the analysis and rinse pumps on to ensure that liquid is being pumped into the reservoir. Call your local Micromeritics representative if liquid does not pump into the reservoir properly.

Problem	Action
MASTERTECH	
No power to the MasterTech	Ensure that the power cable is plugged securely into the power source.
	Ensure that the ON/OFF switch is in the ON position.
	Check the fuse located in the power entrance located on the rear panel of the MasterTech; replace if necessary. (Refer to **Appendix J**, page J-3 for instructions on installing fuses.)
Stirrer will not work.	Ensure that the stirrer is properly connected.
Turntable will not move.	Press the arm AUTO/LOAD switch on the front panel to place it in the AUTO position.
MasterTech pump will not run.	Ensure that the pump AUTO/OFF switch on the front panel is in the AUTO position.
	Tubing may be bunched up in the pump; pull the tubing taut.
Ultrasonic probe will not work.	Check the BNC connector cable to ensure that it is properly connected.
Ultrasonic agitation diminished.	Check the probe tip; replace if necessary.
MasterTech will not initiate commands from the computer.	Check the cable connection from the MasterTech to the computer to ensure that it is properly connected.
Pump leaks or is not operating efficiently.	Tubing is leaking or clogged; replace tubing.

Cleaning the Analyzer

A clean cloth, dampened with isopropyl alcohol (IPA), a mild detergent or a 3% hydrogen peroxide solution may be used to clean the outside casing of the analyzer and liquid sample handler. It it not necessary to remove any control knobs or screws while cleaning. If you have a MasterTech installed on your Saturn DigiSizer, it may be cleaned in the same manner.

Cleaning the Optics

The accessible optics of the DigiSizer 5205 consist of three components: the sample cell, the detector lens, and the collimator lens. It is important that these components be kept clean.

Sample Cell and Detector Lens

The sample cell should be cleaned as needed based on changes in background intensity (refer to **Appendix I**, Page I-1 for a discussion on background quality). You will need the following items to clean the sample cell (included in the accessories kit):

- Lens cleaner
- Lens paper
- Soft absorbent (non-scratching) foam swab

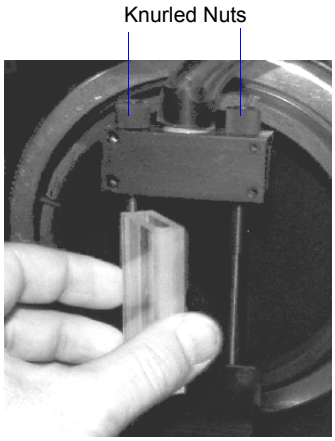
1. Select **Unit [n] > Drain** to drain the system of all liquid and to move the rotation arm out of the way, allowing easy access to the sample cell assembly. The dialog will close when draining is complete.

2. Open the front panel of the DigiSizer analyzer and remove the cover of the analysis compartment.

3. Loosen the two knurled nuts on the top bracket of the sample cell holder; then pull up on the bracket to allow removal of the sample cell.

The sample cell is coated with an anti-reflective substance. Be careful not to scratch or abrade this coating. Also avoid touching the front and back surfaces of the sample cell to prevent fingerprints.

4. Rotate the cell out of its holder by pulling the right-hand side of the cell assembly toward the front of the analyzer. The left side will remain against the vertical support.



5. Grasp the sample cell by its side edges and place on a sheet of lens paper while performing the next two steps.

6. Using your fingertip, check the o-rings in the upper and lower bracket of the sample cell holder to ensure that they are clean (no grit is present) and properly seated. If the o-rings appear dirty, wipe them with a sheet of lens paper dampened with lens cleaner.

7. Using a flashlight or other type of illumination, examine the detector lens (located at the back of the analysis compartment). If particles or smudges are evident, gently clean the lens surface with a sheet of lens paper dampened with lens cleaner. Then, using a dry sheet of lens paper, gently wipe the surface dry.

The detector lens is coated with an anti-reflective substance. Be careful not to scratch or abrade this coating. Also avoid touching the front and back surfaces of the sample cell to prevent fingerprints.

8. Holding the sample cell by its side edges, blow or gently brush away any debris from the surface of the sample cell.

9. Using a sheet of lens paper dampened with lens cleaner, clean the upper and lower edges of the cell. Then, using a foam swab dampened with lens cleaner, clean the outside and inside of the cell.

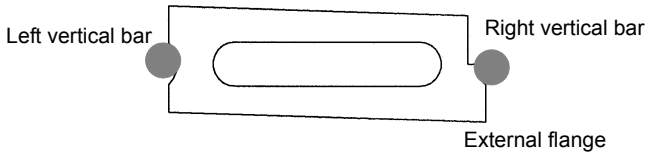
Always hold the sample cell by the side edges. Fingerprints on the front and back surfaces of the cell can alter analysis results.

10. Using a dry sheet of lens paper, gently and completely wipe dry the outside of the cell; **DO NOT** dry the inside of the cell.

11. Reinstall the cell:

    a. Orient the cell so that the groove is on the left side and the extended flange is on the front of the right side.

    b. Slide the grooved (left side) of the cell onto the left vertical bar.



Top View of Sample Cell Seated Against Left and Right Vertical Bars

    c. Rotate the sample cell toward the right vertical bar; ensure that the cell is seated properly between the two vertical bars.

    d. Slide the top bracket of the sample cell holder down; tighten the knurled nuts. You should see a black oval on the bottom of the cell where the o-ring makes a seal.

12. Perform a quick leak-check to ensure proper installation of the cell:

    a. Select **Unit [n] > Rinse > DigiSizer**.

    b. Choose the **Rinses** option, specify **1**, and then click **Start**.

    c. Observe the sample cell. If no leaks occur, proceed to Step 13. If leaks occur, click **Cancel**, then **Yes** to stop the rinsing function.

    d. Close the front panel (you do not have to reattach the cover of the sample analysis compartment); then select **Unit [n] > Drain** to drain the system.

    e. After draining is complete, turn off the analyzer, then close the analysis program.

    f. Open the front panel and remove the rubber mat from the analysis compartment.

    g. Wipe dry the area around the sample cell, the mat, and the analysis compartment; replace the mat.

    h. Make sure the cell is seated properly and the knurled nuts are secure.

    i. Turn on the analyzer and start the analysis program.

    j. Repeat steps a, b, and c (and the remainder if necessary).

13. Replace the sample cell compartment cover and close the front panel.

Collimator Lens

The collimator lens should not require cleaning unless the Saturn DigiSizer is being exposed to an environment where high levels of dust are present. If this is the case, you should occasionally inspect the collimator lens and the analysis compartment to ensure their cleanliness. You should always keep the analysis compartment and the analyzer's front cover closed except during cleaning to minimize dust build-up.

You will need the following items to clean the collimator lens:

- Small mirror
- Lens paper

1. Select **Unit [n] > Drain** to drain the system of all liquid and to move the rotation arm up. The dialog will close when draining is complete.

2. Open the front panel of the DigiSizer analyzer and remove the cover of the analysis compartment.

3. Wipe or brush the inside of the analysis compartment if needed.

4. Use the mirror to locate the collimator lens (on the underside of the rotation arm).

5. Using a sheet of dry lens paper, gently wipe the surface of the lens. Be careful not to touch the lens with your fingertips. Do not use compressed air to blow away particles from the detector lens. This merely resuspends the particles, allowing them to resettle on the optics.

6. Replace the sample cell compartment cover and close the front panel.

Cleaning the Sample Reservoir

Rinsing after analysis generally will keep the reservoir in a clean state. Occasionally, however, particles may accumulate on the surface of the reservoir where rinsing may not sufficiently remove them. If the reservoir appears dirty or feels gritty to the touch, clean it as follows:

1. Select **Unit [n] > Drain** to empty the reservoir of all liquid.

2. Using a clean, soft cloth, wipe the inside of the reservoir. If necessary, use a soft brush to remove any stubborn particles.

3. Perform a rinse operation to rinse the reservoir; this operation also fills the reservoir to the primed level.

Replacing the Tubing

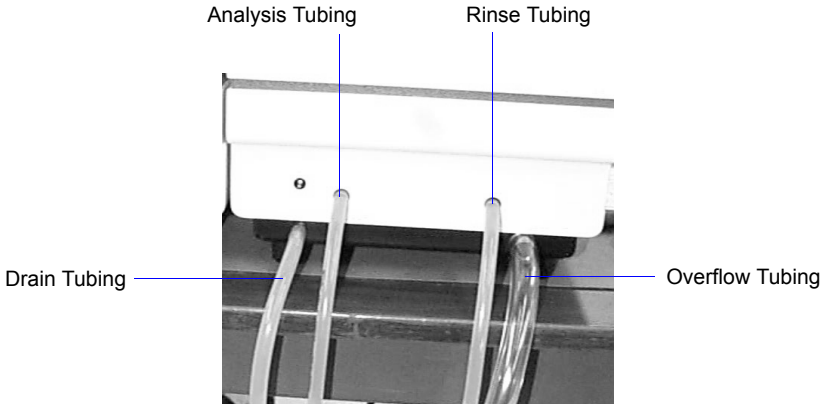
Tubing may occasionally become worn or damaged in some way and require replacing.

Liquid Sample Handler

The types of tubing connected to the liquid sample handler are identified as follows:

- Rinse tubing* 0.64-cm (1/4-in.) diameter
- Analysis tubing 0.64-cm (1/4-in.) diameter
- Overflow tubing 1.27-cm (1/2-in.) diameter
- Drain tubing 0.79-cm (5/16-in.) diameter

*The Low-volume unit uses the same liquid for analysis and rinsing. Therefore, Rinse tubing is not installed. Ignore all references to the rinse tubing in this procedure if you have the Low-volume unit.



The tubing on the liquid sample handler should be replaced as needed. Refer to Chapter 10 for part numbers and ordering information. All tubing is removed and replaced in the same manner. The rinse and analysis tubing are the same type tubing. The drain tubing is the same color and very close to the same size as the rinse and analysis tubing; be sure that you are replacing the damaged tubing with the correct tubing.

1. Slide the damaged tubing off the connector on the front panel of the liquid sample handler.

2. Remove the other end from its liquid container. If you are removing the analysis or rinse liquid tubing, be sure to remove the weights; place aside for installation on the replacement tubing.

3. Slide one end of the replacement tubing onto its appropriate connector on the front panel.

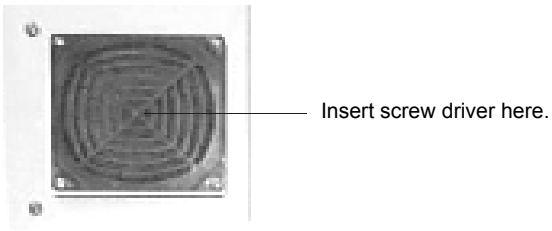
4. Insert the other end of the tubing into its appropriate liquid container. Be sure to reinstall the weights if replacing the analysis or rinse tubing.

Replacing the Air Filter

The air filter should be replaced every 30 days (more often in environments with increased levels of dust).

A supply of air filters is provided in the accessories shipped with your instrument. Refer to Ordering Information, page10-1 when reordering is required.

1. Remove the filter by inserting a pointed object, such as a flat-head screwdriver, into the center portion of the retaining cover; then pop off the cover.



2. Discard the old filter and replace with a new one from your accessories kit.

3. Replace the retainer cover.

Replacing Fuses

If a fuse has blown, the analyzer power indicator will not illuminate.

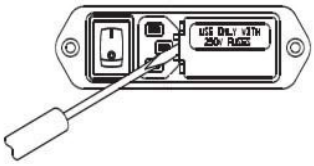
The fuses are located in the power-selector module on the lower, right side of the rear panel of the analyzer.

Replace the fuse(s) as follows:

1. Turn off the analyzer and disconnect the power cord from its power source.

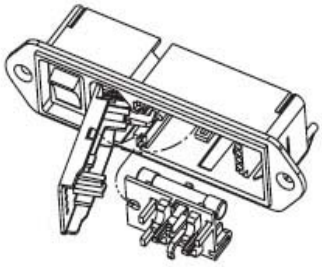
The power cord should be disconnected from the analyzer when replacing fuses. Failure to do so could result in electrical shock.

2. Insert the tip of a small pocket screwdriver (or pointed object) into the left side of the power module located on the rear panel of the AquaPrep.



3. Gently lift up until the cover lifts up approximately 1/4 inch, then swing the cover to the left; the cover is hinged and cannot be removed.

4. Remove the fuse block (you may have to use needle-nose pliers to grasp the fuse block).



5. Remove the blown fuse and replace with a new one. Be sure to use the appropriate fuse for the input power source.

The fuses used in the analyzer must be identical in type and rating to that specified. Use of other fuses could result in electrical shock and/or damage to the unit.

Power Source	Fuse
100-120 VAC	1.6 Amp, slow blow
200-240 VAC	1.25 Amp, 5x20 mm, slow blow (requires two)

6. Position the fuse block so that the side containing the fuses is facing the power module and

7. Close the cover to the power entry module; ensure that the indicator pin is in the correct position.

8. Plug the power cord back into its power source; turn on the analyzer.

10. ORDERING INFORMATION

Components and accessories for the Saturn DigiSizer system can be ordered by one of the following methods:

- contact our Customer Service Department at 770/662-3636
- access our web site at www.micromeritics.com
- contact your local sales representative

When ordering, please use the information provided below.

Part Number	Description
052-00052-00	MasterTech 052, for automatic sample preparation. Redisperses up to 18 samples and transfers them to the DigiSizer for analysis.
055-00000-00	AquaPrep, for preparing water to be used with the DigiSizer
004-32065-00	Lens paper, pkg. of 50
004-38600-00	Lens cleaner
004-35152-00	Foam swab, pkg. of 50
004-27015-00	Air filter (rear panel), package of 10
520-42805-00	Operator's manual
003-51207-00	Fuse, 5 x 20 mm, Slow-Blow, 1.6 Amp (100 - 115 VAC)
003-51197-00	Fuse, 5 x 20 mm, Slow-Blow, 1.25 Amp (220 - 240 VAC)
520-34900-00	Sample cell, packed in protective case; includes lens papers for handling the cell
004-25575-01	O-ring, for sample cell, Viton®
520-32802-00	Gasket (spacer), light blocking, for tubing orifices on liquid sample handler
004-16841-00	Reference material, Garnet, 5.30 µm
520-32803-04	Tubing, flexible, for lower sample cell port (standard liquid sample handler)
520-32803-05	Tubing, flexible, for upper sample cell port (standard liquid sample handler)
520-32804-07	Tubing, flexible, for lower sample cell port (low-volume liquid sample handler)
520-32804-04	Tubing, flexible, for upper sample cell port (low-volume liquid sample handler)

Part Number	Description
———— MASTERTECH ACCESSORIES ————	
004-61021-01	Beaker, tall form, 100 mL, glass
003-51131-00	Fuse, 3AG, Slow-Blow, 2 Amp
003-51197-00	Fuse, 5 x 20 mm, Slow-Blow, 1.25 Amp
051-14811-00	Evaporation cover
051-14814-00	Turntable assembly
051-32901-00	Tubing set, Tygon
051-58605-02	Ultrasonic probe tip, 1/8 in.
052-58605-02	Ultrasonic probe tip, 1/4 in.
052-54600-00	Key, Tubing loading

A. ERROR MESSAGES

Two types of error messages may be encountered while operating the Saturn DigiSizer program:

- Numbered error messages: displayed during operational procedures
- Unnumbered error messages: displayed on the instrument schematic

If the Action response for either type of message instructs you to contact your service representative, record the error message and make backup copies (if appropriate) of any files involved in the operation.

The 1000-series error messages (used primarily for software testing) are not included in this appendix. These errors should not occur during normal operation. If you receive a 1000 series error message or an error message not listed in this appendix: record the error message, make backup copies of any files involved, then contact your service representative.

Numbered Messages

2400 Series

2430- Error accessing file (file name), error code = (number).

Cause A: Media may be damaged.

Action A: Clean the media drive. If this does not eliminate the problem, attempt operation using a backup copy of the file.

Cause B: Hard disk may be damaged.

Action B: Run diagnostics on your computer.

Cause C: A software error occurred when the file was accessed.

Action C: Contact your service representative.

Cause D: The name specified contains one or more invalid characters.

Action D: Enter a valid filename; do not use characters such as * or ?.

2431- Error writing file (file name), error code = (number).

Cause: The hard disk does not have enough space left to perform the operation.

Action: Copy files not used regularly from the hard disk to diskette, delete them from the hard disk, and then try the operation again.

2432- Invalid response from MMI 'FILE_READ' request.

Cause: An internal processing and/or hardware error has occurred.

Action: Contact your service representative if you continue to receive this error message.

2433- New entries have been found in this directory. Refresh the directory information?

Cause: Several Saturn DigiSizer files (sample information, analysis conditions, material properties, or report options) have been added to this directory by some function other than the Saturn DigiSizer program.

Action: Select **Yes** to update the directory information with data from each new file. This operation may take a minute.

Select **No** if you do not want to spend the time updating the directory information. This option may be feasible if a large number of files have been copied into the directory and you know the name of the file you wish to access.

2434- File (file name) — Subset # (number) wrote wrong amount of data.

Cause: An internal processing and/or hardware error has occurred.

Action: Contact your service representative if you continue to receive this error message.

2436- Path specification (path name) is invalid.

Cause: You entered an invalid path name and/or extension.

Action: Type a valid path name (including the proper extension) and press **Enter**.

2437- File (file name) does not exist.

Cause: You entered an invalid file name.

Action: Enter the name of an existing file or select a file name from the list box.

2438- Disk drive (letter): is inaccessible.

Cause: You selected a disk drive that is not presently accessible.

Action: Ensure that the media in the disk drive is not write-protected.

2439- Could not register file.
2440- Subset not found.
2441- Seek within file failed.
2442- Had header in subset file.
2443- Subset owner denied access.
2444- Not a valid file format.
2445- Subset wrote the wrong amount of data.
2446- Error reading data.
2447- Error writing data.

Cause: An unexpected error occurred when you tried to access a data file.

Action: Contact your service representative.

2448- File directory (path name) is invalid. Resetting to the installation directory.

Cause: A working directory specified in the .INI file is invalid. The directory may have been deleted or moved to a different location.

Action: The installation directory will be substituted. The next time you open a file, use the **Directories** list to move to the correct directory.

2449- This field does not contain a valid file specification.

Cause: You entered an invalid file name.

Action: See the description of file naming conventions in your Windows documentation and reenter the name.

2458- An instrument is performing a critical operation. Wait a few moments before exiting the application.

Cause: You attempted to exit the application while the analyzer is performing a critical operation. This operation must be completed before the application can be exited.

Action: Wait a short time and attempt to exit the application again.

2459- An instrument is busy. Continue with program Exit? (Yes, No)

Cause: You attempted to exit the application while an analysis is in progress. While this is possible, the data collected while the application is inactive will not be permanently recorded until the application is restarted. A power failure to the instrument could cause some data to be lost.

Action: If you are not concerned with the potential for loss of data should a power failure occur, select **Yes** to continue; otherwise select **No**.

2460- Fatal Communications error on (Unit n - S/N: nnnn)

Cause: There was a fatal error in the communications between the application and the analyzer. All displays for that analyzer will be closed.

Action: Ensure that the ethernet cable is securely connected at the computer and analyzer ports. Exit the analysis program and then restart it. If this error persists, contact your service representative.

2461- No active instruments. Application will stop.

Cause: At least one instrument must be active for the application to operate. The initialization of all of the instruments configured with the Setup program has failed. The application stops.

Action A: Usually this message is preceded by another message giving the reason for the instrument's failure to initialize. See the instructions for that message.

Action B: Check the cable connection between the analyzer and the computer. Verify that the instrument has the power switch in the **ON** position and that the light on the front panel is illuminated. If the application continues to fail in its attempts to initialize the instrument, contact your service representative.

2468- The instrument contains an unknown software version. Do you want to reset it?

Cause: The application has discovered a different version of software operating in the instrument.

Action: If there is no chance that an instrument other than the Saturn DigiSizer is connected to the computer, select **Yes** to reset the instrument and download the proper software. Otherwise, select **No** to leave the instrument unchanged.

2469- The instrument software did not initialize properly on Unit n - S/N: nnnn.

Cause: The Saturn DigiSizer software failed to execute properly.

Action: Reinstall the software, then restart it. If the problem persists, contact your service representative.

2470- Unable to read instrument software file for Unit n - S/N: nnnn.

Cause: The application tried to read the instrument software file to download it to the instrument. It was unable to do so.

Action: Reinstall the Saturn DigiSizer software, then restart it.

2477- Unit n - S/N: nnnn did not properly initialize.

Cause: The software was unable to initialize this instrument; this is usually caused by one of the conditions listed in the error messages above.

Action: Correct the problem as described above, then restart the application.

2486- Could not construct (name) report type. Program will terminate.

Cause: An internal processing and/or hardware error has occurred.

Action: Contact your service representative if you continue to receive this error message.

2487- Could not start report generator. Error code (number). Program will terminate.

Cause: An internal processing and/or hardware error has occurred.

Action: Contact your service representative if you continue to receive this error message.

2488- File (file name) cannot be opened for editing. It is already in use.

Cause: The file you specified is already open for editing.

Action: Check the Windows list to locate the other edit session.

2489- File (file name) cannot be opened for writing. It is already in use.

Cause: The file you specified in a **Save As** operation is already open for edit.

Action: Select a different file for the **Save As** operation.

2490- No '.INI' file present. Application will terminate.

Cause: The ASCII file containing initialization information and system options information used during program startup does not exist.

Action: Uninstall the application, then reinstall to create the control file required by the analyzer.

2492- This field's entry is INVALID.

Cause: The highlighted field contains an invalid entry.

Action: Check the entry and correct the error.

2493- An entry is REQUIRED for this field.

Cause: This field requires a valid entry for you to proceed.

Action: Enter or select an appropriate value.

2494- Value is out of the valid range.

Cause: The value you entered in the highlighted field is outside the valid range of values.

Action: Check the entry and enter or select an appropriate value.

2495- Value is out of the valid range. Enter a value between (value) and (value).

Cause: The value you entered in the highlighted field is outside the valid range of values.

Action: Check the entry and enter or select a value within the indicated range.

2496- Invalid number.

Cause: The number you entered in the highlighted field is invalid.

Action: Check the entry and enter or select a valid number.

2497- This field contains an invalid character.

Cause: You entered an invalid character in the highlighted field.

Action: Check the entry and enter valid characters.

2498- The requested change to the Sample's status is invalid at this time.

Cause: A request to change the file's status (for example, from automatically collected to manually entered) could not be done.

Action: Contact your service representative if you continue to receive this error message. Record the name of the sample file in which the problem occurred.

2499- Sequence number must contain at least 3 digits.

Cause: You tried to enter a sequence number that did not contain at least three digits.

Action: Enter a sequence number that contains at least three digits.

2500 Series

2500- All sample file names that can be created using the sequence number pattern already exist. You may want to modify the next sequence number.

Cause: No more sample information files can be created using the currently specified file sequence number.

Action: Select **Options > Sample Defaults** from the Main menu and enter a new sequence number.

2501- System resources have reached a dangerously low level. Please close some windows to avoid the loss of data.

Cause: A large number of windows are open and consuming the system resources available to all applications.

Action: Close one or more windows on the screen. Contact your service representative if you continue to receive this error message.

2502- Error writing to file (name) during print. Error code: (number).

Cause: An error occurred in the file being written to during a print operation.

Action: Ensure that there is sufficient space on the drive containing the file.

2505- Error Logger cannot be initialized. Error code (number). Program will exit.

Cause: An internal processing and/or hardware error has occurred.

Action: Contact your service representative.

2506- (sample file) Output device (name) is not installed. Printing cannot be accomplished.

Cause: The selected output device is not installed in Windows.

Action: Select a different output device. Use the **Control Panel > Printers** option to specify a default printer.

2507- Error opening file (name) for printing. Error code: (number).

Cause: An error occurred in the selected file for print output.

Action: Ensure that sufficient space is available on the drive containing the file.

2508- (sample file) Overlay file (name) was not found. It will not be included in the reports.

Cause: The specified overlay file could not be found.

Action: Ensure that the file specified as an overlay does exist.

2509- (sample file) Error opening file (name): (error). Reports cannot be produced.

Cause: An error occurred while the program was opening a file necessary to the report operation.

Action: Use the name given in the error message to investigate. Contact your service representative if you continue to receive this error message.

2510- (sample file) Error parsing reports from file (name). Reports cannot be produced.

Cause A: One or more data entry fields in the sample file may contain an invalid character (such as a single quote or double quotes).

Action A: Review the data entry fields (for example, the Sample field) and remove the invalid character.

Cause B: The system was unable to create the usual temporary files during the report, possibly due to insufficient disk space.

Action B: Check the space available on the hard disk.

Cause C: An internal processing error occurred.

Action C: Contact your service representative.

2511- Print job (name) has been canceled due to insufficient disk space. Delete unnecessary files and restart the report.

Cause: The disk drive does not have enough space for the temporary file required by the Windows Print Manager. Therefore, printing of the requested report has been canceled.

Action: Delete unnecessary files from the disk. You will require at least five megabytes of free space for normal operation.

2512- Print job (name) has been canceled.

Cause: The requested print job was canceled at your request.

Action: None required.

2521- Unable to program controller.

Cause: A hardware malfunction has occurred.

Action: Contact your local Micromeritics representative.

2522- Invalid controller application file.

Cause: The application's control file has been corrupted or deleted.

Action: Reinstall the DigiSizer analysis program.

2523- Programming controller failed.
2524- CRC check failed on programming controller.
2525- Unknown error programming controller.

Cause: A hardware malfunction has occurred.

Action: Contact your local Micromeritics representative.

2526- Controller download was not successful.

Cause: A communications problem between the computer and the analyzer has occurred.

Action A: Check the cable connection between the computer and the analyzer.

Action B: Exit the Saturn DigiSizer application, and turn off the analyzer and liquid sample handler. Then turn on the liquid sample handler first, the analyzer second, and restart the Saturn DigiSizer application. If the problem persists, contact your local Micomeritics representative.

2527- Controller CRC error on boot block.
2528- Controller DRAM error.
2529- Controller Com1: error.
2530- Controller Com2: error.
2531- Controller debug port error.

Cause: A hardware malfunction has occurred.

Action: Contact your local Micromeritics representative.

2532- The instrument contains an unknown software version. Do you want to reset it?

Cause: The application has discovered a different version of software operating in the instrument.

Action: If there is no chance that an instrument other than the Saturn DigiSizer is connected to the computer, select **Yes** to reset the instrument and download the proper software. Otherwise, select **No** to leave the instrument unchanged.

2533- Mass initialization failed.

Cause: A hardware malfunction has occurred.

Action: Contact your local Micromeritics service representative.

4200 Series

4200- An error occurred while loading the application control information. Data entry cannot be performed. (Code # [n])

Cause A: You may not have full rights to the application's folders and files.

Action A: Contact your system administrator to have full rights granted.

Cause B: An internal error occurred while read control information was being read from a disk file.

Action B: The disk on which the application is installed may have failed. Contact your Micromeritics service representative and report the code number given in the message.

4201- No reports selected.

Cause: You failed to select reports in the **Reports to Generate** list box. No output could be produced.

Action: Ensure that at least one report is selected for the sample and reinitiate the report.

4202- No valid data to report.

Cause: The sample file you selected for reporting does not contain any valid data.

Action: If the sample is still analyzing, wait until enough data are collected to allow reporting. If the sample file has a **Complete** status, an error or operator intervention stopped the analysis before sufficient data were collected. The analysis may be deleted from the file.

4203- The reference file is not valid. 'Diff. from ref.' column was deleted.

Cause: You requested a tabular report with **Difference from reference** selected as one of the columns. This quantity cannot be computed because the reference file is invalid.

Action: Select a reference file containing valid data.

4204- Coarser specification file is not valid. 'Out of spec.' column was deleted.

Cause: You requested a tabular report with **Out of Specification** selected as one of the columns. This quantity cannot be computed because the coarse specification file is invalid.

Action: Select a file containing valid data.

4205- Finer specification file is not valid. 'Out of spec.' column was deleted.

Cause: You requested a tabular report with **Out of Specification** selected as one of the columns. This quantity cannot be computed because the finer specification file is invalid.

Action: Select a file containing valid data.

4206- The tabular report has no valid columns selected. No report produced.

Cause: You requested a tabular report with all of the columns set to **none**.

Action: Edit the options for that table and select a variable in at least one column of the table.

4207- No valid data is available for this report. No report produced.

Cause: You selected a test in the sample file that does not contain valid data.

Action A: If the sample is still analyzing, wait until enough data are collected to allow reporting.

Action B: Choose another test on which to report. If the sample file has a **Complete** status, an error or operator intervention stopped the analysis before sufficient data were collected. The analysis may be deleted from the file.

4208- An overlay file is not valid. It was not included in the report.

Cause: You selected a sample file for overly that contains invalid data.

Action: On the Report Options dialog, click **Overlays** and remove the file and choose one containing valid data.

4209- The reference file is not valid. The report was not produced.

Cause: You selected the **Difference from Reference** report; it cannot be computed because the reference file is invalid.

Action: You selected a file for reference that contains invalid data; choose a different file.

4210- Coarser specification file is not valid. The report was not produced.

Cause: You selected the **Out of Specification** report; it cannot be computed because the coarse specification file is invalid.

Action: You selected a file that contains invalid data; choose a different file.

4211- Finer specification file is not valid. The report was not produced.

Cause: You selected the **Out of Specification** report; it cannot be computed because the finer specification file is invalid.

Action: You selected a file that contains invalid data; choose a different file.

4212- At least one report item must be selected. Press Cancel if you do not want a report.

Cause: You failed to select reports in the **Reports to Generate** list box. No output could be produced.

Action: Ensure that at least one report is selected for the sample and reinitiate the report.

4213- Are you sure you want to delete the test?

Cause: You clicked **Delete** on the Collected Data dialog to delete a test.

Action: Click **Yes** to remove the indicated test from the sample file; click **No** to allow the test to remain in the file.

4214- The reference file is not valid. The overlay was not produced.

Cause: The reference file specified in the current file does not exist.

Action: On the Report Options dialog, click **Reference** and choose a different file.

4215- Coarser specification file is not valid. The overlay was not produced.

Cause: The file specified for the coarser specification does not exist.

Action: On the Report Options dialog, click **Specification** and choose a different file.

4216- Finer specification file is not valid. The overlay was not produced.

Cause: The file specified for the finer specification does not exist.

Action: On the Report Options dialog, click **Specification** and choose a different file.

4217- No table entries are within the distribution limits.

Cause: **Truncate to distribution** limits is selected on the report editor, but table entries are not within the range of the collected data.

Action: Edit the table entries, or deselect **Truncate to distribution** on the report editor.

4218- In order to use (option) you must select a Statistics Type or Arithmetic Statistics Type.

Cause: You requested a Summary report, but did not select a Statistics Type.

Action: Edit the Summary report and select at least one Statistics Type.

4219- In order to display summary statistics, you must select a Distribution Type.

Cause: You requested a Summary report but did not select a Distribution Type.

Action: Edit the Summary report and select a Distribution Type.

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6003- New data reduction options are currently being applied to the test data. Do you wish to cancel the reprocessing?

Cause: You have requested to cancel the reprocessing of the intensity data.

Action: Select **Yes** to cancel the reprocessing. Select **No** to continue the reprocessing.

6004- All of the test data will be converted to the new data reduction options. Do you wish to continue?

Cause: You requested Scattering Model Advanced Options to be applied to collected data.

Action: Select **Yes** to convert the data to the new data reduction options, and **No** to stop the reprocessing.

6005- Model generation is already in progress. Only one generation is allowed at a time.

Cause: You requested that a new scattering model be generated, but one is currently being generated.

Action: Wait for the current model to complete its generation process and then try again.

6006- Application of new data reduction options to <file name> is complete.

Cause: You requested Scattering Model Advanced Options to be applied to collected data and the process is now complete.

Action: None required; notification message only.

6007- A new model generation cannot be started. One is already in progress.

Cause: You requested that a new scattering model be generated, but one is currently being generated.

Action: Wait for the current model to complete its generation process and then try again.

6008- Error loading the model generation task. Error code: <number>

6009- An error occurred while converting <file name> to a new model. All further processing aborted.

6010- An unusual condition occurred while converting <file name> to a new model. Processing will continue.

Cause: An error occurred while generating the model, probably due to a problem with the background generation application.

Action: Reinstall the software and try again.

6014- Sample (file name) has an invalid status and cannot be used for this analysis.

Cause A: You chose a sample file that has no tests remaining for analysis.

Action A: Choose a sample file with a status of **No Analysis** or **Complete** (with less than eight tests). Eight tests can be performed using one sample file.

Cause B: You chose a sample file that is currently in an analyzing or calculations state.

Action B: Watch the status window and proceed when the status window indicates analysis and/or calculations are complete.

6015- The liquid selected for the analysis in sample (file name) does not match the background.

Cause: You attempted to begin an analysis, but the analysis liquid specified in the sample file did not match that of the current background.

Action A: Measure a new background with the proper liquid and continue with analysis.

Action B: Choose a sample file that matches the dispersing liquid of the current sample and background.

6016- Warning, the instrument is not calibrated.

Cause: You attempted to begin an analysis, but the instrument is not fully calibrated.

Action A: Exit the analysis program and turn off the analyzer. Turn the analyzer back on and restart the analysis program. Select **Unit [n > Unit configuration** to verify that calibrations are installed (calibration items will contain dates). If no information displays for the calibration items, go to Action B.

Action B: Run the setup application and reinstall the calibration files.

6017- Error accessing the sample information file <name>.

Cause: An unexplained error prevents you from accessing this file.

Action: The hard disk drive may be corrupt. Run diagnostics.

6018- File <file name> already has all its tests filled.

Cause: You tried to insert a new test using a sample file which already contains eight tests.

Action: A single sample file can have a maximum of eight tests. If additional tests are required on this sample, you must create another sample file.

6020- File <file name> cannot be analyzed. It is currently being edited.

Cause: You selected a file that was still open in an editing window for analysis.

Action: Finish the changes to the sample file, then save and close the editing window.

6021- An analysis cannot be performed on <file name>. It is open for editing and contains errors.

Cause: You selected a file that is currently being edited. Editing cannot be finished because the sample contains entry fields with errors.

Action: Correct the errors and finish editing the sample file. Then save, close the editing window, and try opening the file again.

6022- The edit session for <file name> must be saved before the analysis. Save changes and continue with the analysis?

Cause: You selected a file for analysis that is currently being edited. The changes to this file must be saved before it can be used in an analysis.

Action: Click **Yes** to save the changes and proceed with the analysis. Click **No** if you wish to review the changes before you save them.

6023- An error occurred while loading the scattering models. Data reduction cannot be performed.

Cause: The application was unable to load the scattering models properly.

Action: Exit the application and reinstall the software.

6024- An automatic analysis mode is enabled. The sample defaults may not be edited while this mode is active.

Cause: One of the automatic analysis modes is active. Sample defaults cannot be edited while this mode is active.

Action: End all automatic analysis modes on all attached units and try again.

6025- Unable to find optical model <file name>.

Cause: The model used by the sample could not be loaded.

Action: Select the **Options** push button on the Materials Properties dialog and make sure the selected model exists.

6026- The angles of the optical <file name> do not match the collected data.

6027- The size classes of the optical model <file name> do not match the standard size classes.

6028- Cannot read the deconvolution results.

6029- Cannot execute the deconvolution application.

Cause A: An error occurred during deconvolution of the model, probably due to a problem with the background calculation application.

Action A: Reinstall the software and try again.

Cause B: A model file generated for the DigiSizer 5200 was used with the DigiSizer 5205 application.

Action B: Remove DigiSizer 5200 model files from the model directory and install or calculate models for the DigiSizer 5205 application.

6042- Unable to download CCD characterization data.

6043- Unable to download calibration data.

Cause A: A communications error occurred between the computer and the instrument during initialization.

Action A: Exit analysis program and turn off the analyzer. Ensure that the ethernet cable is securely connected to the computer and the analyzer. Turn on the analyzer and restart the program.

Contact your Micromeritics service representative if the problem persists.

Cause B: System components were not turned on in the proper order.

Action B: Refer to Turning on the System in Chapter 2 for the correct sequence.

6045- CCD characterization data not found.

6046- Calibration data not found.

Cause: The calibration file for this analyzer could not be found.

Action: Insert the CD containing your analysis program and reinstall the calibration file.

6054- Unknown error downloading CCD characterization data.

Cause A: A communications error occurred between the computer and the instrument during initialization.

Action A: Exit analysis program and turn off the analyzer. Ensure that the ethernet cable is securely connected to the computer and the analyzer. Turn on the analyzer and restart the program.

Cause B: The calibration file for this analyzer could not be found.

Action B: Insert the CD containing your analysis program and reinstall the calibration file.

Action C: If Actions A and B do not correct the problem, contact your Micromeritics service representative.

6056- Unable to establish the TCP connection with the instrument.

Cause: A communications problem between the computer and the analyzer has occurred.

Action A: Check the cable connection between the computer and the analyzer.

Action B: Exit the Saturn DigiSizer application, and turn off the analyzer and liquid sample handler. Then turn on the liquid sample handler first, the analyzer second, and restart the Saturn DigiSizer application. If the problem persists, contact your local Micomeritics representative.

6058- Unrecognized sample handler.

Cause: A communications problem between the analyzer and liquid sample handler has occurred.

Action A: Check the cable connection between the analyzer and the liquid sample handler.

Action B: Exit the Saturn DigiSizer application; turn off the analyzer and liquid sample handler. Then turn on the liquid sample handler first, the analyzer second, and restart the Saturn DigiSizer application. If the problem persists, contact your local Micomeritics representative.

6060- Invalid laser parameters

Cause: A hardware malfunction has occurred.

Action: Contact your local Micromeritics representative.

6069- Detector: Laser interlock disabled.

Cause: The analyzer's front panel is not closed properly.

Action: Be sure the front panel is closed completely. If problem persists, contact your local Micromeritics representative.

6070- Detector: DAC timeout (type: X)
6071- Detector: Exposure timeout (status: X, delay: X sec)
6072- Detector: ADC busy (type: X, status: X)
6073- Detector: ADC out of range (type: X, LD: X, BT: X)
6074- Detector: Timeout on waiting for pixel buffer.
6075- Detector: Pixel buffer X is not ready.
6076- Detector: Filter move timeout (type: X, status: X)
6077- Detector: Filter move failed (type: X, status: X)
6078- Detector: CCD temperature out of range (A/D: X)
6079- Detector: CCD setpoint out of range (A/D: X)
6080- Detector: Laser temperature out of range (A/D: X)
6081- Detector: Laser setpoint out of range (A/D: X)
6082- Detector: Detector temperature out of range (A/D: X)
6084- Rotator: Rotation timeout (steps = X, status = X, X)
6085- Rotator: Output timeout (status = X).

Cause: A hardware malfunction has occurred.

Action: Contact your local Micromeritics representative.

6086- Rotator: Interlock disabled.

Cause: The analyzer's front panel is not closed properly.

Action: Be sure the front panel is closed completely. If problem persists, contact your local Micromeritics representative.

6087- Rotator: Position unknown.
6088- Rotator: Command error (status = X).
6089- Rotator: Position error (status = X).

Cause: A hardware malfunction has occurred.

Action: Contact your local Micromeritics representative.

6090- LSHU: Error sending message.
6091- LSHU: Error receiving message.
6092- LSHU: Error parsing message (options=X, state=X)

Cause: A communications problem between the analyzer and liquid sample handler has occurred.

Action A: Check the cable connection between the analyzer and the liquid sample handler.

Action B.: Exit the Saturn DigiSizer application; turn off the analyzer and liquid sample handler. Then turn on the liquid sample handler first, the analyzer second, and restart the Saturn DigiSizer application. If the problem persists, contact your local Micomeritics representative.

6093- LSHU: Error circulating pump thermal overload.
6094- LSHU: Error 24 Volt line is not available.

Cause: A hardware malfunction has occurred.

Action: Contact your local Micromeritics representative.

6095- MasterTech: Not responding.
6096- MasterTech: Error moving arm (expected X, actual X)
6097- MasterTech: Stirrer on/off error (expected X, actual X)
6098- MasterTech: Stirrer speed error (expected X, actual X)
6099- MasterTech: Pump on/off error (expectedX, actual X)
6100- MasterTech: Pump direction error (expected X, actual X)
6101- MasterTech: Ultrasonic on/off error (expected X, actual X)
6102- MasterTech: Error moving turntable (expected X, actual X)
6103- MasterTech: Error querying
6104- MasterTech: Error getting status

Cause: A communications problem between the analyzer and the MasterTech has occurred, or the MasterTech has malfunctioned.

Action A: Check the cable connection between the analyzer and the MasterTech.

Action B: Exit the Saturn DigiSizer application, and turn off the analyzer, the liquid sample handler, and the MasterTech. Then turn on the MasterTech first, the liquid sample handler second, and the analyzer third. Restart the Saturn DigiSizer application. if the problem persists, contact your local Micromeritics representative.

6105- Detector operation: Error light dose offset out of range (X).
6106- Detector operation: Error beam transmittance offset out of range (X).
6107- Detector operation: Error light dose integrating offset out of range (X)
6108- Detector operation: Error beam transmittance integrating offset out of Range (X).
6109- Detector operation: Error light dose offset calibration failed (X,X).
6110- Detector operation: Error light close integrating offset calibration failed (X, X).

Cause: A hardware malfunction has occurred.

Action: Contact your local Micromeritics representative.

6111- Detector operation: Error, unable to calculate beam center (X).

Cause: Excessive vibration is preventing repeatable beam center alignment.

Action A: Position the liquid sample handler so that only the soft foam rings surrounding the cell tubing are in contact with the analyzer, creating a light, tight seal. Metal-to-metal contact causes excessive vibration of the analyzer.

Action B: Minimize external sources of vibration. If problem persists, contact your local Micromeritics service representative.

6112- Detector operation: Beam angle adjusted (X).

Cause: Realignment of the beam center caused a rotator angle adjustment.

Action: None required.

6113- Detector operation: Error, unable to select optic axis.

Cause: Too many CCD pixels near the focused laser beam have been temporarily marked as defective.

Action: Exit the analysis program and turn off the analyzer. Wait approximately one minute; turn on the analyzer and restart the program.

If the problem persists, contact your Micromeritics service representative.

6114- Detector operation: Error, unable to locate optic axis (X,X).

Cause: Excessive vibration is preventing repeatable beam center alignment.

Action A: Position the liquid sample handler so that only the soft foam rings surrounding the cell tubing are in contact with the analyzer, creating a light, tight seal. Metal-to-metal contact causes excessive vibration of the analyzer.

Action B: Minimize external sources of vibration. If problem persists, contact your local Micromeritics service representative.

6115- Detector operation: Error finding rotation lower limit switch.

Cause: A hardware malfunction has occurred.

Action: Contact your local Micromeritics service representative.

6116- Error, timeout on draining reservoir.

Cause A: Drain tubing may be obstructed

Action A: Ensure that the drain tubing is unobstructed and the outlet end is not submerged in the waste liquid.

Cause B: A drain valve or level sensor malfunction has occurred.

Action B: Access the instrument schematic and enable manual control. Open and close the drain valve several times. Then rinse the system. If the problem persists, contact your local Micromeritics service representative.

6117- Error, timeout on filling reservoir. Make sure there is liquid present and resume the analysis.

Cause A: The analysis or rinse liquid inlet tubing is out of liquid.

Action A: Check the analysis and rinse liquid tubes to ensure that they are both submerged and have adequate supplies of liquid.

Cause B: The analysis or rinse pump is unable to prime itself.

Action B: Raise the liquid container above the liquid sample handler and resume operation. After the liquid has started to pump, place the container back in its normal position.

Cause C: A hardware malfunction has occurred.

Action C: Contact your local Micromeritics service representative.

6118- Error, fill stabilization failed after X tries.

Cause: A hardware malfunction has occurred.

Action: Contact your local Micromeritics representative.

6119- Error, rinse failed after [n] tries. Current obscuration [n]. Required obscuration [n].

Cause A: The cell and liquid sample handler are clean, but the beam transmittance has changed since the last background measurement.

Action A: Perform a background analysis.

Cause B: The liquid sample handler and/or sample cell are dirty and cannot be cleaned by rinsing.

Action B: Use a surfactant that will effectively remove the contamination and perform a rinse, or manually clean the sample cell and the liquid sample handler.

Cause C: The rinse liquid differs in transmittance from the liquid used in the current background measurement.

Action C: Perform as many rinses as is necessary to clean the system. Do not use the Autorinse function with a liquid which differs substantially in transmittance from the last background analysis liquid. Always perform a background measurement with the current analysis liquid before analyzing samples.

6120- Error, ultrasonic probe is out of liquid.

Cause: Ultrasonic probing was requested when the liquid level was not at least primed.

Action: Fill the liquid sample handler with liquid before turning on the probe.

6121- Error, Maximum number of overrange pixels was exceeded (X, X).

Cause: A hardware malfunction has occurred.

Action: Contact your local Micromeritics representative.

6125- The instrument <serial number> is not calibrated.

Cause: You started the application program, but no calibration files were found for the attached instrument.

Action: Run the Setup program and reinstall the calibration files.

6128- Invalid deconvolution results.

Cause: The deconvolution was unable to create a valid particle size distribution from the collected intensity data.

Action A: Make sure enough sample was used in the analysis to provide good intensity data.

Action B: Measure a background to ensure that this information is still valid.

6129- Sample (file name) already contains eight tests and cannot be used for an analysis.

Cause: The analysis could not be started because the sample file contains the maximum eight tests allowed. The sample file has been removed from the schedule and replaced with an empty entry.

Action: Remove the empty entry. If desired, click **Insert** to create a replacement entry and choose or create a new sample file. Click **Start** to restart the MasterTech schedule.

6130- No data available in file <file name> for reporting.

Cause: You requested that a report be generated on a sample containing no particle size data.

Action: Wait for the completion of at least one test, and then try again.

6132- Warning, the default sample file does not request a rinse after analysis.

Cause: You selected the QuickStart **Autodetect** mode of analysis, but the default sample file does not specify a rinse after analysis. This may result in repeated analyses of the same physical sample.

Action: Unless you plan to repeat the analysis on the same sample, cancel the QuickStart window. Access **Sample defaults** from the **Options** menu and specify to rinse after analysis. Then restart the QuickStart mode.

6133- Configured serial number does not match instrument.

Cause: The instrument serial number specified for this unit during installation does not match the serial number recorded in the attached instrument.

Action: Attach the correct instrument, or run the Setup program and install the calibration files for the correct instrument serial number. The instrument serial number is located on the back panel of the analyzer.

6135- Detector Operation: Warning, beam center drive current adjusted from [nn.nn] to [nn.nn].

Cause: Operating characteristics of the laser have changed since the last focus calibration.

Action: A new focus calibration is recommended. The analyzer will continue to function properly. Contact your local service representative.

6136- Detector Operation: Error, beam center too large.

6137- Detector Operation: Error, beam center underrange.

Cause A: There is an obstruction or dirt in the optical path.

Action A: Remove the obstruction or clean the dirty lens or cell. Refer to **Cleaning the Optics** in Chapter 9 for instructions on cleaning the optics.

Cause B: A problem has developed in the laser or detector system.

Action B: Contact your local Micromeritics service representative.

6138- Detector Operation: Error, beam center overrange.

Cause: A problem has developed in the laser or detector system.

Action: Contact your local Micromeritics service representative.

6139- Detector: Temperature in calibration mode, temperature control disabled.

6140- Detector Operation: Error, temperature not in calibration mode.

6141- Detector Operation: Error, temperature calibration out of range (A/D: nnnn).

Cause: A temperature calibration was performed on your analyzer and a problem has occurred.

Action: Contact your Micromeritics service representative.

Unnumbered Messages

These messages display on the instrument schematic as yellow text on a red background in the area of their associated component.

Liquid Sample Handler

24Volt Failure
Thermal Overload

Cause: An electronic failure has occurred.

Action: Contact your local Micromeritics service representative.

Laser

Filter Error: Sensors on
Filter Error: Sensors off

Cause: An electronic failure has occurred.

Action: Contact your local Micromeritics service representative.

Laser disabled

Cause: The front panel of the analyzer is open.

Action: Ensure that the front panel is completely closed before beginning an operation. If the message remains on the screen after closing the front panel, contact your local Micromeritics service representative.

Laser temperature invalid

Cause: An electronic failure has occurred.

Action: Contact your local Micromeritics service representative.

Laser temperature out of band

Cause: Instrument initialization is in progress.

Action: None required; the message will disappear after initialization is complete. If the message should remain displayed on the screen after approximately 10 minutes, contact your local Micromeritics service representative.

Laser thermal overload
Temperature control disabled

Cause: An electronic failure has occurred.

Action: Contact your local Micromeritics service representative.

Test switch on

Cause: A manufacturing test switch was accidentally left turned on.

Action: None required; the message will disappear when the laser is activated.

Rotation Arm

Rotator thermal overload

Cause: An electronic failure has occurred.

Action: Contact your local Micromeritics service representative.

Charge-Coupled Device (CCD)

CCD temperature invalid

Cause: An electronic failure has occurred.

Action: Contact your local Micromeritics service representative.

CCD temperature out of band

Cause: Analyzer initialization is in progress.

Action: None required; the message will disappear after initialization is complete. If the message should remain displayed on the screen after approximately 10 minutes, contact your local Micromeritics service representative.

B. SAMPLE DISPERSION AND CONCENTRATION

Sample dispersion and concentration plays a vital part in obtaining accurate and reliable results. This appendix provides a discussion on dispersion techniques and sample concentration in relation to obtaining an appropriate beam obscuration for your sample.

Sample Dispersion

Sample materials should be well dispersed in a liquid of known density and viscosity and the difference between the powder and liquid densities be accurately known. Viscosity and density data for some common liquids are given in **Appendix D**. Handbook values for other liquids are usually sufficiently accurate, so the latter requirement means that only the powder density must be determined if it is unknown and if composition information does not permit calculation from handbook values. For this, one of Micromeritics' pycnometers is recommended.

The liquid should be one in which the powder can be completely dispersed (separated into unattached particles) for accurate size results to be obtained. Obviously, the liquid should be nontoxic, readily available, and one in which the sample is insoluble. Complete insolubility may be difficult to achieve in some instances. Solubility problems may be minimized by allowing the liquid to stand in contact with the particle material prior to using the liquid for the test sample. This cannot completely eliminate problems, however, because particle solubility is a function of particle size. Small particles are more soluble than large ones; in a dispersion of different sizes, the smallest particles tend to go into solution while precipitation occurs on the larger particles.

There are no established rules or laws by which complete particle dispersion can be assured. Only guidelines can be offered. Some powders disperse easily in any of several liquids and remain so while others require careful attention to conditions in order to achieve dispersion and are prone to reagglomerate if conditions shift a small amount. A few can be dispersed only after extended treatments.

Agitation, resulting in the application of strong shear forces, aids dispersion. The more rigorous the agitation — perhaps carried out in a high-speed blender, homogenizer, or an ultrasonic device — the better generally is the dispersion. Stirring a suspension while subjecting it to ultrasonic dispersion generally achieves the best dispersion because this ensures that all portions of the mix are brought into the zones of greatest energy. For a few friable materials, such agitation can result in comminution of the particles for which measurements are desired. This is not likely to be the case with solid particles, particularly when the particles are under 50 to 100 mm in diameter.

Air bubbles cause misleading results if trapped in the liquid during agitation. Care should be taken to avoid bubble entrapment, especially when the liquid is highly viscous. The Saturn DigiSizer performs bubble elimination routines and checks to verify their effectiveness, but the best agitation procedure is one that does not introduce them in the first place.

Chemical wetting or dispersing agents also generally aid dispersion. A great variety of such products are marketed. Appendices C and E list some of the more useful dispersing aids, as well as sources for some of these materials. These agents have been found useful for particle dispersion in Micromeritics' Materials Analysis Laboratory but are not the only agents available.

Some commercial surfactants are intended for use in specific pH ranges and in particular non-aqueous solutions. Slight solution composition differences may alter the effectiveness of any agent. The chemical supplier should be contacted about this type of problem. Sometimes merely shifting the pH of an aqueous dispersion will yield great improvements in the degree of dispersion. Metal oxides and metals that are likely to have oxide layers on their surface ordinarily are most easily dispersed in mildly alkaline media. Metal powders with any likelihood of grease on them should always be degreased prior to a dispersion attempt. Noble metal powders usually need a wetting agent for good dispersion. Dispersions involving hydrocarbon liquids that are immiscible with water are often difficult to make unless the powder is quite dry. Sometimes moisture picked up from the air is more than enough to cause difficulties.

Some powders flocculate upon standing a few moments after having been dispersed. Flocculation, of course, prevents accurate particle size analysis, and better dispersion and stabilization techniques must be sought.

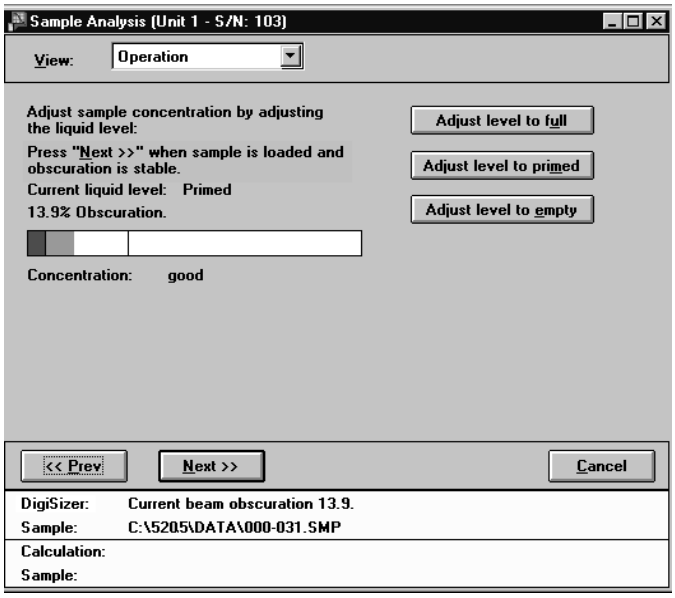
As a general guide, the best dispersing technique (includes agent and procedure) is the one producing consistently the finest distribution of sizes. We make this assertion because of the high reproducibility of the DigiSizer when presented identical samples. If the sample preparation technique is deficient in freeing particles one from another or if, though unlikely, it is producing particle fracture, this will be evidenced by an inconsistency of results.

The rheological behavior of high concentrations of fine powder in a liquid gives a good preliminary indication of the suitability of both the liquid medium and the dispersing agent. Some powders containing as much as 50 percent liquid act as if they were almost a solid mass, but a few tenths of a percent of wetting agent can cause the mass to take on the consistency of soup. This reaction is indicative of a very good agent. The effect will not often be so dramatic, but working the mass with a spatula will give a good indication of the efficacy of an agent.

A test for the optimum quantity of a dispersing agent is conducted by measuring the sediment volume from a slurry of about 5 weight percent concentration. The slurry and agent must be mixed and allowed to stand in a sedimentation tube undisturbed by either mechanical vibrations or thermal currents. The minimum sediment volume indicates the best agent concentration level. If several dispersing agents are compared at the same time, the minimum sediment volume is also a measure of the best dispersing agent.

Sample Concentration

After you choose a sample file and click **Next**, a window showing the beam obscuration based on your sample's concentration is displayed.



While observing the beam obscuration and concentration, gradually add your sample to the reservoir. Use the following guidelines for your sample concentration:

Expected Mean Particle Diameter (micromerters)	Recommended Beam Obscuration (%)
Less than 0.1	4
0.1 to 1	5 to 10
1 to 10	10 to 20
10 to 100	20 to 30
100 to 1000	30 to 45

If your beam obscuration level is too high, the **Adjust** push buttons on the right side of the dialog can be used to add more liquid. If the **Autodilute** function is being used, concentration adjustment will be made automatically.

If your beam obscuration level is too low, simply add more sample. If the reservoir is too full, again you can use the Adjust push buttons to adjust the liquid level.

Listed below are some guidelines for sample concentration in relation to attaining an appropriate beam obscuration for various sized particles.

Small Particles and Multiple Scattering

Analysis of small particles (<1 micrometer diameter) is subject to errors caused by multiple scattering, that is light scattered by one particle striking another particle and being scattered again. This effect increases as sample concentration increases, and causes the particle size to appear smaller than it is.

To test for this:

1. Perform an analysis in the recommended beam obscuration range. Run two or more tests to ensure the results are repeatable, indicating that the dispersion is stable.

2. Dilute the sample to a lower beam obscuration, for instance 2% below the first beam obscuration. This is accomplished by clicking **Adjust level to primed** and observing the reduction in beam obscuration. Repeat as needed until the desired beam obscuration is achieved.

3. Perform another analysis of two or more tests and compare the results to the earlier tests. If the lower beam obscuration produces a significantly larger mean particle size, then significant multiple scattering may have occurred with the original concentration. Repeat these steps to determine the obscuration at which there is no significant multiple scattering.

Note that analyzing with beam obscuration of less than 5% is not recommended, since there may not be enough scattered light for an accurate measurement. Running a background analysis shortly before introducing sample may improve results from a low beam obscuration analysis.

Medium Size Particles

For particles in the range of 1 to 100 micrometers diameter, it is ideal to use a high enough sample concentration that the Goodness of Fit Report shows the measured intensities level out at smaller scattering angles before decreasing as scattering angle increases. This clearly defines the maximum particle size present. This can be important in detecting dispersion problems indicated by the apparent presence of larger than expected sizes.

Large Particles

For particles greater than 100 micrometers in diameter, relatively few particles are required to achieve a given beam obscuration. For this reason using a higher sample concentration can improve repeatability by increasing the number of particles, thus improving the sampling statistics and presenting a more representative sample of the material.

C. CHEMICAL AIDS FOR PARTICLE DISPERSION

Name	Type	Active Ingredient
Aerosol 22	Anionic	Tetrasodium N-(1,2-dicarboxyet hyl)-N-octadecysulfosuccinanate, 35%
Aerosol OT	Anionic	Dioctyl ester of sodium sulfosuccinic acid, 70%
Atlas G-3300	Anionic	Amine salt of alkylaryl sulfonate
Calcium Chloride	Cationic	$CaCl_2$
Calgon	Anionic	Sodium hexametaphosphate, unadjusted
Calgon T	Anionic	Part of sodium replaced by other cations, predominantly zinc
Cobaltous Chloride	Cationic	$CoCl_2$
Cobalt Citrate	Anionic	$Co_3(C_6H_5O_7)_2$
Daxad 23	Anionic	Sodium salts of polymerized substituted benzoid alkyl sulfonic acid (alkyl, long chain), 84.5%
Daxad 30	Anionic	Sodium salt of polymerized carboxylic acid, 25%
FC-134	Cationic	Fluorochemical surfactant
FC-161	Anionic	Fluorochemical surfactant
FC-170	Nonionic	Fluorochemical surfactant
Igepal CO-530	Nonionic	Nonylphenoxypoly (ethyleneoxy) ethanol, 100%
Oleic Acid	Anionic	$CH_3(CH_2)_7CH=CH(CH_2)_7COOH$
Renex 648	Nonionic	Ethoxylated nonylphenol, 100%
Sodium Silicate	Anionic	Na_2SiO_3
Triton X-100	Nonionic	Octyl phenoxy polyethoxy ethanol, 100%
Tamol SN	Anionic	Sodium salt of condensed naphthalene sulfonic acid, 100%
TSPP	Anionic	Tetrasodiumpyrophosphate, $Na_4P_2O_7$
Twitchell Base 8240	Anionic	Sodium salt of low molecular weight, sulfonated oil, parafin oil, water, and diethylene glycol
Tween 20	Nonionic	Polyoxyethylene Sorbitan monolaureate (polysorbate 20), 100%
Zonyl S-13	Anionic	Fluoroalkyl phosphate
Zonyl A	Nonionic	Ethylene oxide-ester condensate

Data extracted from McCutcheon's Detergents and Emulsifiers, McCutcheon Division, MC Publishing Co., Glen Rock, NJ, 1980.

D. LIQUID DENSITY AND VISCOSITY DATA

Listed below are density and viscosity of pure liquids and solutions (aqueous, by weight) as functions of temperature at atmospheric pressure.

Liquid or Solution	Temperature (°C)	Density (g/cm^3)	Viscosity (mPas)
Ethanol (absolute)	25 30 35	0.7851 0.7808 0.7764	1.096 1.003 0.914
Ethylene Glycol	25 32 40	1.1100 1.1051 1.0995	16.10 12.18 9.13
Glycerol (10%)	25 30 35	1.0206 1.0192 1.0178	1.1530 1.0240 0.9150
Glycerol (20%)	25 30 36	1.0452 1.0436 1.0400	1.5430 1.3590 1.1743
Glycerol (40%)	25 30 35	1.0970 1.0948 1.0926	3.1860 2.7280 2.3400
Glycerol (50%)	25 30 35	1.1238 1.1211 1.1182	5.041 4.247 3.540
Hexane (n)	25 30 35	0.6550 0.6504 0.6459	0.3046 0.2900 0.2828
Isopropanol	30 32 35	0.7769 0.7752 0.7728	1.7800 1.6800 1.5400
Sucrose (20%)	20 30 40	1.0810 1.0777 1.0737	1.945 1.493 1.184
Sucrose (30%)	20 30 40	1.1270 1.1232 1.1189	3.187 2.373 1.833
Sucrose (40%)	20 30 40	1.1765 1.1721 1.1676	6.167 4.375 3.241
Sucrose (50%)	20 30 40	1.2296 1.2250 1.2200	15.43 10.11 6.991

Liquid or Solution	Temperature (°C)	Density (g/cm^3)	Viscosity (mPas)
Water	26 32 38	0.9968 0.9951 0.9930	0.8737 0.7679 0.6814
n-Butanol	25 32 40	0.8058 0.8003 0.7940	2.59 2.18 1.78

Data extracted from (with interpolation in some cases):

Honig, P., *Principles of Sugar Technology*, p. 31, Elsevier Publishing Co., New York, 1953.

Swindells, J.F., Snyder, C.F., Hardy, R.C. and Golden, P.E., *Viscosities of Sucrose Solutions at Various Temperatures: Tables of Recalculated Values*, Supplement to N.B.S. Circular 440, U.S. Government Printing Office, Washington, 1958.

CRC Handbook of Chemistry and Physics, 59th Edition, The Chemical Rubber Co., Cleveland, OH, 1978-79.

The Merck Index, 9th Edition, Merck & Co., Rahway, NJ, 1976.

E. SOURCES OF DISPERSING AIDS

Dispersant	Source
Aerosol OT Aerosol 22	American Cyanamid Company, Process Chemicals Department, One-T Cyanamid Plaza, Wayne, NJ 07470
Calcium Chloride	Can be purchased at most laboratory supply houses.
Calgon Calgon T	Calgon Corporation, Water Management Division, Calgon Center, P. O. Box 1346, Pittsburgh, PA 15230
Cobalt Citrate	Shepherd Chemical Company, Cincinnati, OH 45212
Cobaltous Chloride	Can be purchased at most laboratory supply houses.
Daxad 23, 30	Hampshire Chemical Corporation, 55 Hayden Avenue, Lexington, MA 02173
Dispex 40	Allied Colloids, 2301 Wilroy Road, Suffolk, VA 23434
FC-134, -161 and -170	3M Company, Chemical Division,
St. Paul, MN 55141	
Igepal CO-530	GAF Corporation, 1361-T Alps Road, Wayne, NJ 07470
Lomar D	Henkel, 300 Brookside Avenue, Ambler, PA 19002
Oleic Acid	Can be purchased at most laboratory supply houses.
Renex 648 Tween 20 Atlas G-3300	ICI Americas, Inc., Chemical Division, New Concord ville Pike, Wilmington, DE 19897
Triton X-100 Tamol SN	Rohm and Haas Company, Independence Mall West, Philadelphia, PA 19105
Sodium Silicate “N” Brand	Philadelphia Quartz Company, 1301-T E. Fort Avenue, Baltimore, MD 21230
Tetrasodium Pyrophosphate (TSPP)	Can be purchased at most laboratory supply houses.
Zonyl A, S-13	E. I. DuPont de Nemours and Company, Dyes and Chemical Division, 1000-T Market Street, Wilmington, DE 19898

F. DATA REDUCTION

The volume frequency data corresponding to standard size parameter classes is derived by deconvolution. The particle size for each class is derived by multiplying its size parameter by the wavelength of light produced by the laser in each instrument. The volume frequency data are expressed as a fraction of the total.

The reference for calculation of various statistics is the *ASTM Manual on Presentation of Data and Control Chart Analysis, Sixth Edition*, by American Society for Testing and Materials. Other calculations have references as noted.

In the following calculations, log() always refers to log base 10. ln() refers to natural log.

Scattering Model Generation

Mie and Fraunhofer Calculations

Scattering models are theoretically derived patterns of light scattered by ideal, spherical particles of a known refractive index, based on Mie theory. The refractive index of the particle relative to the surrounding medium and the ratio of the diameter of the particle to the wavelength of the light are the two distinguishing parameters for each pattern. A simpler, diffraction-only Fraunhofer theory can also be used; it is independent of refractive index. The algorithms used for performing the Mie and Fraunhofer calculations as well as description of the theories are found in *Absorption and Scattering of Light by Small Particles* by Bohren and Huffman.

Volume Normalization

The Mie and Fraunhofer calculations give scattered light intensities and extinction coefficient for an individual particle. These intensities are normalized by particle volume so that all stored patterns are for a unit volume of sample.

Polarization

The calculations provide scattered intensities for light polarized parallel to and perpendicular to the polarization of the incident light. These two components are recorded separately. At the time the model is used, they are combined based on the polarization of the laser in the instrument.

Size Parameters

Models are calculated for a standard set of size parameters, or ratios of particle diameter to wavelength. The actual diameters represented must be calculated by multiplying the size parameter by the wavelength produced by the laser in each instrument.

Size Subclasses

Each size class represents a continuum of sizes spanning the class interval. The Mie and Fraunhofer algorithms calculate a pattern for a single, discrete size. A representative scattering pattern for each class is computed by a weighted average of scattering patterns for different sizes spanning the class, called *subclasses*. The interval between the subclasses is 1/4 the interval between size classes. In addition to the five subclasses spanning the class interval (including both ends of the interval), the nearest subclass in each adjacent class interval is included for a total of seven subclasses combined in each class. This provides a fairly smooth transition in size class patterns. The patterns are combined using a cosine^2 weighting function, with coefficients of {0.1464,0.5,0.8536,1.0,0.8536,0.5,0.1464}.

Angle Subclasses

Each angle class represents a continuum of angles spanning the class interval. The Mie and Fraunhofer algorithms calculate scattered light intensity for a set of discrete angles. An average intensity for each angle class must be computed by averaging over its angle interval. Scattering patterns for large particle sizes contain very high frequency changes in intensity with angle, requiring averaging over many discrete angles to compute an accurate average intensity. Patterns for small particle sizes have much less detail and require fewer discrete angles for accurate averaging.

For averaging, each angle subclass intensity is weighted by its fraction of the total area subtended by the angle class, which is proportional to the cosine of the angle.

Scattering Vector

Plotting the scattered intensity data versus the magnitude of the scattering vector q is useful for comparing data on scattering independently of the scattered wavelength:

$$q = \left(\frac{4\pi N}{\lambda}\right) \sin\left(\frac{\theta}{2}\right)$$

where

N = refractive index of surrounding medium
λ = wavelength of light in a vacuum
θ = scattering angle

Deconvolution

Deconvolution is the process of determining what distribution of scattering models for different size classes provides the best fit to the measured scattered intensity data for a sample. The inputs to deconvolution are a set of scattering models for different size classes and a set of measured scattered intensity vs. angle data. The output is a volume frequency distribution by size class that best fits the measured intensity data.

The best fit is determined by a weighted, regularized nonnegative least squares method which minimizes |Ax - b| where A is a matrix of scattering models and regularization constraints, b is the measured intensity pattern, and x is the size distribution resulting from the fit. The matrix A and vector b are modified to weight the contribution of error for each measured intensity.

After A and b are constructed, the nonnegative least squares fit (NNLS) is performed as described in *Solving Least Squares Problems*, C.L.Lawson and R.J.Hanson, Prentice-Hall,1974, p.160, with modifications described below.

Angle Classes and Size Classes

Each angle class with measured intensity data is included in the deconvolution.

For each scattering model at one of the predefined size classes, a minimum amount of intensity data for the first lobe of the scattering pattern is required in order to characterize adequately the scattering model for that size class. This is expressed as the Minimum Fraction of First Lobe Classes.

For a given size class, let M be the index of the angle class where the first minimum in the intensity pattern occurs.

Let N be the first angle class for which significant intensity data was measured, i.e. the first angle class with a Signal Fraction greater than or equal to the Minimum Significant Signal Fraction.

Then if (M - N) / M is greater than or equal to the Minimum Fraction of First Lobe Classes, the class is included. The largest size class satisfying this criterion is the largest class to be used in deconvolution, or the Maximum Size Class. The number of classes from this class to the smallest size class (inclusive) is the Number of Size Classes.

If the number of measured intensity data points is less than the Number of Size Classes, the Minimum Size Class is increased to make the number of intensity data points and the Number of Size Classes equal.

Regularization

The result of the NNLS deconvolution is regularized by adding an additional set of constraints to minimize the second derivative of the solution vector (the frequency distribution). These constraints are weighted by an overall regularization parameter (RegParam = RegParamHigh, RegParamMed, or RegParamLow) based on the user input degree of smoothing from the Material Properties dialog. The regularization constraints form a tridiagonal submatrix appended to the matrix A as extra rows, with corresponding 0's in b. If there are M angle classes and N size classes, for angle class j and size class k:

$$F_k = \sum_j (A_{k,j-1} - 2 \times A_{k,j} + A_{k,j+1})^2$$

using $A_{k,-1} = A_{k,M} = 0$

$$G_k = \text{RegParam} \times \ln\frac{1}{F_k}$$

$A_{M+k,k-1} = G_k$ for k>0

$A_{M+k,k} = -2 \times G_k$

$A_{M+k,k+1} = G_k$ for k>N

$A_{M+k,i} = 0$ for all other i

$b_{M+k} = 0$

Modifications to NNLS

After A and b are constructed as above, NNLS is performed as described in *Lawson and Hanson* with the following modifications:

Maximum Number of Iterations

A maximum number of iterations are performed before the result is returned.

Check for Repeats

After each iteration, the result is checked against each of the most recent iterations. If it is identical to any of them, the process is stopped and the result returned.

Dual Vector

The dual vector in NNLS steps 2,3,4 is calculated for largest step size rather than for steepest descent. After vector w is calculated as in step 2, it is modified:

$$w_j = \frac{w_j}{\sum (E_{ij} \times E_{ij})^2}$$

To shorten computation time by eliminating the addition of size classes that make an insignificant contribution, w j is tested against a cutoff value greater than 0:

$$\text{cutoff} = \text{DualThresh} \times \text{MaxModelIntensity} \times \frac{100}{\text{MaxIntensity}}$$

where

DualThresh= the Dual Vector Threshold and the maximum intensity values as defined above.

Nonnegative Tolerance Parameter

A Nonnegative Tolerance Parameter (referred to as Tau in L&H p.80-81) is used.

Also, this value times the sum of the solution vector is used instead of 0 as the lower limit for nonnegative elements in the solution vector (p.161 step 7).

Weighted Residual

The contribution of an individual intensity error to the total error or residual of the least squares fit is weighted by the fraction of the total intensity signal due to scattering (as opposed to background), and by the magnitude of the intensity:

$$W_i = \left(\frac{I_{SCAT_i}}{I_{TOT_i}}\right)^2 (I_{SCAT_i})^{-0.7}$$

$$E_{SQ_i} = W_i \left(\frac{I_{SCAT_i} - I_{FIT_i}}{I_{FIT_i}}\right)^2$$

$$\text{Weighted Residual} = 100 \left(\frac{\sum E_{SQ_i}}{\sum W_i}\right)^{0.5}$$

where

W_i = weighting factor for intensity point i
I_{SCATi} = scattered intensity for point i
I_{TOTi} = total intensity (scattered plus background) for point i
I_{FITi} = model fit intensity for point i
E_{SQi} = error squared for point i

Input Quantities

Standard Particle Size Classes and Standard Size Parameter Classes

For the predefined size classes:

The diameter interval bounds are spaced geometrically and the average diameter for each interval is the geometric mean of the high and low diameters of the interval. The low diameter for one interval or class is the high diameter for the next interval or class. For a diameter range of 0.1 to 1000.0 and 40 classes per decade:

ClassFact= ratio between adjacent class
= ratio between adjacent class averages
= 101/40 = 1.05925372518

The ratio between a class average and either of its class bounds is

1.059253725181/2 = 1.0292005272

The average diameter array has 193 elements:

AvgDiam[193] = {0.040,0.042,0.045,0.047,0.050,0.053...,1883.6,1995.3,2113.5, 2238.7,2371.4,2511.9}

The diameter interval array has 173 elements:

IntvlDiam[152] = {0.039,0.041,0.043,0.046,0.049,0.052,...,1938.7,2053.5,2175.2, 2304.1,2440.6,2585.2}

For a laser of the nominal wavelength, these particle size classes correspond to the size parameter classes for which the scattering models are generated and the deconvolution performed. Since all lasers will not have the nominal wavelength, a frequency distribution based on the standard particle size classes must be interpolated from the deconvolution distribution, which is based on the sizes derived from the actual laser wavelength and the standard size parameters:

ParticleDiameter = SizeParameter x Wavelength

High/Low Diameter and Average Diameter

For the standard size classes:

Average Diameter is taken directly from the standard size class Average Diameter array AvgDiam[] above.

The High and Low Diameters for class i are:

HighDiami = IntvlDiam[i]
LowDiami = IntvlDiam[i-1]

For user entered size tables:

The user entries are used as the IntvlDiam array as above, with the HighDiam and LowDiam values assigned from it. Note that there is always one less size interval than the number of entries in IntvlDiam.

AvgDiami is the geometric mean of HighDiami and LowDiami = $(\text{HighDiami} \times \text{LowDiami})^{1/2}$

Standard Sieve Sizes

ASTM E-11 standard sieve sizes and a few common sizes are used.

Sieve Number (in.)	Aperture Size (μm)	Sieve Number (in.)	Aperture Size (μm)
5	125000	No. 8	2360
4.24	106000	No. 10	2000
4	100000	No. 12	1700
3 1/2	90000	No. 14	1400
3	75000	No. 16	1180
2 1/2	63000	No. 18	1000
2.12	53000	No. 20	850
2	50000	No. 25	710
1 3/4	45000	No. 30	600
1 1/2	37500	No. 35	500
1 1/4	31500	No. 40	425
1.06	26500	No. 45	355
1	25000	No. 50	300
7/8	22400	No. 60	250
3/4	19000	No. 70	212
5/8	16000	No. 80	180
0.530	13200	No. 100	150
1/2	12500	No. 120	125
7/16	11200	No. 140	106
3/8	9500	No. 170	90
5/16	8000	No. 200	75
0.265	6700	No. 230	63
1/4	6300	No. 270	53
No. 3 1/2	5600	No. 325	45
No. 4	4750	No. 400	38
No. 5	4000	No. 450	32
No. 6	3350	No. 500	25
No. 7	2800	No. 635	20

Graph Particle Size Intervals

The predefined standard particle size classes are always used in computing quantities for graphs. For merged or entered data, the extra data are shown at the intervals for which it was entered, except for the frequency data for which the predefined classes are extended to the range needed to make sure that all the frequency classes are of the same width.

Interpolation

All interpolation is performed using the Akima semi-spline routine. Refer to BASIC Scientific Subroutines Vol. II, by F.R.Ruckdeschel, Copyright 1981 BYTE Publications/ McGraw Hill, p. 305. If the quantity to be used as either axis is a size quantity (diameter), the interpolation should be done on a log scale for that axis.

Merged Data

Merged data entries pre-empt compatible collected data; for example if overlap occurs, the merged data are reported and the overlapping sizes from the collected data are discarded.

If sieve size data are entered for the merged data, the aperture size of the smallest sieve size used will not in general fall on a standard particle size class boundary. A `pbridge' class must be constructed in this case extending from the minimum sieve aperture size to the next lower standard size class boundary. If the resulting class would be less than half the width (on the log diameter scale) of a standard size class, it is combined with the next lower standard size class which becomes the `bridge' class. A cumulative coarser value is interpolated at the minimum aperture size from the collected data, which becomes the cumulative coarser value for the `bridge' class. The frequency for the `bridge' class can then be calculated from the cumulative coarser curve in the normal way. The `bridge' class is treated as a collected data class for purposes of subsequent scaling and reporting.

If Autoscale percent/fraction of total sample is enabled on the Collected Data/ Merge Data dialog, the region of overlap between merge data and collected data is determined, and a scale (which is equal to the total frequency of the merged data in the overlap region over the total frequency of the collected data in the overlapped region) factor is determined. The collected data are then scaled by this factor. Finally, the frequency data over the whole range is rescaled to the total fraction accounted for by the merged data. All this is done in the Frequency fraction determined by the user (Volume/Area/Length/Number).

If Autoscale percent/fraction of total sample is disabled on the Collected Data/ Merge Data dialog, the entered percentiles/fractions for the merged data are used as is and the non overlapping portion of the collected data is scaled to be the percent/fraction passing the smallest sieve size used.

Fundamental Quantities

Distribution Type (Volume, Area, Length, Number)

The base distribution data provided by the deconvolution is volume frequency fraction. Conversion of the distribution to area, length, or number is as follows for each size class:

$$\text{AreaFreqFrac} = \frac{\text{VolFreqFrac}_i / \text{AvgDiam}_i}{\sum \text{VolFreqFrac}_k / \text{AvgDiam}_k}$$

$$\text{LenFreqFrac}_i = \frac{\text{VolFreqFrac}_i / \text{AvgDiam}_i^{\,2}}{\sum \text{VolFreqFrac}_k / \text{AvgDiam}_k^{\,2}}$$

$$\text{NumFreqFrac}_i = \frac{\text{VolFreqFrac}_i / \text{AvgDiam}_i^{\,3}}{\sum \text{VolFreqFrac}_k / \text{AvgDiam}_k^{\,3}}$$

or to convert back to Volume percent based on the others,

$$\text{VolFreqFrac}_i = \frac{\text{AreaFreqFrac}_i / \text{AvgDiam}_i}{\sum \text{AreaFreqFrac}_k / \text{AvgDiam}_k}$$

$$\text{VolFreqFrac}_i = \frac{\text{LenFreqFrac}_i / \text{AvgDiam}_i^{\,2}}{\sum \text{LenFreqFrac}_k / \text{AvgDiam}_k^{\,2}}$$

$$\text{VolFreqFrac}_i = \frac{\text{NumFreqFrac}_i / \text{AvgDiam}_i^{\,3}}{\sum \text{NumFreqFrac}_k / \text{AvgDiam}_k^{\,3}}$$

These Formulae will automatically normalize the Frequency fractions to 100%. If there exists merged or entered data, the user may have chosen not to have this add up to 100%. If this is the case, a conversion into the style (Vol/Area/Len/Num) that he has chosen will also cause a rescaling to his chosen percentage, A conversion into a different style will automatically be rescaled to 100%. This affects the cumulative percentage as well as things like median diameter which are based on cumulative coarser. For distribution statistics, there is an implicit rescaling to 100%.

Subsequent calculations based on the frequency distribution do not vary based on Distribution Type; therefore the formulas reference FreqFrac without specification of Distribution Type.

Particle Size (Diameter/Radius)

Any particle size quantity or derived quantity having the same units can be expressed as radius or diameter.

Radius = Diameter / 2

Quantities include:

- Mean
- Mode
- Median
- Standard deviation (of the distribution)
- Confidence limits
- Size at User Defined Percentiles
- User Defined Sizes
- High particle size
- Low particle size
- Average particle size
- Standard deviation for [n] tests of any of the above quantities

Percent/Fraction

Any cumulative quantity, frequency quantity, percentile, or derived quantity having the same units can be expressed as percent or fraction.

Pct = 100 x Frac

These include:

- Maximum Out of spec
- User Defined Percentiles 1 to 5
- Percent at User Defined Sizes 1 to 5
- Peak Report Minimum percent to report
- Peak Report Percent of distribution
- Cumulative Coarser/Finer
- Frequency
- Difference from reference
- Out of spec
- Standard deviation for [n] tests of any of the above quantities

Other quantities (Sample concentration, Beam obscuration) are calculated or stored as fractions but reported as percent.

Cumulative Coarser/Finer, Retained/Passed

Any cumulative quantity can be expressed as Coarser or Finer (Retained or Passed on Tabular Report by Sieve Size).

For data defined by the standard class sizes (Summary, Tabular Defined by Size Class, Graphs):

$$CumFracCoarser_i = \sum FreqFrac_k \text{ for all classes k such that } AvgDiam_k > AvgDiam_i$$

$$CumFracFiner_i = \sum FreqFrac_k \quad \text{for all classes k such that } AvgDiam_k > AvgDiam_i$$

$$CumFracRetain_i = \sum FreqFrac_k \quad \text{for all classes k such that } AvgDiam_k > AvgDiam_i$$

$$CumFracPass_i = \sum FreqFrac_k \quad \text{for all classes k such that } AvgDiam_k > AvgDiam_i$$

or, equivalently

$$CumFracFiner_i = 1.0 - CumFracCoarser_{i-1}$$

$$CumFracRetain_i = CumFracCoarser_{i-1}$$

$$CumFracPass_i = 1.0 - CumFracCoarser_{i-1}$$

For Tabular Defined by Size Table or by Sieve Sizes:

CumFrac (Coarser or Finer, Retained or Passed) is calculated for the standard size classes as defined above. CumFrac is then interpolated from CumFrac vs. Particle Size at each Particle Size in the Size Table or Aperture Size in the Sieve Table.

Frequency

Frequency is always calculated for a class. It is always the difference in the CumFracCoarser at the upper bound and the lower bound of the class. If this is a standard class, it is calculated as follows

$$FreqFrac_i = CumFracCoarser_{i-1} - CumFracCoarser_i$$

If it is not a standard class, The value of CumFracCoarser is interpolated at the two endpoints.

User-Entered Percentile Size

If the $UserPct_n$ is larger then the total percentage accounted for by any merged or user entered data, then " ***** " is printed.

$UserPctDiam_n$ = Diameter interpolated from $HighDiam_i$ vs. $CumFracCoarser_i$ at $UserPct_n$

User-Entered Size Percent

$UserDiamFrac_n$ = CumFracCoarser interpolated from $CumFracCoarser_i$ vs. $HighDiam_i$ at $UserDiam_n$

Peak Report Quantities

$$DiffFreqFrac_i = FreqFrac_i / \log(HighDiam_i / LowDiam_i)$$

Starting at the small particle size end of the frequency distribution,

1. Scan $DiffFreqFrac_i$ for a local maximum, i.e. $DiffFreqFrac_k > DiffFreqFrac_{k+1}$ and $DiffFreqFrac_k > DiffFreqFrac_{k-1}$

   $AvgDiam_k$ is the mode of the candidate peak.

2. If an unresolved peak remains from step 3 of the preceeding peak, the LowDiam from that unresolved peak is the LowDiam for this candidate peak. Otherwise, scan $DiffFreqFrac_i$ from class k toward smaller particle sizes to find a local minimum,

   i.e. $DiffFreqFrac_m = 0$

   or $DiffFreqFrac_m < DiffFreqFrac_{m+1}$ and $DiffFreqFrac_m < DiffFreqFrac_{m-1}$

   If $DiffFreqFrac_m < (DiffFreqFrac_k *$ Minimum Peak Valley Decrease), $LowDiam_m$ is the LowDiam of the candidate peak. Otherwise, this is an unresolved peak and will be added to the previous peak.

3. Scan $DiffFreqFrac_i$ from class k toward larger particle sizes to find a local minimum,

   i.e. $DiffFreqFrac_n = 0$

   or $DiffFreqFrac_n < DiffFreqFrac_{n+1}$ and $DiffFreqFrac_n < DiffFreqFrac_{n-1}$

   If DiffFreqFracn < ($DiffFreqFrac_k$* Minimum Peak Valley Decrease), $HighDiam_n$ is the HighDiam of the candidate peak. Otherwise, this is an unresolved peak and will be added to the next peak. Record the LowDiam for this unresolved peak for use on the next peak and repeat from step 1.

4. Sum values of $FreqFrac_i$ from i=m to i=n, but include only half of the FreqFrac values for end classes m and n. This is to split the frequency data between two adjacent peaks.

   If this is an unresolved peak as determined in step 2, add the sum to the Fraction of Distribution for the preceding peak and set the preceding peak's HighDiam to n.

   Otherwise, if the sum is greater than or equal to the Minimum Fraction to Report, the candidate peak is qualified and the sum is the Fraction of Distribution. Other peak quantities are calculated using the same formulas as for the entire distribution, except only the range from class m to class n is used.

   Otherwise, the candidate peak is disqualified.

5. In either case, peak identification repeats from step 1, starting with class n. When the end of the distribution is reached by scanning in either step 1 or step 3, peak identification is complete.

NOTES:

In step 1 if the end of the distribution is reached on an increasing frequency slope, i.e. $DiffFreqFrac_k > DiffFreqFrac_{k-1}$, then class k is treated as the mode of a candidate peak and as the high size end of the candidate peak.

If the beginning or end of the distribution is reached while scanning for a local minimum in step 2 or step 3, the beginning or ending class is treated as the local minimum.

For calculating Standard Deviation for N Tests, peaks from the various tests are simply matched by their order, i.e. Peak 1 from Test 1 is matched with Peak 1 from Test 2, etc.. If all tests do not have the same number of peaks, Standard Deviation for N Tests is reported as "N/A." If the peak numbers are not the same, and the user chose average of n tests. A single row is filled in with all N/A (including the peak number).

Size Statistics

Standard Deviation of Quantity for N Tests

For Quantity, substitute the variable name for which the standard deviation is being determined. The subscript k refers to the test number.

If NumTests <= 1, StdDevTestQuantity = 0. Else:

$$\text{MeanTestQuantity} = \frac{\sum \text{Quantity}_k}{\text{NumTests}}$$

$$\text{StdDevTestQuantity} = \frac{\sqrt{\sum (\text{Quantity}_k - \text{MeanTestQuantity})^2}}{\text{NumTests} - 1}$$

Mode

For a mode calculation, the definition of the standard classes is extended over the range of input for all the data; frequencies are calculated for these classes. It is this frequency data that are used in determining the peak quantities so that all the classes are of the same width.

ModeDiam = AvgDiam_i such that DiffFreqFrac_i is the maximum DiffFreqFrac

Median

MedianDiam = Diameter interpolated from HighDiam vs. CumFracCoarser at CumFracCoarser = .5. If the calculation is being done on a peak, the interpolation point is at CumFracCoarser = $(\text{CumFracCoarser}_m + \text{CumFracCoarser}_n)/2$.

Arithmetic Calculations

Standard Deviation (of the distribution):

$$\text{MeanDiam} = \frac{\sum \text{FreqFrac}_i \cdot \text{AvgDiam}_i}{\text{FreqFrac}_i}$$

Standard Deviation (of the distribution):

$$\text{StdDevDiam} = \sqrt{\frac{\sum \text{FreqFrac}_i \, (\text{AvgDiam}_i - \text{MeanDiam})^2}{\sum \text{FreqFrac}_i}}$$

Coefficient of Variation:

$$\text{CoefVar} = \frac{\text{StdDevDiam}}{\text{MeanDiam}}$$

Skewness:

$$\text{Skew} = \frac{\sum \text{FreqFrac}_i \, (\text{AvgDiam}_i - \text{MeanDiam})^3 / \sum \text{FreqFrac}_i}{(\sum \text{FreqFrac}_i \, (\text{AvgDiam}_i - \text{MeanDiam})^2 / \sum \text{FreqFrac}_i)^{3/2}}$$

Kurtosis:

$$\text{Kurt} = \frac{\sum \text{FreqFrac}_i \, (\text{AvgDiam}_i - \text{MeanDiam})^4 / \sum \text{FreqFrac}_i}{(\sum \text{FreqFrac}_i \, (\text{AvgDiam}_i - \text{MeanDiam})^2 / \sum \text{FreqFrac}_i)^2} - 3$$

$+x\,\sigma$

$$\text{PlusNSig} = \text{MeanDiam} + x \cdot \text{StdDevDiam}$$

where x is the user-selected number.

$-x\,\sigma$

$$\text{MinusNSig} = \text{MeanDiam} - x \cdot \text{StdDevDiam}$$

where x is the user-selected number.

Geometric Calculations

Mean:

$$\text{GeoMeanDiam} = 10^{\frac{\sum \text{FreqFrac}_i \log(\text{AvgDiam}_i)}{\sum \text{FreqFrac}_i}}$$

Standard Deviation (of the distribution):

$$\text{GeoStdDevDiam} = 10^{\text{StdDevLogDiam}}$$

Standard Deviation of Log (size):

$$\text{StdDevLogDiam} = \sqrt{\frac{\sum \text{FreqFrac}_i (\log(\text{AvgDiam}_i) - \log(\text{GeoMeanDiam}))^2}{\sum \text{FreqFrac}_i}}$$

Skewness of Log (size):

$$\text{SkewLog} = \frac{\sum \text{FreqFrac}_i (\log(\text{AvgDiam}_i) - \log(\text{GeoMeanDiam}))^3 / \sum \text{FreqFrac}_i}{(\sum \text{FreqFrac}_i (\log(\text{AvgDiam}_i) - \log(\text{GeoMeanDiam}))^2 / \sum \text{FreqFrac}_i)^{3/2}}$$

Kurtosis of Log (size):

$$\text{KurtLog} = \frac{\sum \text{FreqFrac}_i (\log(\text{AvgDiam}_i) - \log(\text{GeoMeanDiam}))^4 / \sum \text{FreqFrac}_i}{(\sum \text{FreqFrac}_i (\log(\text{AvgDiam}_i) - \log(\text{GeoMeanDiam}))^2 / \sum \text{FreqFrac}_i)^2} - 3$$

$+x\sigma$:

$$\text{PlusNSigLog} = 10^{\log(\text{GeoMeanDiam}) + x \log(\text{GeoStdDevDiam})}$$

where x is user-selected number.

$-x\sigma$:

$$\text{MinusNSigLog} = 10^{\log(\text{GeoMeanDiam}) - x \log(\text{GeoStdDevDiam})}$$

where x is user-selected number.

Material Formulae

Relative refractive index

Relative refractive index is the complex quotient of the complex Particle refractive index and the real Analysis Liquid refractive index:

$$\text{RelRefIdx(Re)} = \frac{\text{ParticleRefIdx(Re)}}{\text{LiquidRefIdx}}$$

$$\text{RelRefIdx(Im)} = \frac{\text{ParticleRefIdx(Im)}}{\text{LiquidRefIdx}}$$

Sample Concentration

This is calculated exclusively for the collected and deconvoluted data.

BeamObscuration is obtained from collected data.

$\text{BeamLength}_m = 5000$
ExtCoef_i = extinction coefficient for size class i, available from scattering model

$$\text{ConcFrac} = \frac{\log(\text{BeamObscuration})}{-\frac{3}{2}\,\text{BeamLength}_{\mu m}\left[\frac{\sum \text{ExtCoef}_i \text{VolFreqFrac}_i / \text{AvgDiam}_i}{\sum \text{VolFreqFrac}_i}\right]}$$

Specific Surface Area

This is calculated exclusively for the collected and deconvoluted data.

ParticleDensity is obtained from the Material Properties.

$$\text{SurfArea} = \frac{6\left[\frac{\sum \text{VolFreqFrac}_i / \text{AvgDiam}_i}{\sum \text{VolFreqFrac}_i}\right]}{\text{Particle Density}}$$

Specification/Reference Quantities

Out of Spec

$SampCumFrac_i$ = cumulative fraction coarser/finer/passed/retained for class i from sample distribution.

$CoarseSpecCumFrac_i$ = cumulative fraction coarser/finer/passed/retained for class i from Coarse Specification distribution interpolated if the bins are of different size. This is always the average of all the tests in that sample file[1].

$FineSpecCumFrac_i$ = cumulative fraction coarser/finer/passed/retained for class i from Fine Specification distribution interpolated if the bins are of different size. This is always the average of all the tests in that sample file*.

If { $SampCumFracCoarser_{i-1} > CoarseSpecCumFracCoarser_{i-1}$}

OutSpecFracCoarseri = $SampCumFracCoarser_{i-1}$ - CoarseSpecCumFracCoarseri-1

Else if { $SampCumFracCoarser_{i-1} < FineSpecCumFracCoarser_{i-1}$ }

$OutSpecFracCoarser_i = SampCumFracCoarser_{i-1} - FineSpecCumFracCoarser_{i-1}$

Else $OutSpecFracCoarser_i = 0$

or

$OutSpecFracFiner_i = -OutSpecFracCoarser_{i-1}$

$OutSpecFracRetain_i = OutSpecFracCoarser_{i-1}$

$OutSpecFracPass_i = -OutSpecFracCoarser_{i-1}$

Difference from Reference

$SampCumFrac_i$ = cumulative fraction coarser/finer/passed/retained for class i from sample distribution

$RefSpecCumFrac_i$ = cumulative fraction coarser/finer/passed/retained for class i from Reference Specification distribution interpolated if the bins are of different size. This is always the average of all the tests in that sample file*.

$DiffRefCoarser_i = SampCumFrac_i - RefCumFrac_i$

1 Always using the average of the tests in reference files is done so that printing out reports on a file will not affect its use as a reference.

or

$DiffRefFiner_i = -DiffRefCoarser_{i-1}$

$DiffRefRetain_i = DiffRefCoarser_{i-1}$

$DiffRefPass_i = -DiffRefCoarser_{i-1}$

Maximum Out of Spec

MaxOutSpecFrac = maximum (abs value ($OutSpecFrac_i$))

Pass/Fail by Specification

If MaxOutSpecFrac = 0

PassFail = “PASSED by Specification”

ElsePassFail = “FAILED by Specification”

SPC Report Variables

Regression Chart Variables

The line of best fit for the Regression Chart is calculated by the usual Least Squares method. Refer to *BASIC Scientific Subroutines Vol. II*, by F.R.Ruckdeschel, Copyright 1981 BYTE Publications/McGraw Hill, p. 16. If there is only a single point, or all N points have the same x-value, there can be no line of best fit in the standard form.

$$\text{Xave} = \frac{\sum x_i}{N}$$

$$\text{Yave} = \frac{\sum y_i}{N}$$

$$\text{Slope} = \frac{\text{Sum}(x_i - \text{XAve})(y_i - \text{YAve})}{\sum (x_i - \text{XAve})^2}$$

The coefficient of Correlation for this line is also calculated in the usual way. Refer to *Mathematical Handbook for Scientists and Engineers*, by Granino A Korn, and Theresa M. Korn, Copyright 1961, 1968 McGraw Hill, Sec 18.4.

$$\sigma_x = \sqrt{\frac{\sum (x_i - \text{XAve})^2}{N}}$$

$$\sigma_y = \sqrt{\frac{\sum (y_i - \text{YAve})^2}{N}}$$

$$\text{Cov}(x, y) = \frac{\sum (x_i - \text{XAve})(y_i - \text{YAve})}{N}$$

$$\text{CorrelationCoef} = \frac{\text{Cov}(x, y)}{\sigma_x \sigma_y}$$

Control Chart Variables

$$\text{Mean} = \frac{\sum y_i}{N}$$

$$\text{StdDev} = \sqrt{\frac{\sum (y - \text{Mean})^2}{N - 1}}$$

$$\text{CoefVaar} = \frac{\text{StdDev}}{\text{Mean}}$$

$$\text{PlusNSig} = \text{Mean} + n \cdot \text{StdDev}$$

$$\text{MinusNSig} = \text{Mean} - n \cdot \text{StdDev}$$

G. FORMAT OF EXPORTED DATA

This appendix gives the format for sample files exported in ASCII text. All character strings are delimited with quotation marks; columns are separated with a comma and white space.

The following types of data can be exported:

- Particle Size
- Intensity

Particle Size Data

Record Number	Information Conveyed	Form
1	File status 1 = complete 2 = analyzing 4 = entered 8 = no analysis	integer
2	Sample identification	quoted string (40 characters)
Merged Data (if present in sample file)		
1	Blank line	
2	Merged data indicator	"Merged Data"
3	Distribution type 0 = volume 1 = area 2 = number 3 = mass	integer
4	Number of points	integer
5	Particle size, cumulative fraction/percent (units as per the data presentation settings, repeated for each point)	floating point, floating point
Collected Data		
1	Blank line	
2	Test data identifier	"Test n:" where n = test number

Record Number	Information Conveyed	Form
3	Distribution type 0 = volume 1 = area 2 = number 3 = mass	integer
4	Number of points	integer
5	Particle size, cumulative fraction/percent (units as per the data presentation settings, repeated for each point)	floating point, floating point

Records 1 through 5 repeated for every test in sample file.
Test data identifier is changed accordingly.

Intensity Data

Record Number	Information Conveyed	Form
Intensity Data		
1	Blank line	
2	Test data identifier	"Test n:" where n = test number
3	Beam obscuration	floating point
4	Polarization	floating point
5	Laser wavelength	floating point
6	Number of points	integer
7	Bounding angle class, intensity (repeated for each point)	floating point, floating point
8	Bounding angle class	floating point

Records 1 through 8 repeated for every test in sample file.
Test data identifier is changed accordingly.

Record Number	Information Conveyed	Form
Background Data		
1	Background data identifier	"Background:"
2	Number of points	integer
3	Bounding angle class, intensity (repeated for each point)	floating point, floating point
4	Bounding angle class	floating point

Records 1 through 4 repeated for every test in sample file. Background data identifier is changed accordingly.

H. ETHERNET CONFIGURATION

Your computer and analyzer communicate by means of an ethernet connection. This appendix contains instructions for ensuring that the ethernet connection operates properly.

The sample screens shown in this appendix are Microsoft operating system screens, which may be subject to change. The screens are included for reference purposes only.

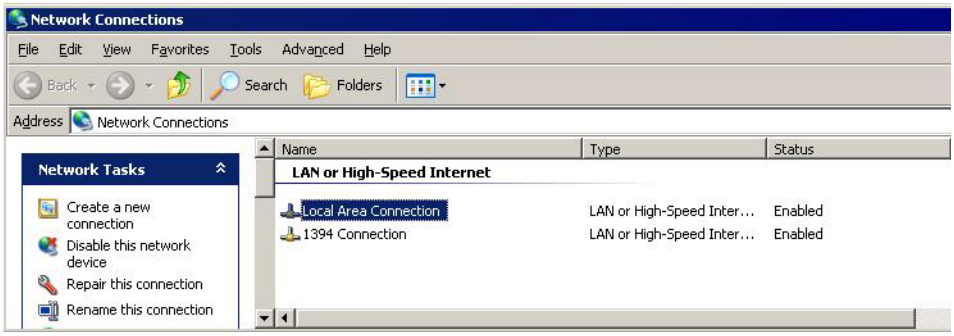
Configuring the Ethernet Port

This section contains instructions for configuring an ethernet port in either Microsoft® Windows XP Professional or Windows Vista. The instructions do not apply to any other operating system.

Depending on your desktop settings, you may have to access the dialogs in this procedure in a different manner. Refer to your Windows help system if you need assistance.

Windows XP Professional

1. Select **Start > Settings > Network Connections** from the Status bar at the bottom of the screen; the Network Connections dialog is displayed.

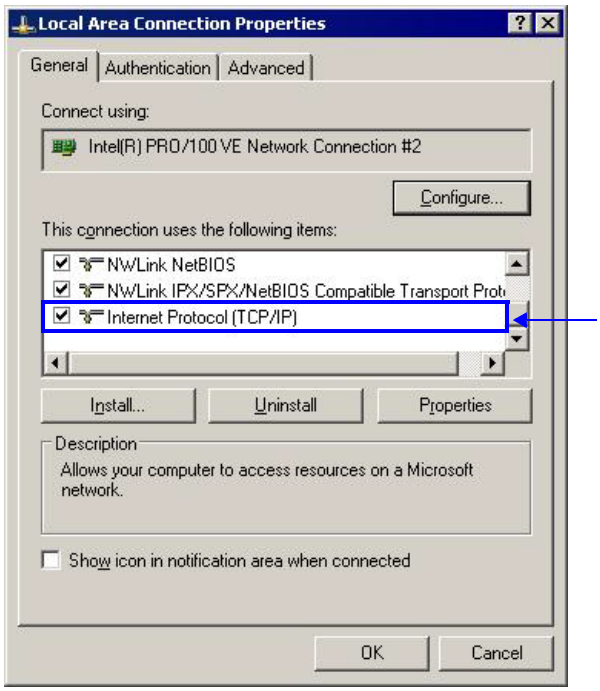


2. Double-click the appropriate Local Area Connection, which is actually the ethernet port; the Local Area Connection Status dialog is displayed.

If no Local area connections are displayed, Windows did not detect an ethernet port. Contact your system administrator.

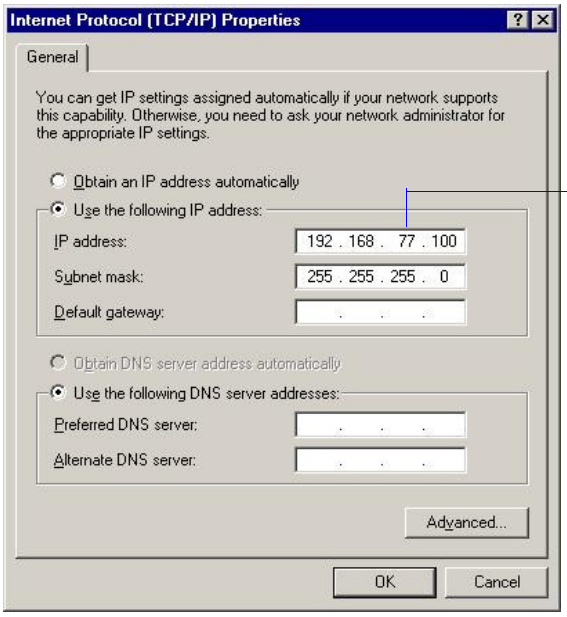
3. Click **Properties**; the Local Area Connection Properties dialog is displayed.

4. Scroll to **Internet Protocol (TCP/IP)** and make sure a check mark appears in the box to the left of the item. If it does not, click on the box to insert a check mark.



5. Select **Internet Protocol (TCP/IP)** to highlight it, then click **Properties**; the Internet Protocol dialog is displayed.

6. Click **Use the following IP address**, then enter the following in the **IP address** fields: **192 168 77 100**.



7. The following numbers should display in the **Subnet mask** field: **255.255.255.0.** If these numbers are not displayed, enter them.

8. Leave all other fields in the dialog blank.

9. Click **OK** to return to the Local Area Connection Properties dialog, then **OK** on this dialog to return to the Local Area Connection Status dialog.

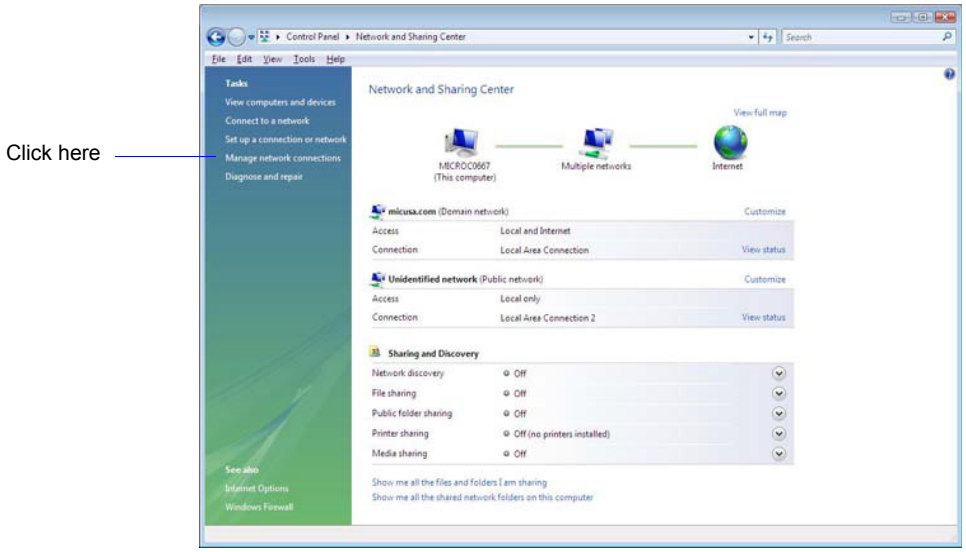
10. Click **Close** to close the Local Area Connection Status dialog.

Windows Vista

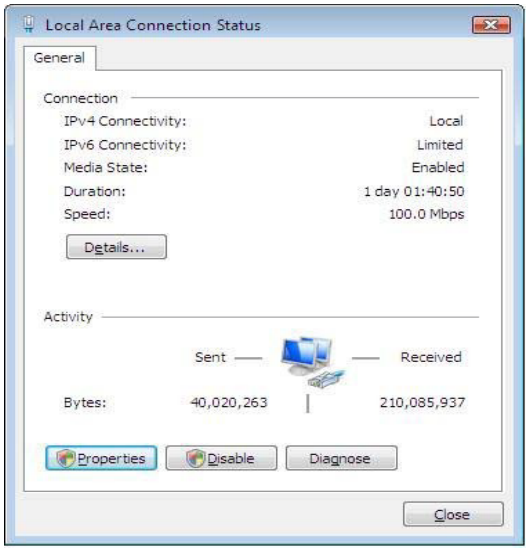
Depending on your desktop settings, you may have to access the dialogs in this procedure in a different manner. Refer to your Windows help system if you need assistance.

1. Select the **Windows icon** from the Status bar at the bottom of the screen, then select **Control Panel**.

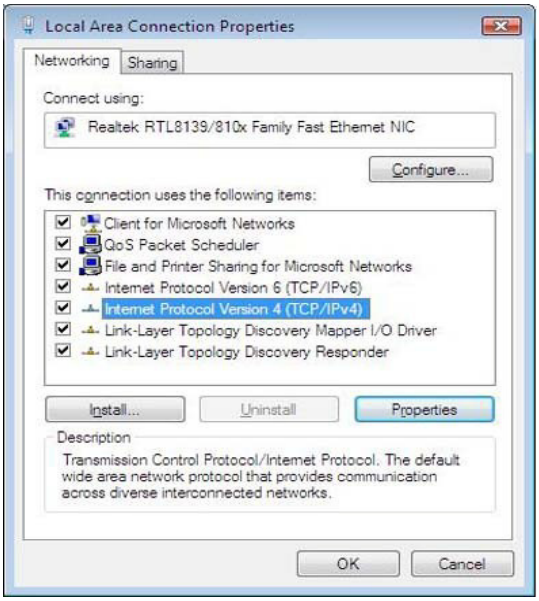
2. Double-click on **Network and Sharing Center**; a dialog similar to this one is displayed.



3. Click **Manage network connection** from the **Tasks** list on the left side of the window, then click **Local Area Connection** for your analyzer on the dialog that displays. You should see a dialog similar to this one.

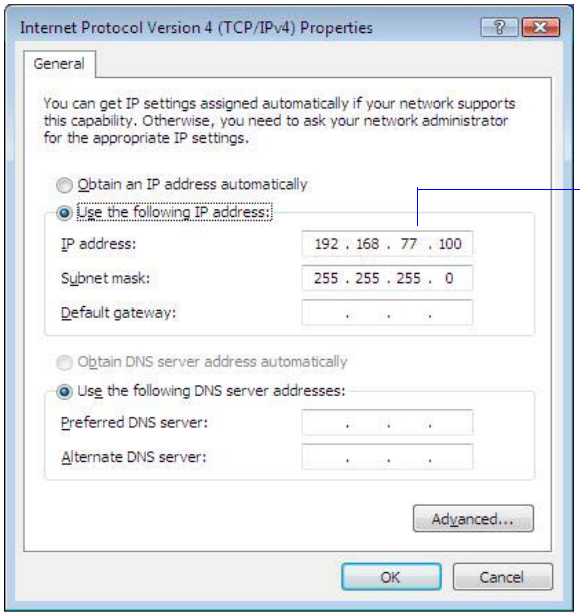


4. Click **Properties**; the Local Area Connection Properties dialog is displayed.



5. Highlight **Internet Protocol Version 4**, then click **Properties**; the Internet Protocol Version 4 Properties dialog is displayed.

6. Click **Use the following IP address**, then enter the following in the **IP address** field: **192 168 77 100**. Use the right arrow key to advance to the fourth field.



7. The following numbers should display in the **Subnet mask** field: **255.255.255.0.** If these numbers are not displayed, enter them.

8. Leave all other fields in the dialog blank.

9. Click **OK** to close the Internet Protocol Version 4 dialog.

10. Then click **OK** or the **X** in the upper right-hand corner of the remaining dialogs and windows to close them.

Configuring the Firewall Setting

An ethernet firewall typically is enabled by default for the Windows XP and Windows Vista operating systems. Windows operating systems prior to these versions did not have firewalls. To prevent an initialization failure when running the Micromeritics software, you must turn off the firewall option between your computer and the analyzer. You must also do this for any third-party firewalls you may have installed (refer to the firewall software manual or contact your system administrator for instructions).

Depending on your desktop settings, you may have to access the dialogs in this procedure in a different manner. Refer to your Windows help system if you need assistance.

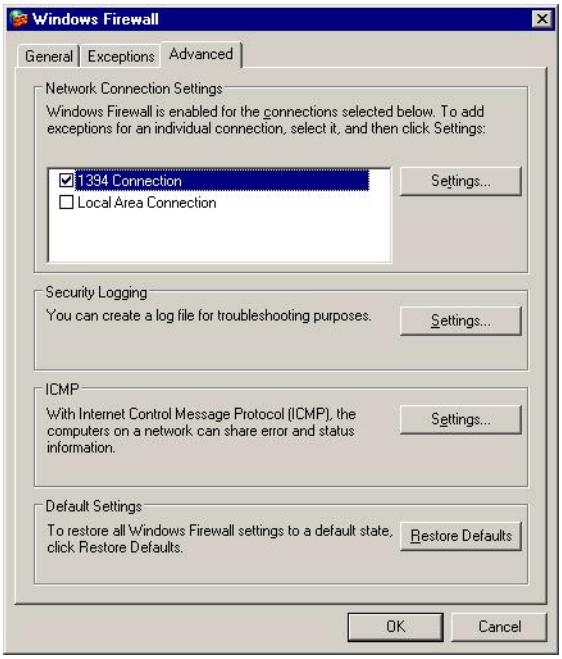
Windows XP Professional

Perform the following steps to disable the ethernet firewall for the instrument connection:

1. Select **Start > Settings > Control Panel** from the **Status** bar at the bottom of the screen; the Control Panel window is displayed.

2. Double-click the **Windows Firewall** icon; the Windows Firewall dialog is displayed.

3. Click the **Advanced** tab; a list of network connections is displayed.

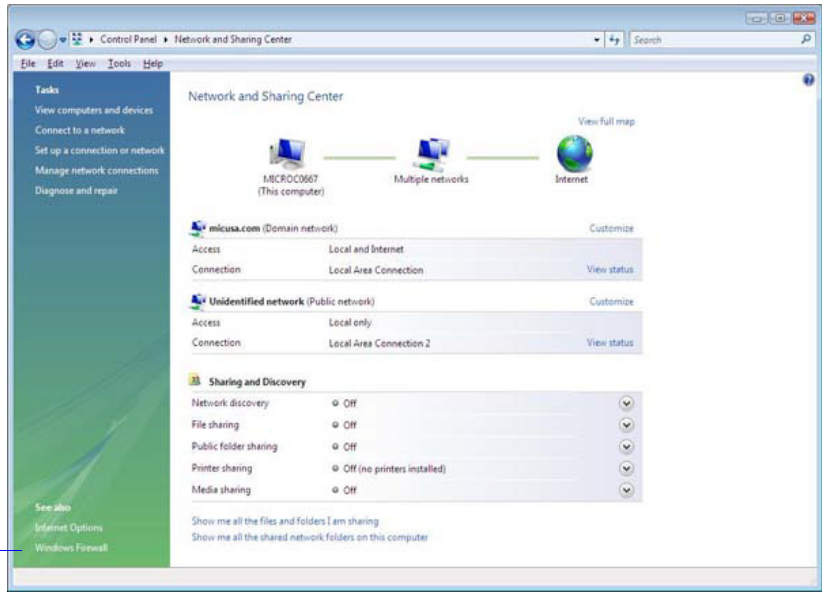


4. Click the check box next to the connection assigned to your analyzer to clear the check mark, then click **OK**.

Windows Vista

1. Select the **Windows** icon from the **Status** bar at the bottom of the screen, then select **Control Panel**.

2. Double-click on **Network and Sharing Center**.

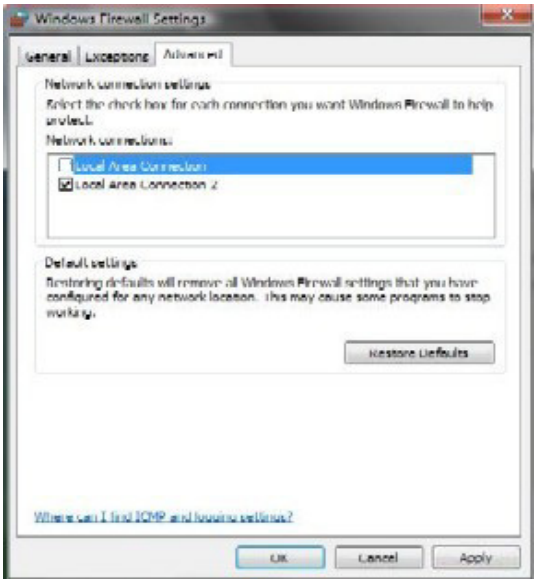


3. Double-click **Windows Firewall**; the Windows Firewall dialog is displayed.

Note that the **Windows Firewall** statement is highlighted with green, indicating the Firewall is turned on.

4. Click **Change Settings**; a dialog requesting permission to continue is displayed. Click **Continue**; the Windows Firewall Settings dialog is displayed.

5. Click the **Advanced** tab, then **OK**; a list of network connections is displayed.



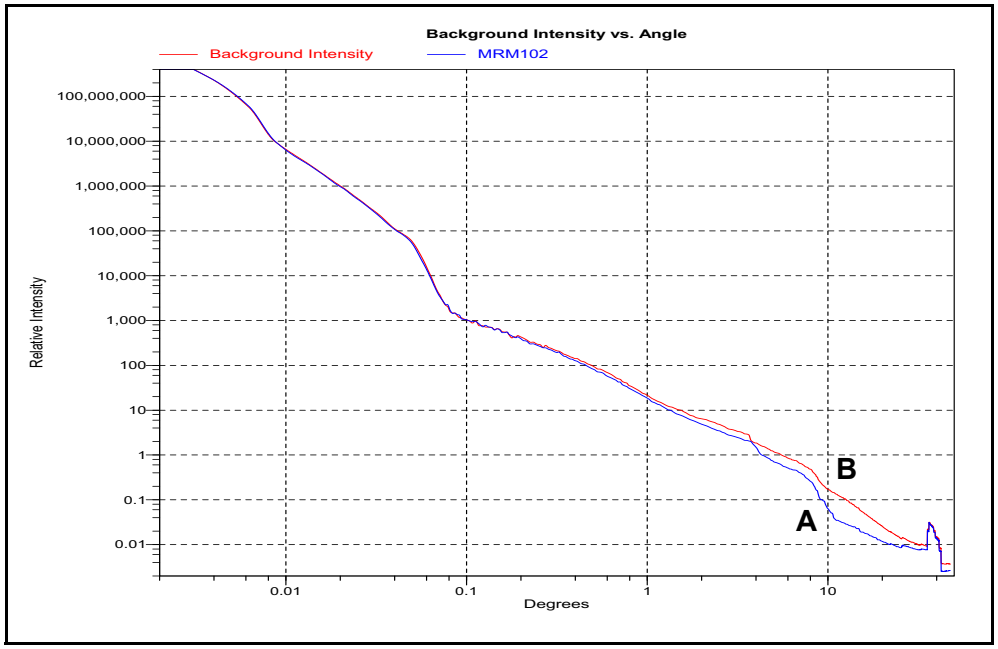
6. Click the check box next to the connection assigned to your analyzer to clear the check mark, then click **Apply.** Click **OK** to close the dialog.

7. Click the **X** in the upper right-hand corner of the remaining associated windows to close them.

I. BACKGROUND QUALITY

The results from a background measurement show intensity versus angle when no sample is present in the system to scatter light. When all of the sample has been rinsed from the system and the cell is clean (as indicated by Curve A) in the illustration shown below), the background data will show the lowest possible light intensity levels, decreasing by about 10 orders of magnitude from a maximum at 0.0025 degrees to a minimum near 48 degrees. The intensity will normally rise between 36 degrees and 44 degrees. Sharp steps at the boundaries between beam angles (e.g. at approximately four degrees) and other fine details are evident in the intensity curve. This is because unscattered, stray light is being measured, which varies discontinuously with incident beam angle.

When the system is inadequately rinsed or the cell is dirty, higher intensities are seen especially at larger angles (as indicated by Curve B). The data also appear to be smoother, showing less sharp detail. This is because contaminants are present and scattering light in a smooth, continuous fashion. These contaminants may be (1) particles (or bubbles) suspended in the liquid, (2) particles adhered to the inside of the cell, or (3) smudges, fingerprints, dust, etc. on the outside of the cell, on the detector lens, or on the collimator lens.



To aid in recognition of a dirty system, the previous background data are shown overlaid with each new set at the end of the background measurement. If the current background curve is higher than the previous, some contamination may exist. Note that some small fluctuations in intensity at large angles can occur due to slight variations in the dissolved oxygen content, or variations in the amount of surfactant in the liquid.

For your convenience and as a reference for a good background, a sample file containing background and sample data from the instrument calibration and checkout is included with your instrument calibration files. This file is named MRMxxx.SMP (where xxx = instrument serial number) and is located in the \5205\Data directory. This file shows what a background looked like when the instrument was new and clean, and provides a valuable point of reference. You may wish to select this file for overlay on the current background report.

If a contaminated background is indicated, perform 1 to 3 rinse cycles to remove any remaining suspended particles; then remeasure the background. If background data do not return to the minimum level, (1) check the analysis liquid for contaminants, or (2) try preparing a fresh batch of analysis liquid. Excess dissolved oxygen or bacterial growth may cause problems in liquid that has been allowed to stand for more than a few days. If the problem persists, drain the system and remove and clean the cell following the instructions provided in Chapter 9. Reinstall the cell and repeat the background measurement.

If frequent cell cleaning is necessary it may be that the system is not being thoroughly rinsed, or that samples are being improperly dispersed. Excessive sample adherence to the cell is an indication of inadequate dispersion.

J. MASTERTECH INSTALLATION

This appendix describes how to install the MasterTech 052 autosampler. The MasterTech 052 Autosampler allows you to queue up to 18 samples and transfer them to the Saturn DigiSizer analyzer automatically for analysis. After installation, its operation should be verified to make sure that it is operating properly before actual analyses are attempted.

Removing Packing Material from the Unit

Carefully remove the MasterTech and its components from the shipping carton. Remove all packing material and verify that all items listed on the packing list are included.

Equipment Damage or Loss During Shipment

If equipment is damaged or lost in transit, make note of the damage or loss on the freight bill. The freight carrier, not Micromeritics, is responsible for all damage or loss occurring during shipment. If you discover damage or loss of equipment during shipment, report the condition to the carrier immediately.

Equipment Return

Micromeritics strives to ensure that all items arrive safely and in working order. Occasionally, due to circumstances beyond our control, a customer may receive equipment which is not in working order. When equipment has been damaged (either during shipment or in use) and you wish to return the equipment to Micromeritics for repair or replacement, follow the steps below:

1. Pack the MasterTech in its original shipping carton if possible. If the original carton is unavailable, for a nominal fee Micromeritics can provide another carton for your use.

2. Tag or otherwise identify the defective equipment, noting the defect and, if possible, the circumstances under which the defect occurred.

3. Reference the sales order or purchase order number for the MasterTech, and provide the date the it was received.

4. Notify the Micromeritics Service Department of the defect and request shipping instructions. The Service Department will assign a Returned Materials Authorization (RMA) number. Write the RMA number on the outside of the carton.

Installing the MasterTech

Place the MasterTech on a tabletop and proceed with the following instructions.

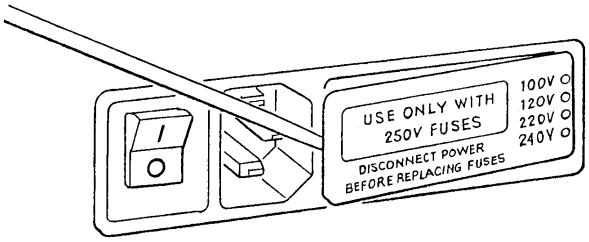
Selecting the Voltage

The MasterTech leaves the factory set for 120 VAC and with the line fuse removed. The correct setting of the universal power entrance must be checked and the appropriate fuse installed before the MasterTech can be operated. The MasterTech is designed to operate with either 100, 120, 220, or 240 VAC at 50 or 60 Hz. Voltage selection and fusing are made at the power connector which is located on the rear panel of the unit.

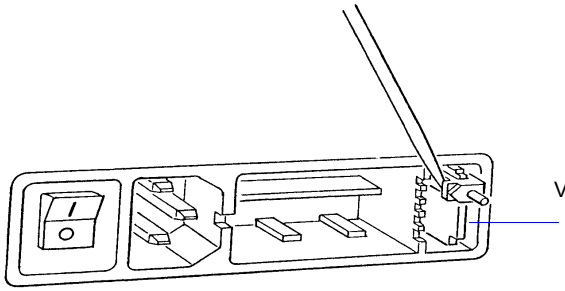
The power cord should be disconnected from the MasterTech before removing the cover from the power input connector. Failure to disconnect the power cord could result in electrical shock.

1. Make sure the power cord is disconnected from the MasterTech.

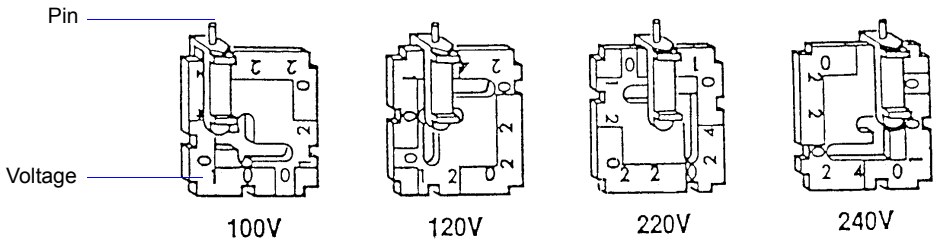
2. Using a pointed object, remove the fuse block and cover assembly from the power connector at the rear of the MasterTech.



3. Pull the voltage selector card straight out of the power connector housing.

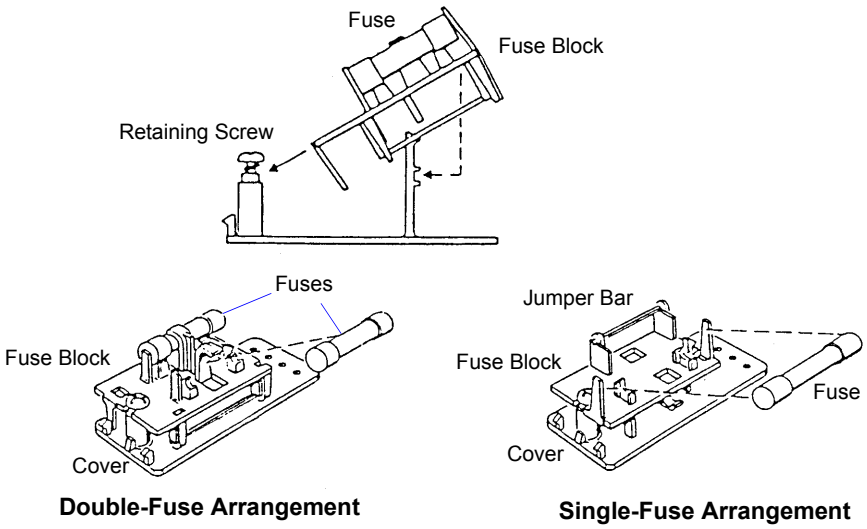


4. Orient the voltage selector card so that the desired voltage is indicated at the bottom. Orient the indicator pin so that it points upward as shown in the following illustration.



5. Insert the voltage selector card into the power connector housing with the edge containing the desired voltage first and with the printed side facing the power ON/OFF switch.

6. Fuse the input power line according to local safety practices. The input power connector can be used with either a single-fuse arrangement or a double-fuse arrangement, as shown in the following illustration.



Double-Fuse Arrangement **Single-Fuse Arrangement**

The power cord should be disconnected from the MasterTech when installing or replacing fuses. Failure to do so could result in electrical shock.

a. Observe the position of the fuse block, using the previous figure for reference. If the single-fuse arrangement is desired, position the fuse block so that the side with the single-fuse slot and the jumper bar is away from the cover.

   If the double-fuse arrangement is desired, position the fuse block so that the side with the double-fuse slots is away from the cover.

b. If the fuse block is positioned properly for the fusing desired, proceed to Step c.

   If the fuse block is not positioned properly for the fusing desired:

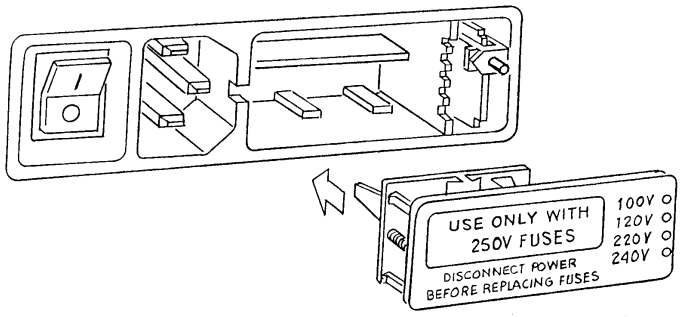
   1) Remove the fuse block retaining screw.
   2) Lift the fuse block from the cover.
   3) Rotate the fuse block.
   4) Mount the fuse block to the cover.
   5) Replace the retaining screw.

The fuses used in the MasterTech must be identical in type and rating to that specified. Use of other fuses could result in electrical shock and/or damage to the MasterTech.

c. Insert appropriate fuse(s) for the input power source. Refer to the chart below for the appropriate fuse rating.

Power Source	Fuse
100-120 VAC	3AG, 2.00 Amp Slow-Blow
200-240 VAC	5x20 mm, 1.25 Amp Slow Blow (Type T)

7. Insert fuse block and cover assembly into input power connector (as shown in the following illustration) and snap it into place. Once the fuse block and cover assembly are in place, the position of the indicator pin shows the input power selected.

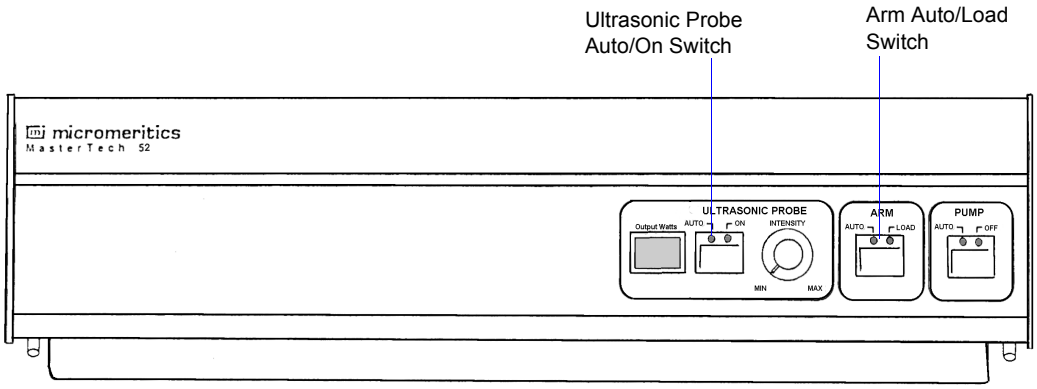


Turning on the MasterTech

1. Make sure the proper operating voltage and fuse are selected and in place.
2. Plug the power cord into an appropriate power outlet.
3. Place the POWER ON/OFF switch in the ON (|) position. The +5 and +24 LEDs on the rear panel and some of the LEDs in the front panel switches should illuminate.

The ultrasonic probe should not be turned on at this point. Observe the indicator on the ULTRASONIC PROBE AUTO/ON switch on the front panel of the MasterTech. If the ON indicator is illuminated, press the switch to turn off the probe; the AUTO indicator should illuminate.

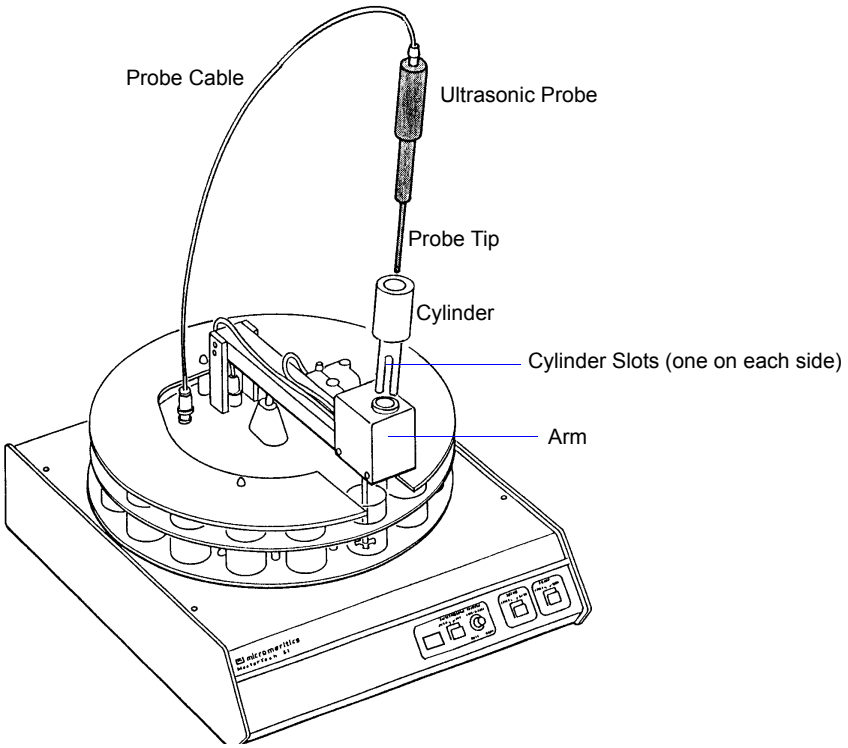
4. Press the ARM AUTO/LOAD switch on the front panel of the MasterTech. The arm should rise to the LOAD position, which is used for removal and replacement of the tray.



Installing the Ultrasonic Probe

Make sure that power is not being supplied to the unit before starting this procedure.

1. Place the POWER switch on the rear panel of the MasterTech in the OFF (O) position.
2. Attach the probe cable to the connector labeled **Ultrasonic Probe**.



3. Ensure that the probe tip is attached to the probe; if not, attach it before proceeding. A 1/4-in. probe tip is supplied with the MasterTech; a 1/8-in. tip is also available (refer to **Ordering Information**).
4. Insert the cylinder into the arm, positioning it so that the longer slots slide over the protrusions inside the arm.

Position the shorter slots of the cylinder over the protrusions if you are using the 1/8-in. probe.

5. Insert the probe into the cylinder.

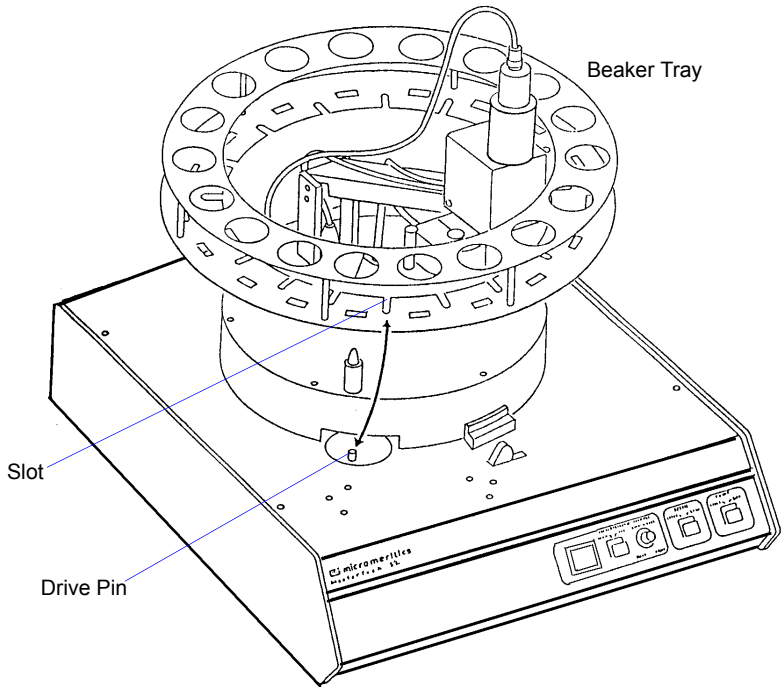
Installing the Beaker Tray

1. Place the POWER switch in the ON position.

2. Make sure the arm of the MasterTech is in the LOAD (uppermost) position; the LOAD LED will be illuminated. If the LED is not illuminated, press the ARM AUTO/LOAD switch.

3. Hold the tray firmly by the outside edge. Notice that the bottom of the tray has small slots positioned radially outward from the inside edge. Place the tray on the MasterTech so that the arm passes through the center opening of the tray.

4. Make sure the drive pin is lined up into a radial slot on the bottom of the tray. The position of the tray does not matter at this point.



Installing Sample Transfer Tubing

This section contains one set of instructions for installing the sample transfer tubing in a MasterTech with serial number 500 or below, and one set of instructitons for a MasterTech with serial number 501 or above. Follow the instructions for your unit.

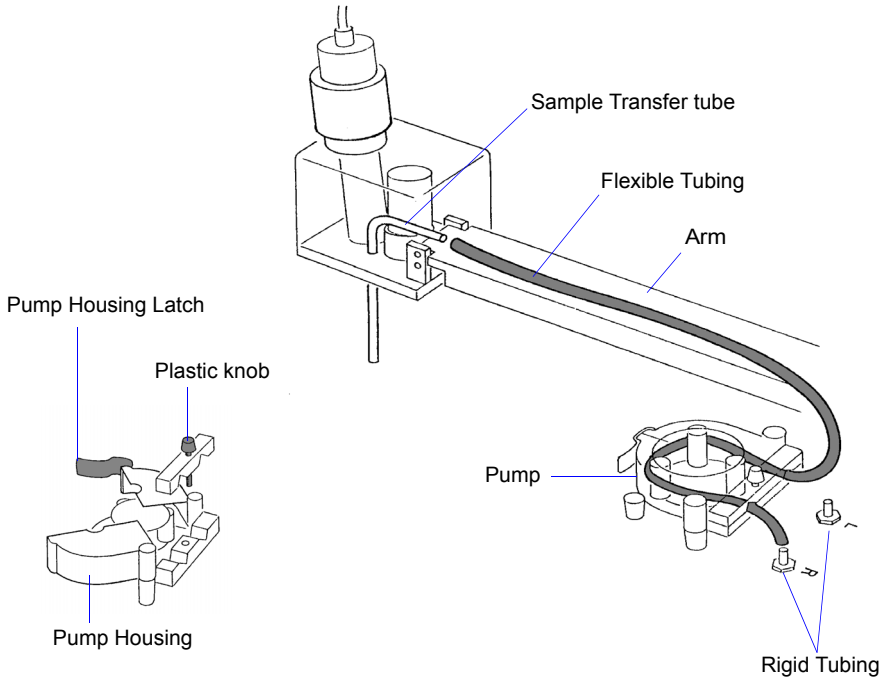
MasterTech with Serial Number 500 or Below

The MasterTech accessories kit contains two pieces of flexible tubing. One piece of tubing is for installation inside the MasterTech arm. The other piece of tubing is installed inside the liquid sample handler, allowing for connection to the MasterTech.

1. Ensure that the MasterTech POWER switch is in the ON position.

2. Make sure the arm is in the LOAD (uppermost) position; the LOAD LED is illuminated. If the LED is not illuminated, press the ARM AUTO/LOAD switch.

3. Press the end of one segment of flexible tubing over the sample transfer tube until there is at least 1/2-in. overlap.



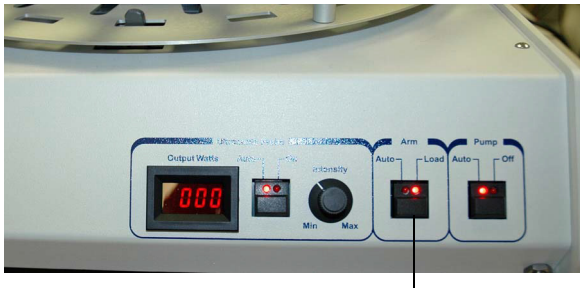
4. Unlatch the pump housing and unscrew the plastic knob on the rear of the pump.

5. Thread the tubing through the pump as shown above and attach it to the rigid tubing labeled **L** (left) or **R** (right). Choose the side that will be adjacent to the liquid sample handler; for example, choose the left (**L**) rigid tubing if the MasterTech is to be placed to the right of the liquid sampler handler.

6. Close and latch the housing. Tighten the plastic knob on the rear of the pump sufficiently to prevent tubing slippage but not enough to restrict flow through the tubing.

MasterTech with Serial Number 501 or Above

1. Make sure that the arm is in the Load (uppermost) position. When the arm is in the Load position, the Load LED is illuminated. If the LED is not illuminated, press the ARM AUTO/LOAD switch.

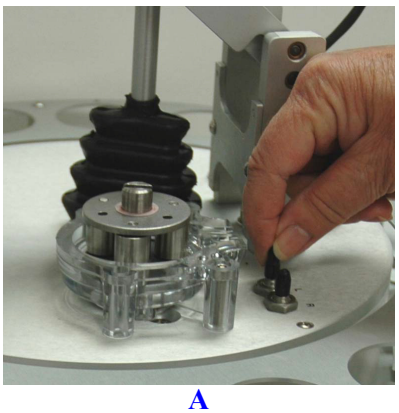


2. Unscrew the two thrumbscrews from the cover of the pump housing, then remove the cover.

A

B

3. A 21-in. segment of flexible tubing is shipped with the MasterTech. Remove the cover from one of the steel tubes labeled **L** (Left) or **R** (Right). Choose the steel tube labeled with the side of the MasterTech from which you want the fluid to be discharged. Then attach one end of the flexible tubing to the steel tube.

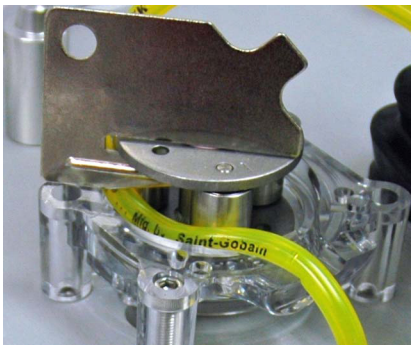


A

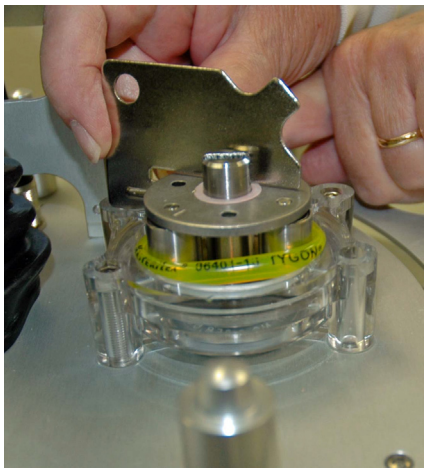
B

4. Loop the tubing around the pump rollers in a clockwise direction, using one hand to hold the two ends of the tubing loop in the two grooves at the base of the pump.

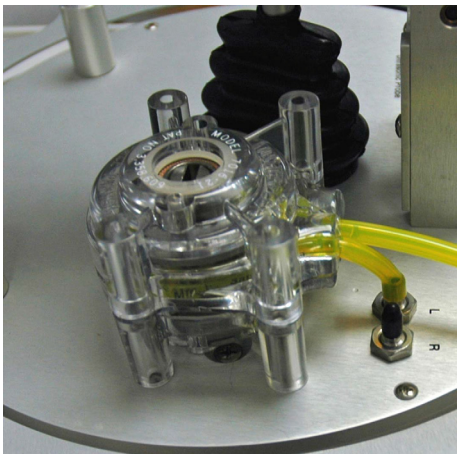
5. Insert the key between the pump rollers near the left side of the pump base, with the key blade between the tubing and the plate on the top of the rollers.



6. Turn the key clockwise so the tubing presses into the groove until the key is stopped by the peg in the right side of the pump body.



7. Slide the key out, then place the cover over the pump, wiggling it slightly to align it with the pump body and press it into place. Then insert and tighten the two thumbscrews only tight enough to secure the cover.



A

B

8. Attach the other end of the flexible tubing to the Sample Transfer tube on the front of the MasterTech as shown below.

9. With the instrument schematic displayed, enable Manual Mode. Right-click the **MasterTech Pump** icon and select **Turn On**.

10. The pump should begin operating. If the pump does not start or is sluggish, pull on the long end of the tubing to create tension and pull excess tubing out of the pump, no more

than 1/4-in. should be required. (Loosen the thumbscrews if necessary.) When the pump is operating freely, hand-tighten the two thumbscrews, then turn the pump off.

11. Press the ARM AUTO/LOAD switch to place the arm in the AUTO position.

Connecting to Liquid Sample Handler

The following steps are common to both liquid sample handlers. After performing these steps, advance to the section applicable to the liquid sample handler you have connected to your analyzer.

1. Select **Unit [n] > Drain > DigiSizer** to remove any liquid that may be in the liquid sample handler.

2. Turn off the liquid sampler and the analyzer.

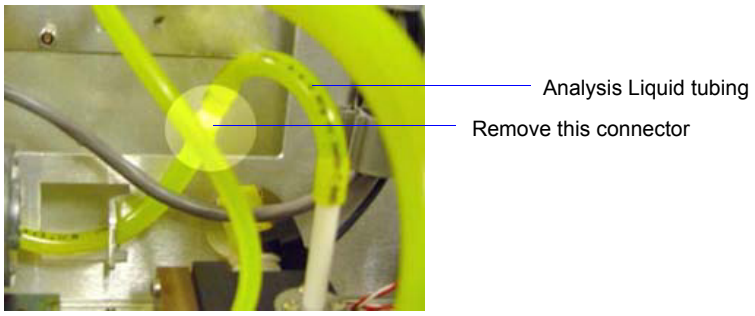
3. Remove the retaining screws on the right side of the liquid sample handler, then loosen the captive thumb screw on the rear panel.

4. Lift off the cover and set aside.

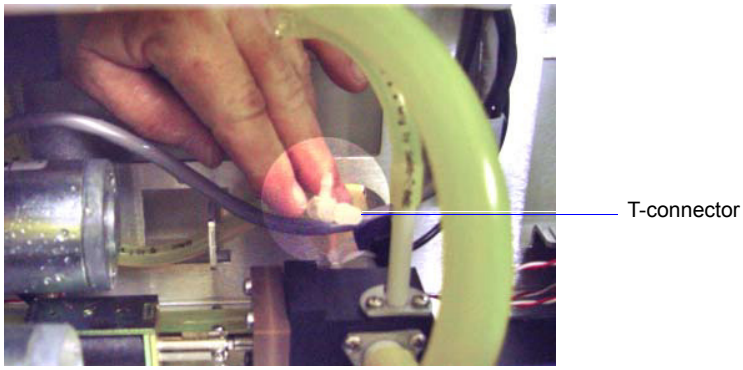
Standard Liquid Sample Handler

1. Locate the analysis liquid inlet tubing on the inside of the liquid sample handler.

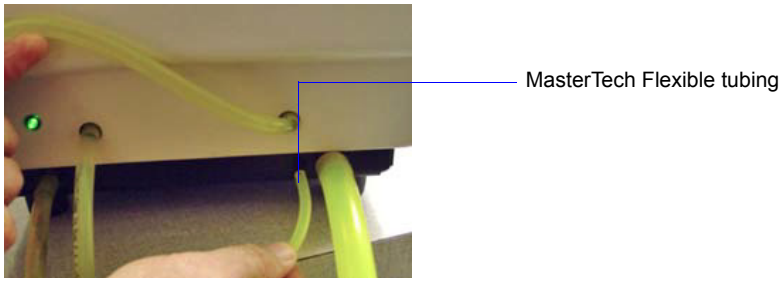
2. The analysis tubing has a connector approximately two inches from the inlet fitting; remove this connector.



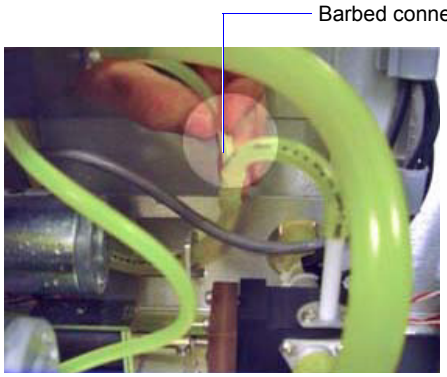
3. Using the T-connector supplied in the MasterTech accessories kit, reconnect the tubing using the two larger ends of the T-connector.



4. Insert the remaining piece of flexible tubing through the hole provided on the base of the sample handler.



5. Guide the tubing through the hole in the front chassis (just below the rinse pump) and connect it to the remaining barbed fitting of the T-connector.



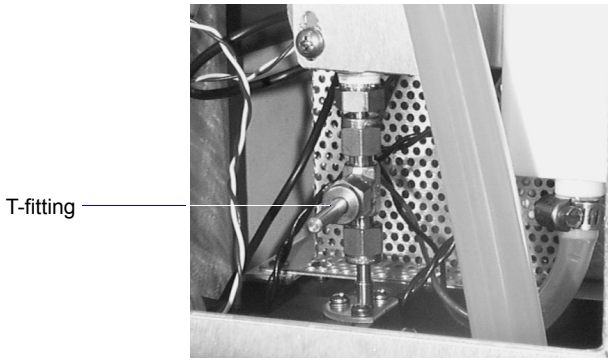
6. Install the other end of the flexible tubing onto the sample transfer tubing connector on the side chosen in **Step 5** of **Installing Sample Transfer Tubing**.

Make sure the side to which you connect the flexible tubing coincides with the one chosen in the arm of the MasterTech.

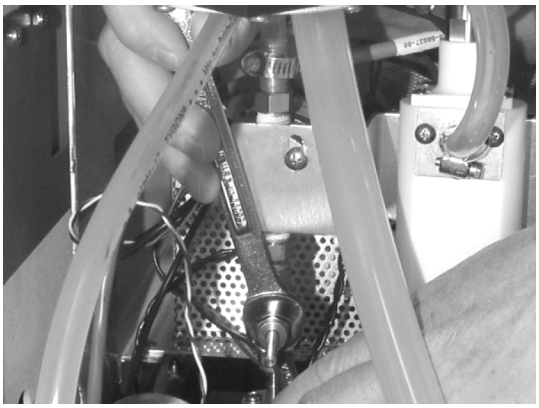
7. Replace the cover of the liquid sample handler. Replace the retaining screws on the right side of the unit and retighten the thumb screw on the rear panel.

Low-Volume Liquid Sample Handler

1. Locate the T-fitting of the stainless steel tubing of the drain manifold.



2. Use the 7/16- and the 1/2-in. wrenches provided in the accessories kit for this step. Hold the T-fitting secure with the 7/16-in. wrench, then use the 1/2-in. wrench to loosen and remove the topmost nut.



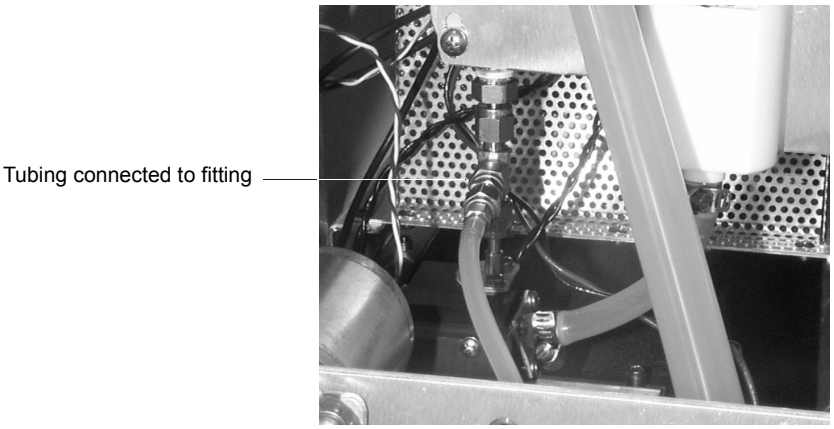
3. Remove the stainless steel plug from the nut. Be sure to store the plug in a secure location. If the MasterTech is disconnected, this plug will need to be reinstalled in the liquid sample handler.

4. Insert the stainless steel connector into the nut (the barbed end should be on the outside).

5. Reattach the nut to the T-fitting; tighten finger-tight. Then, using the two wrenches as shown above, tighten the nut 1/4 turn.

6. Insert one end of the flexible tubing (provided in the accessories kit) through the hole provided on the base of the sample handler.

7. Guide the tubing through the hole in the front chassis and connect it to the barbed fitting of the T-connector.



8. Install the other end of the flexible tubing onto the sample transfer tubing connector on the side chosen in **Step 5** of **Installing Sample Transfer Tubing**.

Make sure the side to which you connect the flexible tubing coincides with the one chosen in the arm of the MasterTech.

9. Replace the cover of the liquid sample handler. Replace the retaining screws on the right side of the unit and retighten the thumb screw on the rear panel.

Connecting Cables

1. Place the MasterTech to the appropriate side (the side designated when installing the sample transfer tubing) of the liquid sample handler.

2. Make sure the power switches on the ultrasonic probe (if installed), analyzer, liquid sample handler, and MasterTech are in the OFF positions.

3. Insert one end of the serial cable into the connector labeled **RS-232 Spare** on the rear panel of the Liquid sample handler.

4. Insert the other end of the cable into the connector labeled **RS232** on the back of the MasterTech.

Verifying Operation

To verify operation, manually move each subsystem using the manual control option of the Saturn DigiSizer analysis program.

1. Turn on the Saturn DigiSizer system components in the following order:

   a. Ultrasonic probe (if installed)

   b. MasterTech autosampler; allow MasterTech to initialize before turning on the liquid sample handler

   c. Liquid sample handler

   d. Saturn DigiSizer

2. Start the Saturn DigiSizer software; initialization may take a few minutes.

3. Fill a beaker with approximately 80 mL of water.

4. Place the beaker in the number **1** position of the tray.

5. To test the ultrasonic probe, remove it from the holder and insert the tip of the probe well into the water.

NEVER operate the ultrasonic probe without having the tip immersed into a liquid. Doing so may harm the probe and/or the driving electronics.

DO NOT let the tip of the probe come in contact with a glass beaker. Doing so may shatter the beaker.

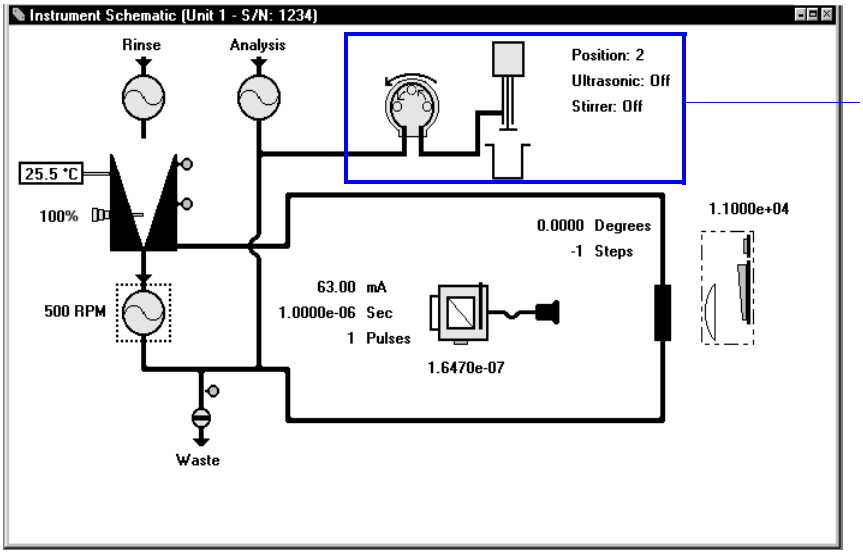
6. While holding the probe tip underwater, press the ultrasonic probe AUTO/ON switch. You will hear a high-pitched sound, indicating that the probe is working properly.

DO NOT press the ultrasonic probe AUTO/ON switch unless the probe and its cable are properly connected to the MasterTech. Doing so may harm the driving electronics.

7. Press the ultrasonic probe AUTO/ON switch again to turn off the probe.

8. Place the probe back into the holder.

9. Select **Unit [n] > Enable Manual Control**. If the instrument schematic is not displayed, select **Show Instrument Schematic**.



10. Ensure that the Arm AUTO/LOAD switch on the front panel of the MasterTech is in the AUTO position.

11. Select **Unit [n] > Initialize MasterTech**.

    A message is displayed indicating that initialization is in progress. The tray on the MasterTech rotates in a counterclockwise direction for one beaker position; the arm lowers to the Rinse position and returns.

    The tray then continues to rotate until position 1 is reached. The beaker inserted in the tray in Step 4 should now be directly under the arm of the MasterTech. Make sure the beaker contains approximately 80 mL of water.

12. On the instrument schematic, select the symbol representing the MasterTech arm.

When manual mode is enabled, components on the instrument schematic have shortcut menus displaying the options available for that component. Select the component, then click the right mouse button to access its menu.

In each instruction for this step, first access the pop-up menu:

a. Select **Move Arm Down** two times.

b. Select **Ultrasonic On**; you will hear a high-pitched sound, indicating that the probe is operational.

c. Select **Ultrasonic Off** to turn off the probe.

d. Select **Stirrer On**; the stirrer begins to operate.

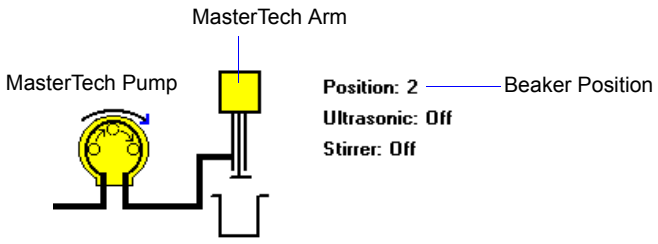
e. Select **Stirrer Speed Fast**.

f. Select **Move Arm Up**.

g. Select **Stirrer Off**.

h. Select **Move Arm Up**.

i. Select **Move To Beaker** and enter the beaker position; note that the display is updated to reflect the position of the beaker tray. The picture on the screen will reflect whether or not a beaker is present.



13. Place the MasterTech pump switch on the front panel in the **AUTO** position, then select the MasterTech pump on the schematic. In each instruction in this step, first access the shortcut menu:

    a. Select **On**; the MasterTech pump should begin operating (you will hear a whirring sound and the pump will begin to operate).

    b. Check the direction of the flow of the MasterTech pump:

    Select **Flow Direction Load**; allows suspension to flow from the MasterTech to the Saturn DigiSizer system for analysis.

    Select **Flow Direction Rinse**; allows suspension to move from the Saturn DigiSizer system to the MasterTech. This direction is used to rinse the sample from the stirrer and transfer tube on the MasterTech.

    c. Select **Off** to turn the pump off.

14. Rinse and prime the tubing of the MasterTech:

    a. Place an empty beaker in position **2** of the MasterTech tray.

    b. Select **Unit [n] > Rinse > MasterTech then DigiSizer**.

    c. Specify 2 as the beaker position, then click **OK**.

This concludes verification of operation of the MasterTech. If everything performed as described above, the system should be fully operational. If you encounter any problems, refer to the troubleshooting section of the operator's manual.

K. LIQUID SAMPLE HANDLER INSTALLATION

This appendix describes how to install liquid sample handlers in the event you wish to use both types available, the standard one or the low-volume one. These instructions are written with the assumption that a liquid sample handler is currently attached to the DigiSizer.

Disconnecting the Current Liquid Sample Handler

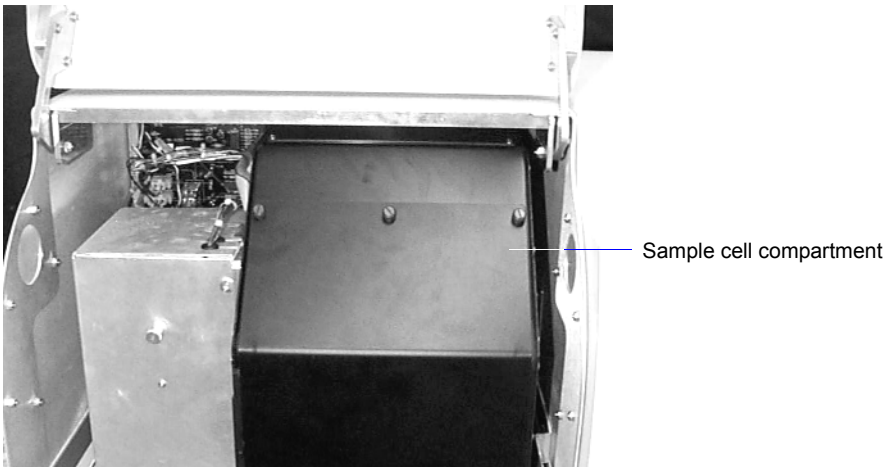
The following steps are common to both liquid sample handlers.

1. Select **Unit [n] > Drain > DigiSizer** to remove any liquid that may be in the liquid sample handler.

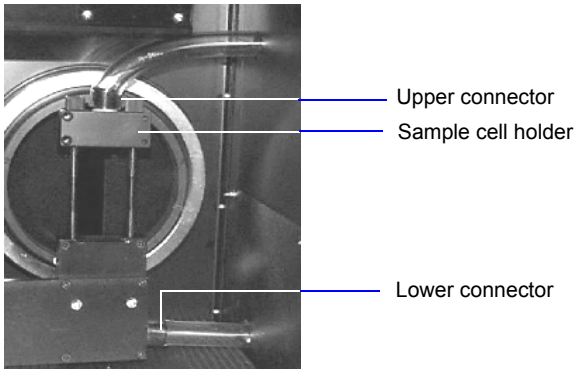
2. Turn off the liquid sample handler and the analyzer.

3. Open the front panel of the analyzer.

4. Loosen all three screws on the cover of the sample cell compartment; remove the cover and set aside.



5. Disconnect the sample transfer tubing from the upper and lower connectors of the sample cell holder.



6. Grasp the liquid sample handler and slowly pull it away from the DigiSizer; store in an appropriate location.

Installing the Liquid Sample Handler

The Liquid Sample Handler is available in two configurations:

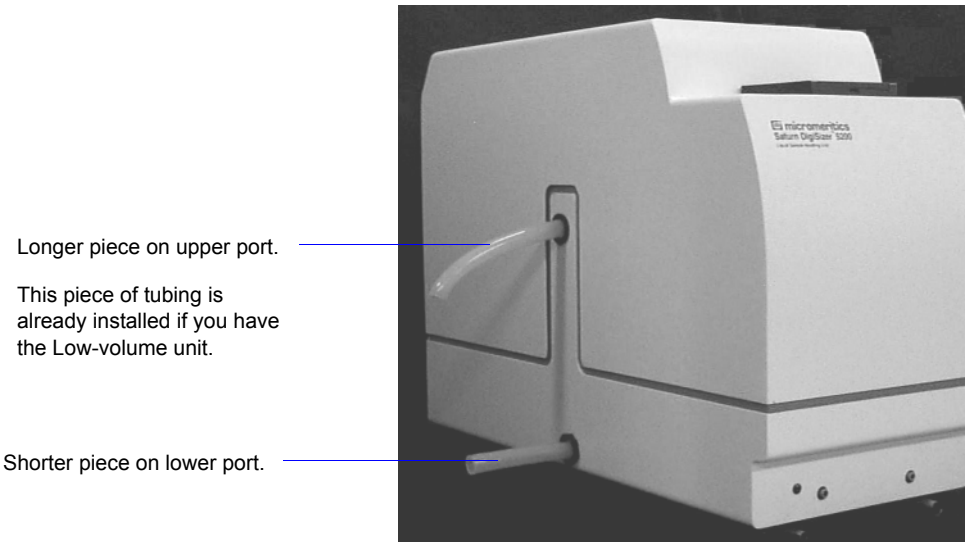
- **Standard unit**: includes a reservoir that holds 500 to 600 mL of dispersed sample. This model is best suited for samples containing coarse particles, or for those of high density.
- **Low-Volume unit**: includes a reservoir that holds 100 to 120 mL of dispersed sample. This model is best suited for analyses where the sample quantity or dispersion liquid is limited, or where the dispersion liquid may be hazardous or difficult to dispose.

The liquid sample handler transfers the sample to the analyzer for analysis. Precut tubing is provided for this purpose; if you are installing the:

- Standard unit, the tubing is 1.27-cm (1/2-in.) diameter (2 pieces)
- Low-volume unit, the tubing is 0.79-cm (5/16-in.) diameter (1 piece)

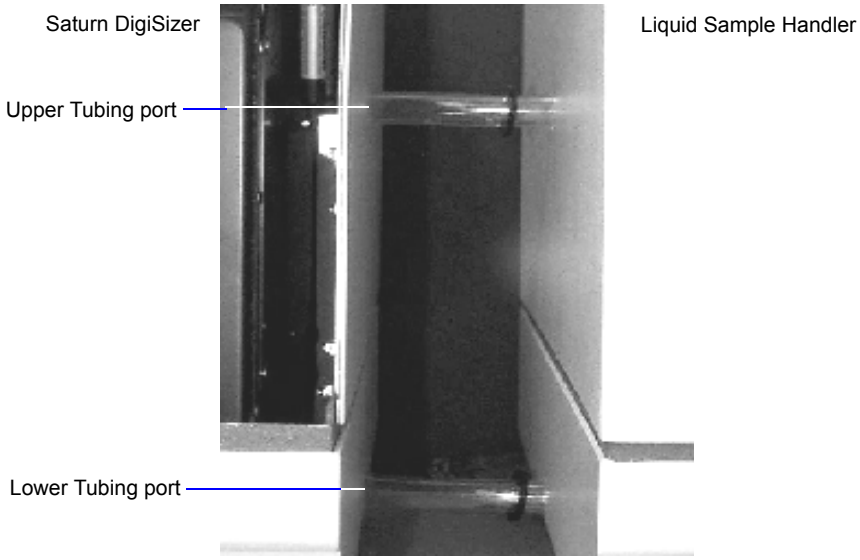
Both configurations are installed similarly; differences are noted.

1. Place the liquid sample handler in position next to the analyzer.
2. Remove the two plugs from the ports on the side of the sample handler.
   - If you are installing the Low-volume unit, the tubing on the upper port is installed; remove the plug from the end of the tubing.
3. Install the tubing onto the connectors provided on the left side of the liquid sample handler. One piece of tubing is approximately 2 inches longer than the other; install this piece on the upper connector and the shorter one on the lower connector.



- If you are installing the Low-volume unit, the tubing on the upper port is installed; install the tubing supplied with the unit on the lower port.

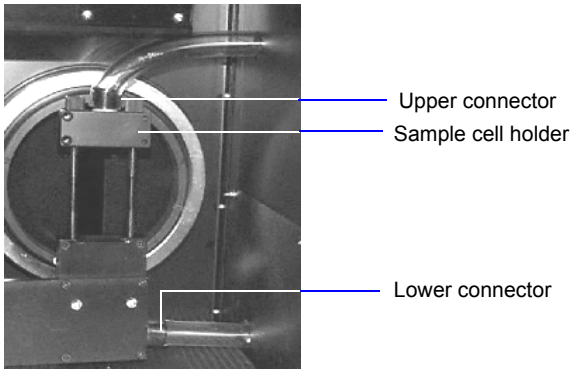
4. Slide the liquid sample handler toward the analyzer, guiding the tubing through the ports on the right side of the analyzer.



Do not allow the analyzer and liquid sample handler to touch; metal-to-metal contact may cause vibrations and, thus, inaccurate data.

5. Open the front panel of the analyzer (if not still open).

6. Attach the sample transfer tubing to the sample cell holder as shown below.



7. Attach the RS232 communications cable as follows:

   a. Connect one end of the cable to the port labeled **RS232 From Saturn Analyzer** on the rear panel of the liquid sample handling unit.

   b. Connect the other end of the cable to the port labeled **Sample Handling Unit RS232** on the rear panel of the analyzer.

8. Plug the liquid sample handler's power cord into an appropriate power source. The liquid sample handler is equipped with universal power input; therefore, voltage selection is unnecessary.

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