# mi micromeritics®

# Saturn DigiSizer® II 5205 Confirm

## Operator's Manual

## Rev G

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**4356 Communications Drive    ●    Norcross, GA 30093-2901    ●    Fax (770) 662-3696**

Domestic Sales - (770) 662-3636                                      Domestic Repair Service - (770) 662-3666
International Sales - (770) 662-3660                                   Customer Service - (770) 662-3636

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# 1.  GENERAL INFORMATION

This manual provides a description of the Saturn DigiSizer system, as well as the menu options and functions available. This manual covers operations for a Developer and an Analyst. A Developer has authority to perform all functions provided on the main menu bar. An Analyst is restricted to certain operations.

To help you operate the DigiSizer analyzer 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 divided 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 for the operations performed with the Saturn DigiSizer.

**Chapter 4**  |  **FILE MENU**

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

**Chapter 5**  |  **UNIT MENU**

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

**Chapter 6**  |  **REPORTS MENU**

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

**Chapter 7**          **OPTIONS MENU**

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


**Chapter 8**          **TROUBLESHOOTING AND MAINTENANCE**

Provides user maintenance and service information.


**Chapter 9**          **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 a cause and action 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**     **BACKGROUND QUALITY**

Provides criteria for obtaining and determining an acceptable background.

**Appendix I**     **MASTERTECH INSTALLATION**

Provides instructions for installing the MasterTech autosampler.

**Appendix J**     **LIQUID SAMPLE HANDLER INSTALLATION**

Provides instructions for uninstalling and installing a liquid sample handler.

**Index**     **INDEX**

Provides quick access to a subject matter.

## 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 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.

## 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.

## Windows Interface

The Saturn DigiSizer Confirm program is designed to operate in a Windows environment and contains the security features required to assist you in meeting CFR Part 11 compliance. Its intuitive user interface makes operation of the DigiSizer easy and the Windows interface allows you to run other applications while an automatic operation is in progress.

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 **6-20** for available options.

To make it easier for you to obtain information, an electronic copy of the operator's  manual is included on the Help menu. This enables you to access the desired information in just a couple of mouse clicks.

# 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<br>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);<br>2 to 12 L/min (Low-volume sample handler) |
| Circulation system volume: | 590 to 690 mL (Standard sample handler);<br>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% <br> 1 to 1000 μm, 3% |
| Resolution: | 0.1 to 1 μm, not applicable <br> 1 to 10 μm, can resolve monosized particles separated by 20% in size <br> 10 to 1000 μm, 30% in size |
| Repeatability: | 0.1 to 1 μm, 3% <br> 1 to 1000 μm, 1% (mean diameter for multiple analyses on the same instrument) |
| Reproducibility: | 0.1 to 1 μm, 5% <br> 1 to 100 μm, 2% <br> 100 to 1000 μm, 5% (particle size distribution, instrument to instrument) |
| **Electrical** | |
| Voltage <br>     Saturn DigiSizer: <br>     Sample Handler: | <br> 100/120, 220/240 VAC <br> 85 to 264 VAC |
| Frequency: | 47 to 63 Hz |
| Power <br>     Saturn DigiSizer: <br>     Sample Handler: | <br> 150 VA <br> 100 VA |

| Characteristic | Specification |
|---|---|
| **Environment** | |
| Temperature: | Ambient + 10 to 35 ºC, operating;<br>-10 to 55 ºC, storing or shipping |
| Humidity: | Up to 90% (non-condensing) |
| **Physical** | |
| Saturn DigiSizer: | Height: 50 cm (19.7 in.)<br>Width:  47 cm (18.5 in.)<br>Depth:  65 cm (25.6 in.)<br>Weight: 45 kg (99 lbs) |
| Sample Handler: | Height: 50 cm (19.7 in.)<br>Width:  27.5 cm (10.8 in.)<br>Depth:  65 cm (25.6 in.)<br>Weight: 26 kg (57 lbs) |
| ——— **COMPUTER** ——— | |
| Minimum requirements: | Computer capable of running Windows XP<br>     Professional or Windows 7 operating system<br>512 megabytes of main memory<br>20-gigabytes hard drive<br>CD-ROM drive<br>Ethernet port* (capable of communicating with a<br>     10 base-T or 100-TX card)<br>1024 x 768 monitor display capability<br><br>*An additional Ethernet port is required if the<br> 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

The Saturn DigiSizer Confirm software is accessed by three different levels of users:

- **Administrator**: installs and maintains software and updates, establishes user accounts and rights (the Administrator responsibilities are covered in a separate manual)

- **Developer**: has access to all functions of the software. The Developer's primary function is to create templates for the Analyst.

- **Analyst**: Creates sample files from predefined templates; some fields, such as Mass and Density, are enabled and can be edited. The Analyst is also allowed to perform other tasks as designated throughout this manual. Tasks not allowed are disabled.

This manual is written for the Developer and Analyst levels of the Saturn DigiSizer Confirm software. Functions for the Administrator level are covered in the Administrator Utility User's Guide.

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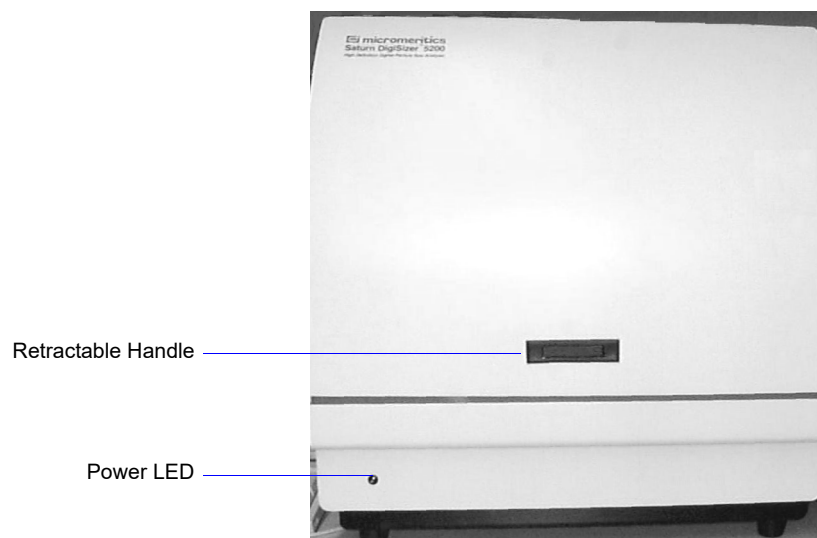
**Power LED**                     Illuminates when the analyzer has been turned on and the analysis program loaded. This LED will flash on and off until the program is completely loaded and ready for operation.

**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
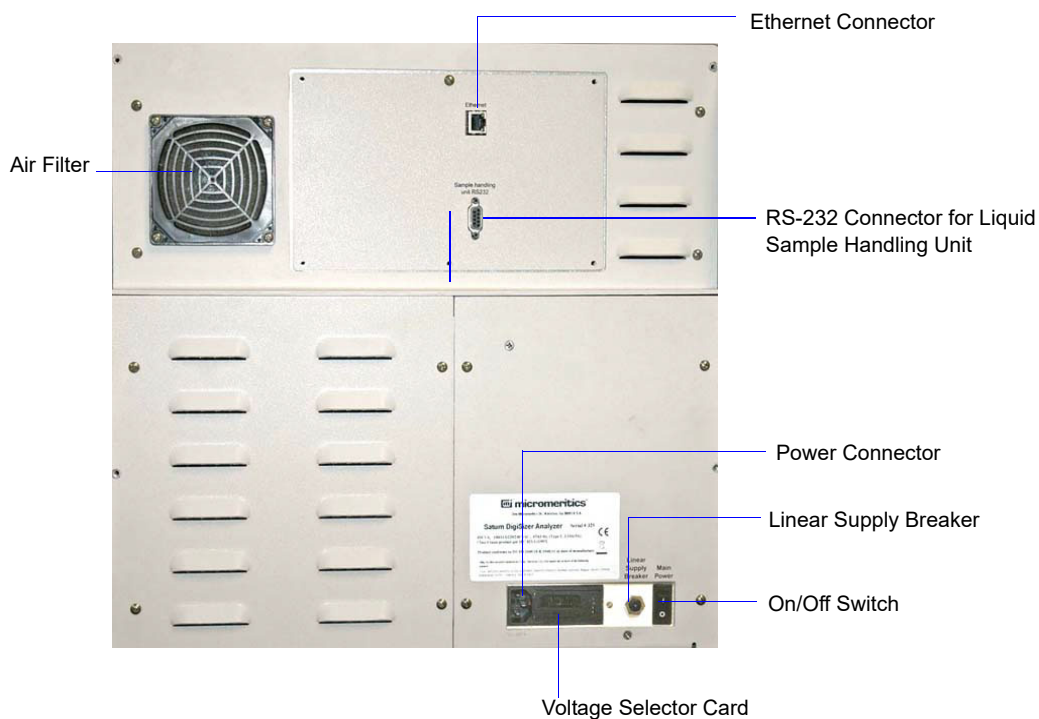


**Air filter**                    Minimizes the buildup of dust within the analyzer.

**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
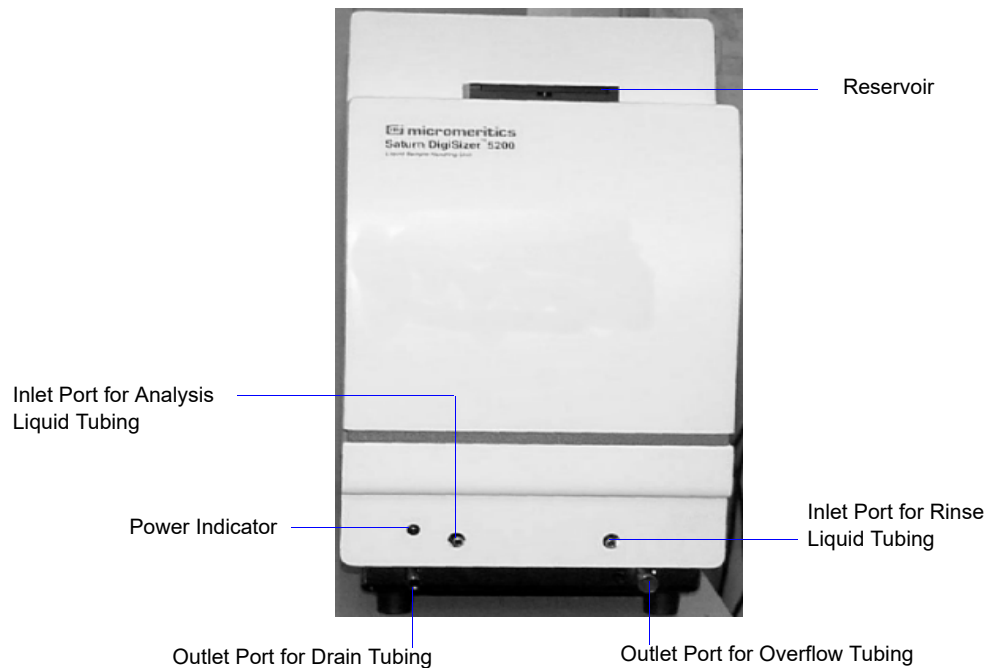


| | | |
|---|---|---|
| **Reservoir** | The compartment into which the sample is placed for transfer to the DigiSizer analyzer for analysis. | |
| **Power indicator** | Illuminated when liquid sample handler is turned on. | |
| **Ports** | For tubing as indicated above. | |

### 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
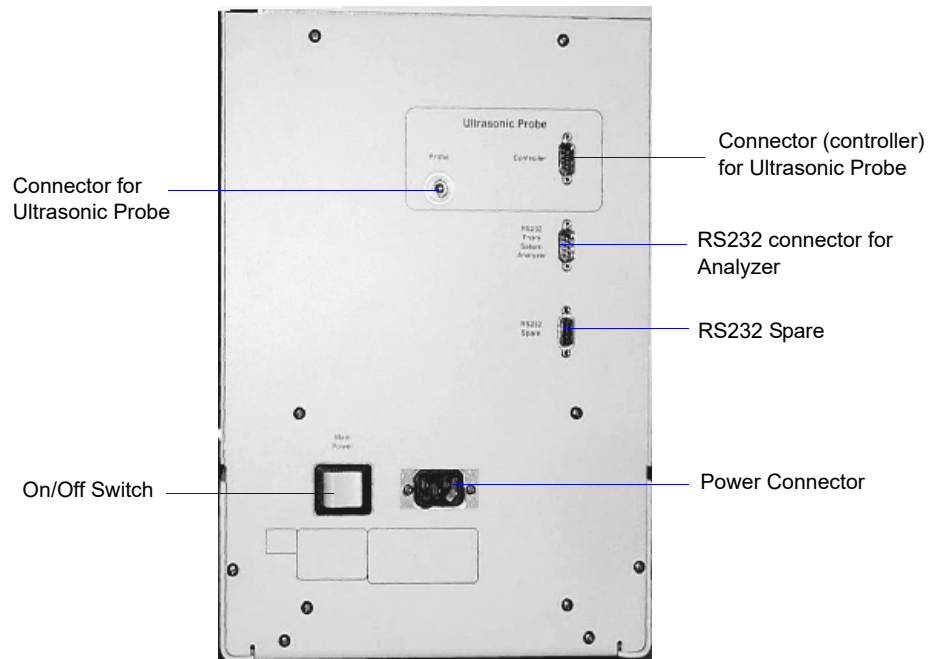


| | |
|---|---|
| **On/Off switch** | Turns electrical power on and off to the liquid sample handler. The left ( | ) position turns on the unit and the right (O) position turns off the unit. |
| **Power connector** | Supplies electrical power to the liquid sample handler. |
| **Controller** | Allows 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

Intensity control

Power Display

Pump Auto/Off Switch

**mi micromeritics**
MasterTech 52
*Autosampler*

Ultrasonic Probe Auto/On Switch      Arm Auto/Load Switch

Discharge tube connector (one on each side)
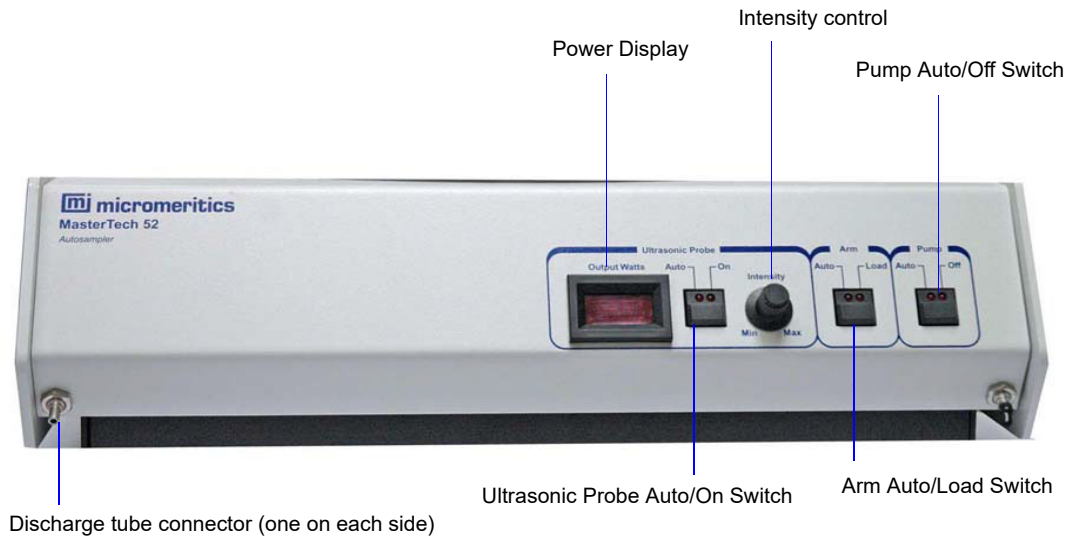
| | |
|---|---|
| **ULTRASONIC PROBE AUTO/ON switch** | LEDs on the switch indicate the mode of operation. |
| | The **AUTO** position places the probe under automatic control. |
| | The **ON** position turns on the probe. Remove the probe from its holder and place it in the liquid before turning on 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.

**Rear Panel**
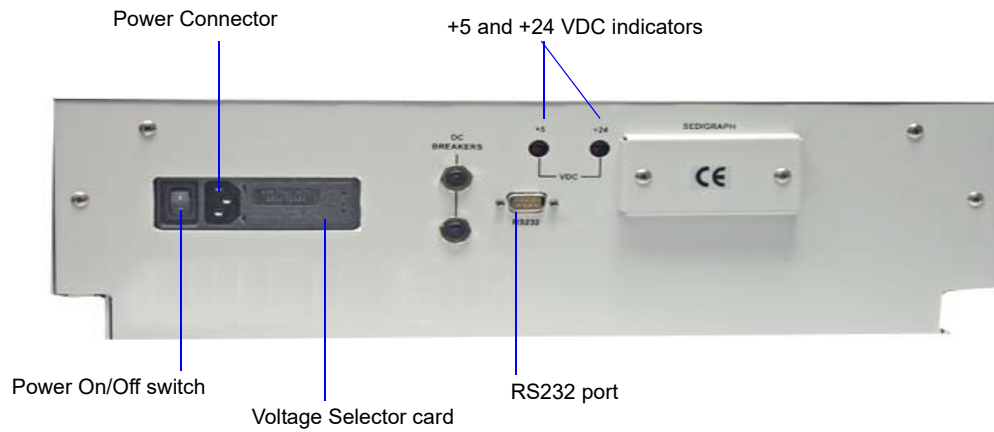


POWER ON/OFF switch     Turns the MasterTech on ( | ) and off (O).

Power connector         Supplies electrical power to the MasterTech.

Voltage selector card   Allows you to specify the proper operating voltage.

+5 and +24 VDC          Illuminate when appropriate power is present in the
indicators              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 data. Continue with program exit?**

   **Yes**                          **No**

   If you click **Yes**, the analysis program will close. However, the analysis and data collection continue and the reports queued in the Print Manager will print. If, however, 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.**

   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 Digi-Sizer 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 **8-4** 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 Saturn DigiSizer confirm program operates in the Windows environment and 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.

## Logging In

Each user — Administrator, Developer, or Analyst — is required to enter a user name and password when opening the application. Initially, the Administrator establishes passwords for the Developer and Analyst(s) when the software is installed. These passwords are temporary and are used for initial log-in; at that time, each user is prompted to specify a password that only he/she knows.

Your password must consist of at least six characters and will expire after a specified time (designated by the Administrator). You will be locked out of the application if you fail to enter the correct password after three (default) tries. This number can be changed by your Administrator. The Administrator is also required to unlock the application in the event it becomes locked after failure to enter the correct password.

## 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 want 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.

```
Resize column
Rename column

Move column          ▶
Align column         ▶

Hide column          ▶
Show column          ▶

Column font
Header font

Edit title...

Copy table as text
```

## Shortcut Keys

Shortcut keys can be used to activate some menu commands. Shortcut-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. For example, to access the <u>**File**</u> menu, press **Alt**, then **F**.

Table 2-1 lists the shortcut key(s) for operating the Saturn DigiSizer program.

*Table 2-1.  Shortcut Keys*

| Select... | To... |
|---|---|
| **F1** | Access an electronic copy of the 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** | Closes 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) selected component on instrument schematic, or (2) onscreen reports |

## 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.
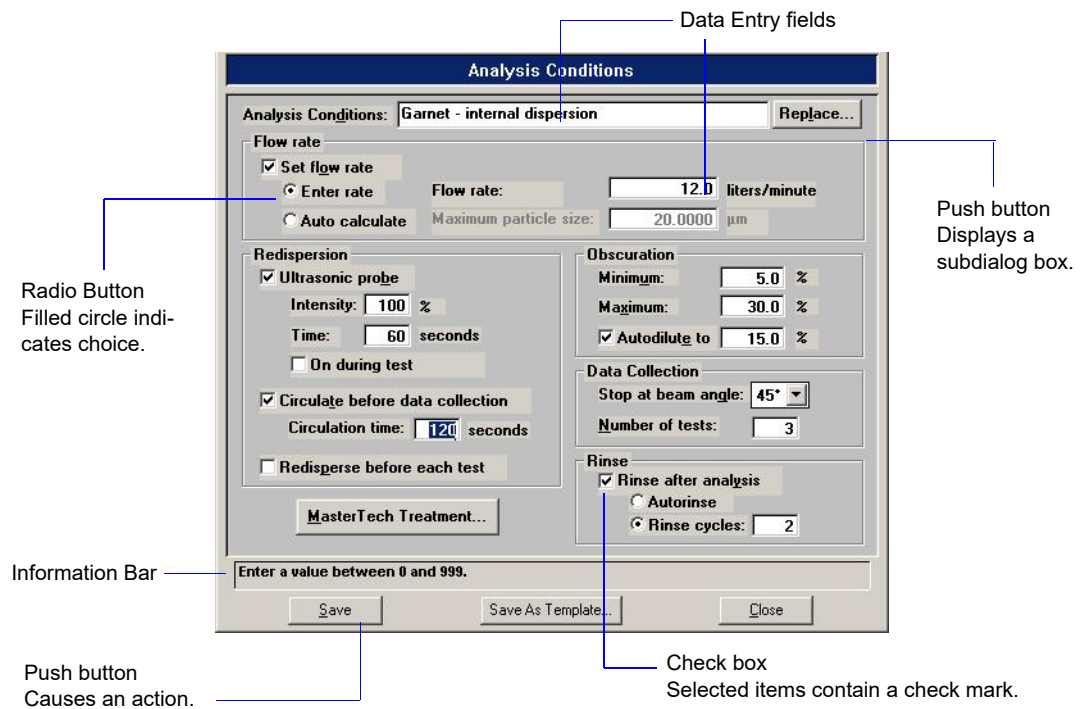


| Data entry field | A data entry field is used to enter text; either numeric (numbers only) or alphanumeric (numbers, letters, or printable characters). |
|---|---|
| **Information Bar** | Some dialog boxes contain information pertinent to the selected field in an information bar across the bottom of 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 invoke 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 (✔).

Indicates an item
is selected.

```
Combined Report                    ▲
✓ Standard Class Size Table
  Standard Sieve Table
  Particle Size Table
  Cumulative Fraction Table
✓ Cumulative Graph
✓ Frequency Graph
✓ Difference from Ref Graph
✓ Out of Spec Graph
  Background Graph                 ▼
```
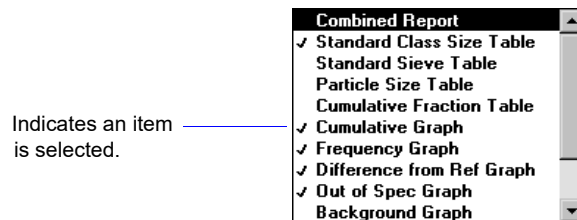
The following push buttons are common to the DigiSizer analysis program and appear on
many of the dialogs:

**Browse**                       Displays a dialog box 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 descriptions. Certain dialog boxes contain a **Files** window, which displays a list of files available for that particular operation. For example, the Open Sample Information File dialog:
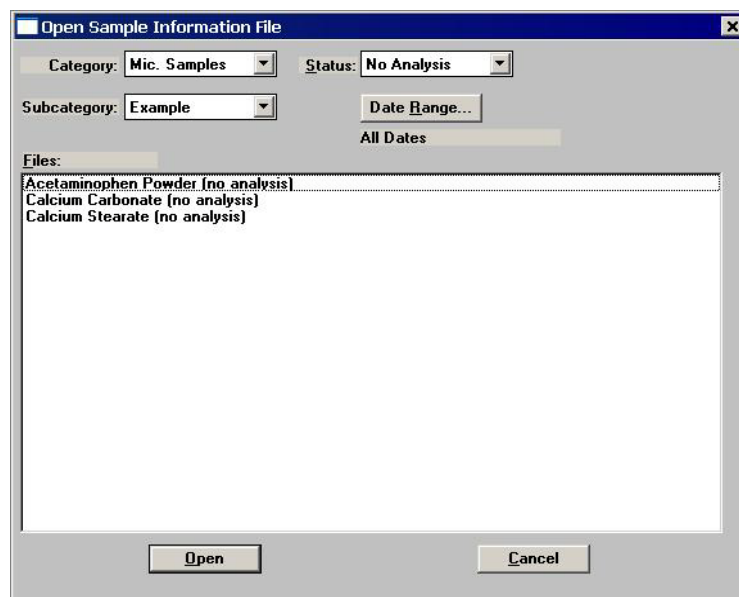


The files displayed in the window are those contained in the selected directories and having the status shown in the **Status** field. To select a file, simply double-click on the desired file in the **Files** window

You can limit the list of files displayed in the **Files** list window by choosing one or more of the following:

• 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

> **You may change the date format by using the Regional Settings function on the windows control Panel.**

• Select a file status from the Status drop-down list. Table 2-2 describes each file status.
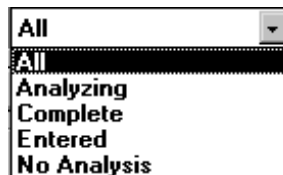
*Table 2-2.  File Status and Description*

| 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** | status 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. |

## Selecting Reports

Reports are selected from the Report Options dialog, or any dialog containing a Selected Reports 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.

Indicates report is selected.

# Menu Structure

Demo Saturn DigiSizer II 5205 Confirm V1.00  Logged in user name: ...

File   Unit 1   Reports   Options   Windows   Help
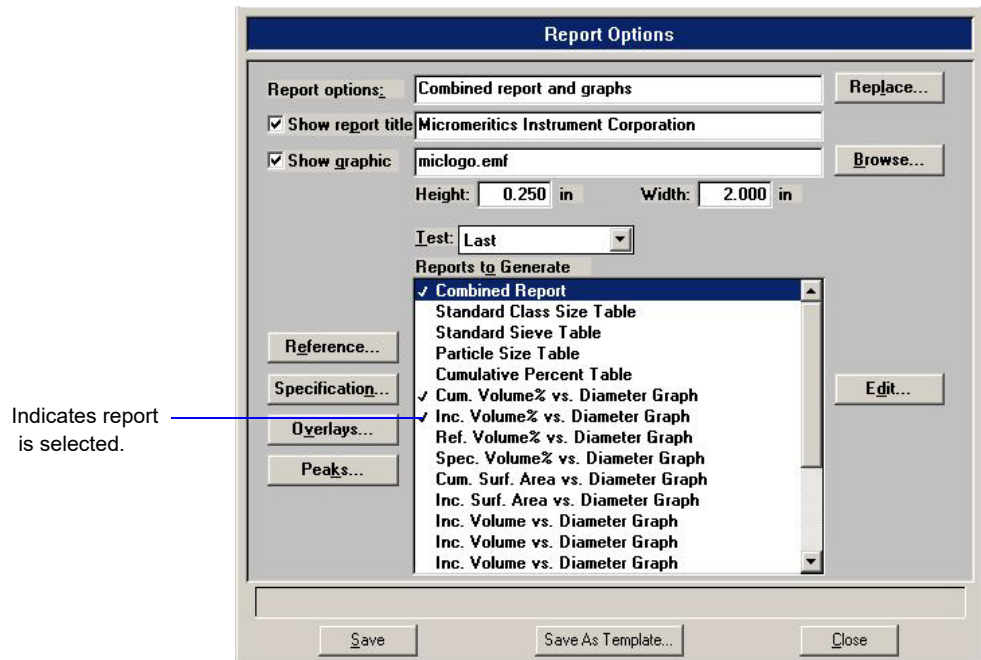
## Main Menu Bar

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 4, **FILE MENU**) |
| **Unit [n]** | Enables you to perform analyses and other instrument operations. (Chapter 5, **UNIT MENU**) |
| **Reports** | Enables you to generate and close reports. (Chapter 6, **REPORTS MENU**) |
| **Options** | Allows you to edit sample defaults, select data presentation formats, and manage models. (Chapter 7, **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 **2-19**) |
| **Help** | Provides access to an electronic copy of the operator's manual. (this chapter, page **2-19**) |

# Windows Menu



Indicates active
window
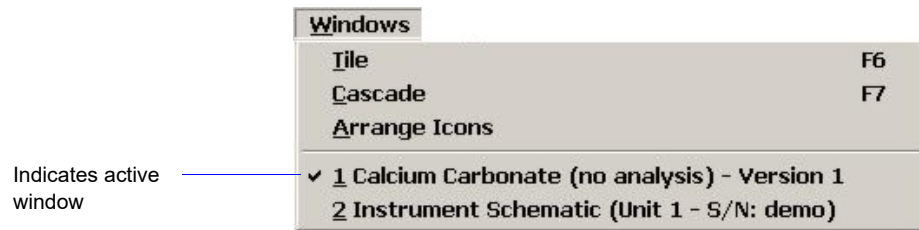
| | |
|---|---|
| **Tile** | Resizes all open windows and arranges them side by side so that the contents of all open windows are visible. |
| **Cascade** | Resizes all open windows and arranges them in a stacked fashion. The active window is positioned on top of the stack. Each window's title remains 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 ($\checkmark$).

# Help Menu



| | |
|---|---|
| **Operator's Manual** | Provides a 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.
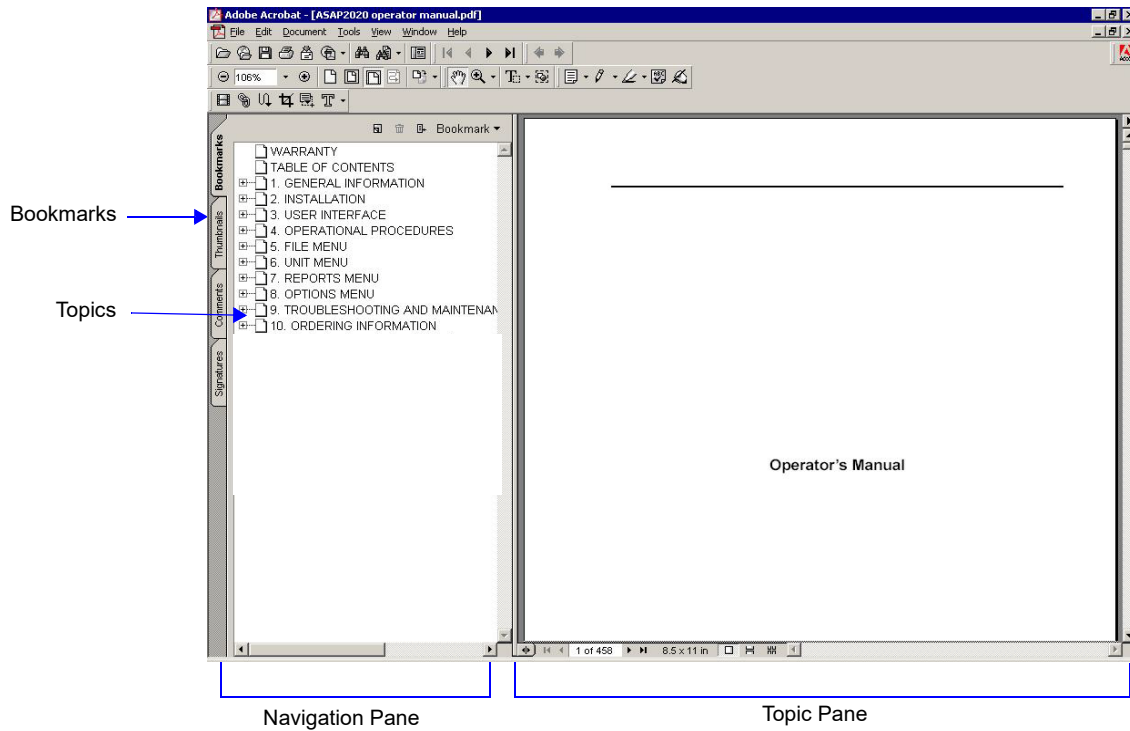


You can use the  +  and  –  buttons next to topics as they are used in Windows Explorer to expand or collapse the topic list.

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.
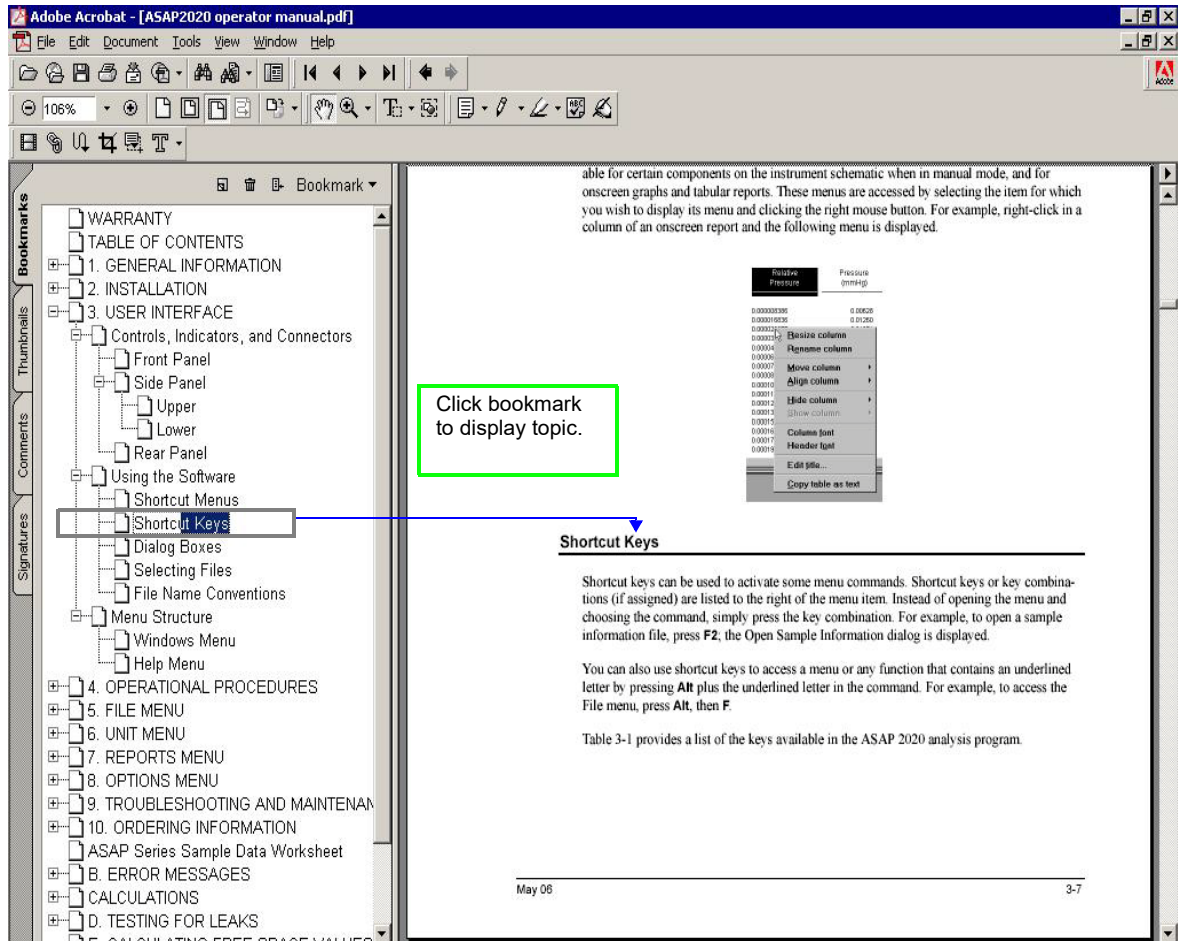
## Using the Table of Contents, Index, and other Links

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.
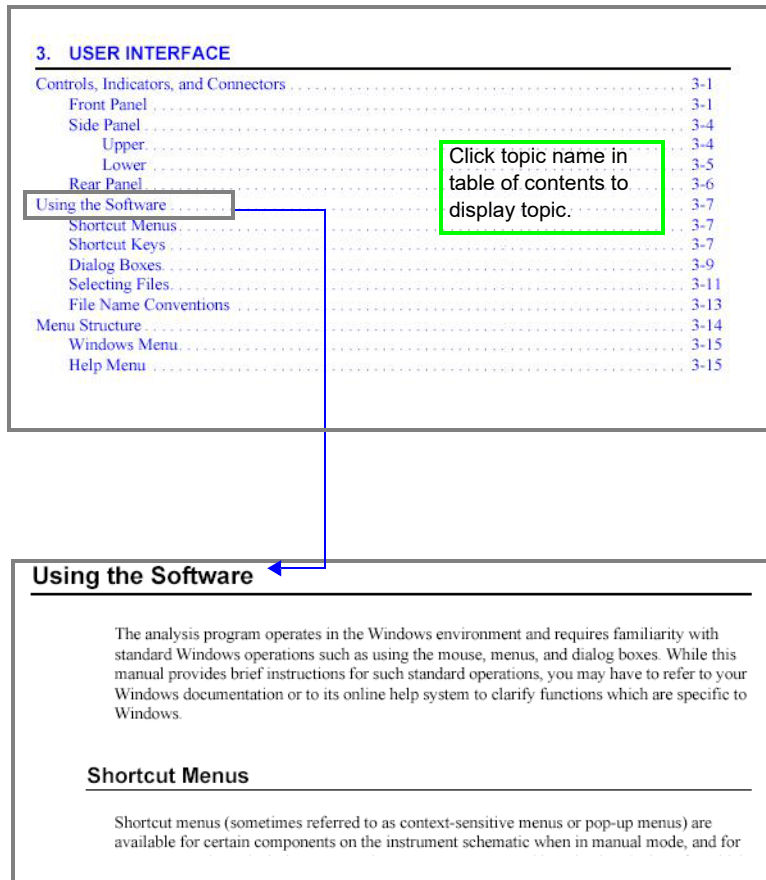
**Index**

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.
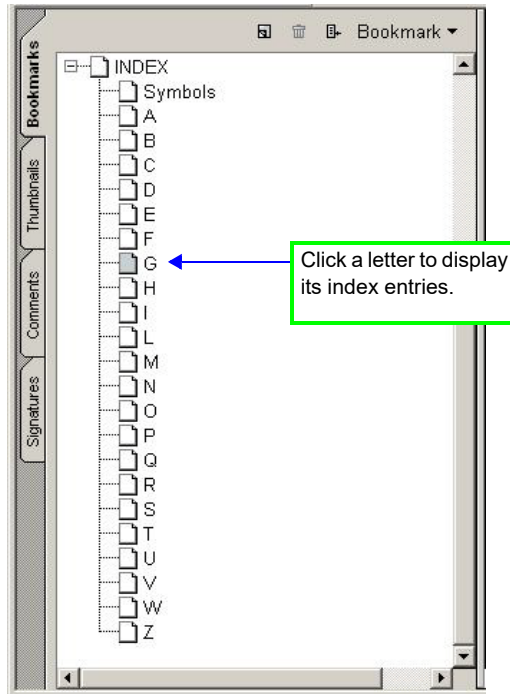


After you display the entries, locate the item of interest and click on the page reference to access the information.

**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.
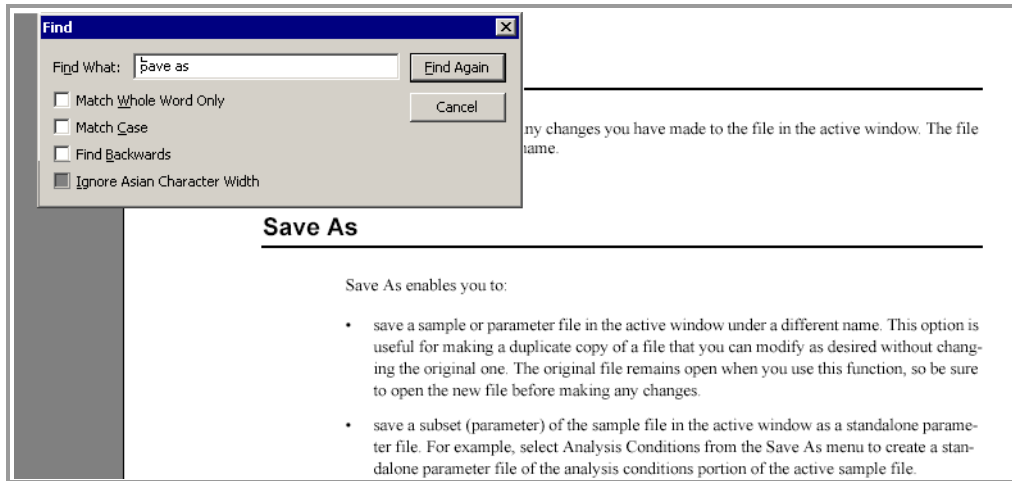
## Printing

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.

Enter this number.

Do not use number in footer of the manual.

Aug 04       1-11

27 of 446   8.5 x 11 in
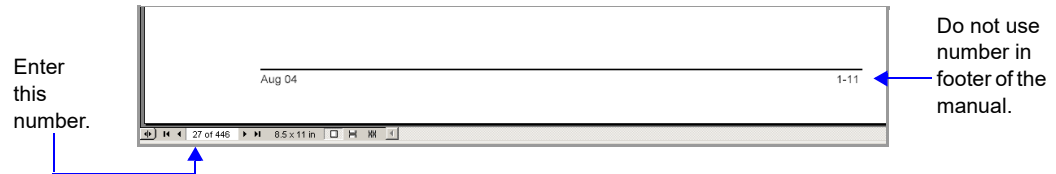
- Select **File > Print**.
  A standard Print dialog is displayed. Select the page(s) to print, then click **OK**.

- 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**.

Thumbnails tab
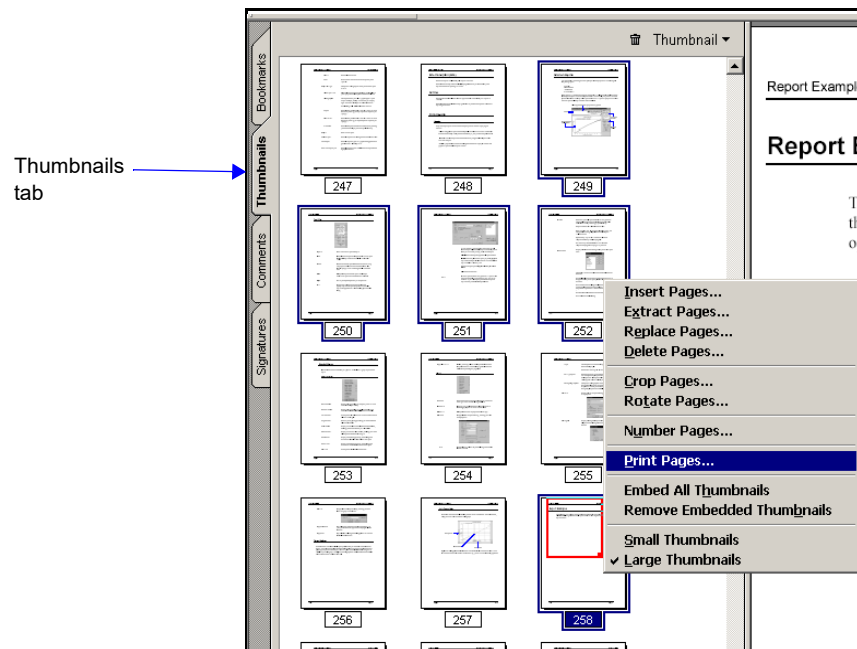
# 3.  OPERATIONAL PROCEDURES

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

This chapter does not contain detailed descriptions of the dialogs used to perform these procedures. Refer to Chapters 4 through 7 for dialog descriptions. Use the index or online manual to assist you in locating the appropriate dialog.

Some procedures cannot be performed by the Analyst; these procedures are marked accordingly.

## Creating File Templates

> **An Analyst is not authorized to create sample and parameter file templates.**

When you create a sample or parameter file, a dialog containing available templates is displayed so that you can choose one on which to base your file. Several predefined templates have been included with the analysis program. A new template can be created using the values from an existing sample file. If you create a template from a completed sample file, you cannot edit the values. For example, you may wish to create a template for a sample file that you used with a sample material that you analyze on a routine basis.

You can also create a template from a sample file that has been created but has not been used with an analysis. This method allows you to edit file parameters as desired before saving the contents as a template. This is the method used in our example below.

The values in a template cannot be edited; however, you can edit the values in the sample file you create using the template.

Perform the following steps to create a template:

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

2.  Click on the **Status** drop-down list and choose **No Analysis**; this allows only the sample files that have not been used with an analysis to display in the **Files** window.

3.  Choose a file, then click **Open**; the Sample Information dialog is displayed.



4.  Edit the fields of all parameters (click the tabs to access each parameter) as desired.

5.  Select **File** > **Save As Template**, then choose:

    • Sample information to save all parameters as a sample file template; the Save As Sample Template dialog is displayed. You can also click **Save As Template** on the sample information dialog if you are saving all parameters. You cannot use this push button to save individual parameter files.

    • a parameter file to save the values of one of the parameters as a parameter file template. For example, select **Analysis conditions** to save the values in the Analysis conditions dialog as a template for Analysis conditions files.

**You can also create parameter file templates using an existing parameter file.**

6.  Edit or enter a new description in the **Sample** field; you can use up to 42 characters. Be sure to use an intuitive description.

7.  Click **Save**; the Save As Template dialog is displayed.

8. Click **Save** to save the sample template. If **Save** is disabled, a template containing the same description already exists. Edit the description to enable **Save**.

9. Click **Close** on the **No Analysis** sample file; the following error message is displayed:

**(file name) has been changed. Save changes before closing?**

Click **No** (unless you wish to save the changes made) to close the dialog.

# Creating Parameter Files

> **An Analyst is not authorized to create parameter files.**

The following file types can exist as part of the sample information file, as well as individual parameter files:

- Analysis conditions
- Material properties
- Report options

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

Several predefined parameter files are included with the Saturn DigiSizer Confirm 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. You can do this by creating a new file and then selecting **Replace**. A dialog is displayed so that you can select the existing parameter file. Then you can make any changes you need to make and the original file remains unchanged.

## Analysis Conditions

Analysis conditions specify the data used to guide an analysis.

Refer to **Analysis Conditions**, page **4-11** for a description of the fields on this dialog.

Perform the following steps to create an analysis conditions file.

1. Select **File > New > Analysis conditions**; the Create an Analysis Conditions File dialog containing the available templates is displayed.

2. Choose a template, then click **Create**; the Analysis Conditions dialog is displayed.

3.  Enter a description in the **Analysis Conditions** field. Be sure to use an intuitive description so that you will recognize it easily when needed.

> Use a description 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.

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

5.  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.

6.  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.

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

    a. Enter the beam angle at which to stop data collection. This field defaults at **45**, and typically is 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.

8. 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.

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

10. Click **Save**; the Save As Analysis Conditions File dialog is displayed.

11. Verify the description, then click **Save** to save the file and return to the Analysis Conditions file dialog. If **Save** is disabled, the description is a duplicate one and must be edited. The DigiSizer Confirm software does not allow duplicate descriptions.

> **You can click Save As Template if you wish to save the values in this file as an analysis conditions template.**

12. Click **Close** to close the dialog.

## Material Properties

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

Refer to **Material Properties**, page **4-16** for a description of the fields on this dialog.

1.  Select **File > New > Material properties**; the Create a Material Properties dialog containing the available templates is displayed.

2.  Choose a template, then click **Create**; the Materials Properties dialog is displayed.



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

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

4.  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**.

5. Choose a dispersing liquid from the **Analysis Liquid** list box. 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**.

6. 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.

7. Click **Save**; the Save As Material Properties File dialog is displayed.

8. Verify the description, then click **Save** to save the file and return to the Material Properties file dialog. If **Save** is disabled, the description is a duplicate one and must be edited. The DigiSizer Confirm software does not allow duplicate descriptions.

**You can click Save As Template if you wish to save the values in this file as a material properties template.**

9. Click **Close** to close the dialog.

## 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. These report options files may be used to generate reports automatically at any time after the analysis.

Report options files also may be defined to include three different types of overlays (refer to **Generating Overlays**, page **3-48**).

Refer to **Report Options**, page **4-21** for a description of the fields on this dialog.

Perform the following steps to define a report options file.

1. Select **File > New > Report options**; the Create a Report Options File dialog containing the available templates is displayed.

2. Choose a template, then click **Create**; the Report Options dialog is displayed.
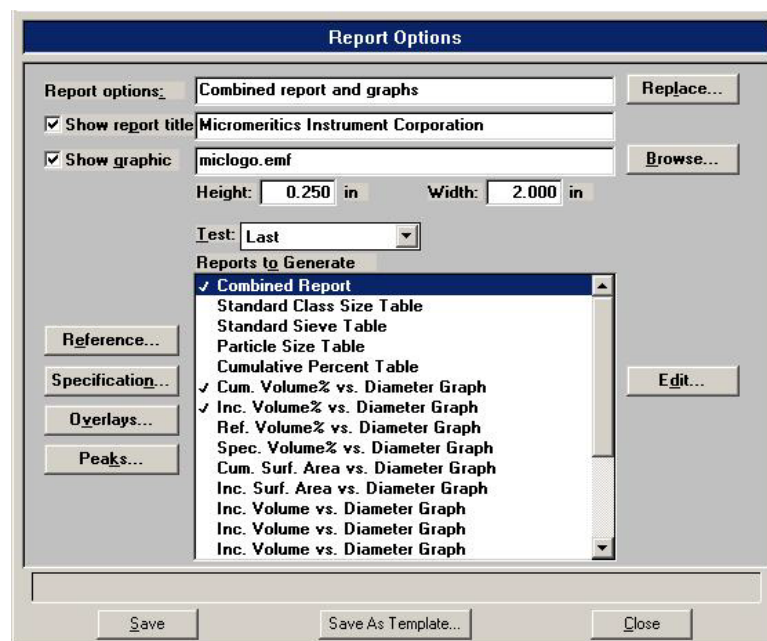


3. Enter a description in the **Report options** field. Enter an identifier which gives a more intuitive description of the file's contents. For example, **Tabular Report using Volume Distribution**.

4. 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), you can have it display in the report header by selecting *Show graphic*. Click Browse to select the file; use the *Height* and *Width* fields to specify the size.**

5. 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.

6. 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.

7. 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.

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

9. 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.

10. From the **Reports to Generate** list, 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 the **Spacebar**.

11. Edit any reports you wish by highlighting the report, then clicking **Edit**.

12. Click **Save**; the Save As Report Options File dialog is displayed.

13. Verify the description, then click **Save** to save the file and return to the Report Options file dialog. If **Save** is disabled, the description is a duplicate one and must be edited. The DigiSizer confirm software does not allow duplicate descriptions.

> **You can click Save As Template if you wish to save the selections in this file as a report options template.**

14. Click **Close** to close the dialog.

# Creating a Sample File

A sample information file must be created for each analysis. The sample information file consists of information groups which, collectively, identify the sample, guide the analysis, and specify report options.

A sample file can be created by a Developer or an Analyst.

## Analyst

An Analyst creates a sample information file by choosing predefined parameters. He/she can switch to an Advanced format to view details of the parameter files, but editing is not allowed.

Refer to **Analyst**, page **4-4** for a description of the fields on this dialog.

Perform the following steps to create a sample information file:

1. Select **File > New > Sample Information**; the Create a Sample Information File dialog containing the available templates is displayed.

2. Choose the desired template, then click **Create**; the Sample Information dialog is displayed.
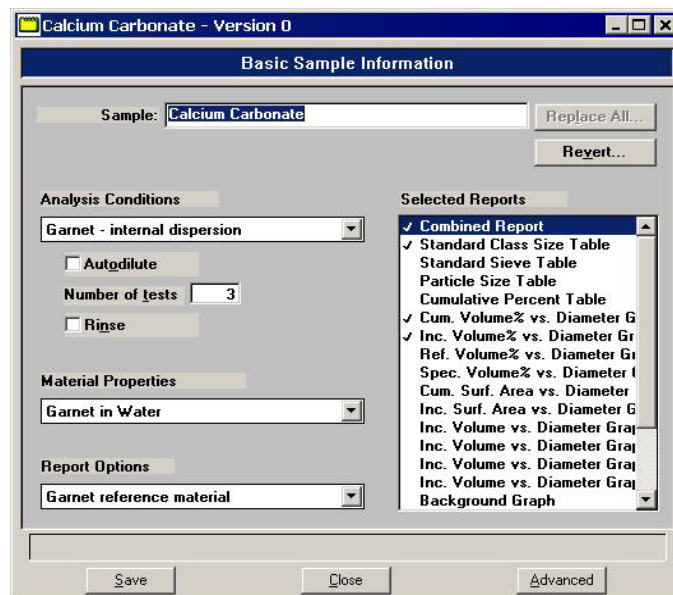


3. Enter a description in the **Sample** field. Be sure to use an intuitive description; the description is what displays in the Files list window.

**Choose Replace All to copy parameters from an existing file into this one. After copying the parameters, you may edit them as desired. The file from which they were copied will not be altered in any way.**

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.  Click the down arrow at the **Material Properties** field and choose a file:

6.  Click 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 **Selected Reports** window. You can edit these selections if desired.

> **You can edit details of a report by switching to the Advanced format.**

7.  After you have selected all parameters, click **Save**; the Save As Sample Information dialog is displayed.

    a.  Choose the directory into which the file is to be saved.

    b.  Edit the description; the DigiSizer Confirm program does not allow duplicate descriptions.

    c.  Enter a comment in the **Comment** window; for example, you may wish to enter the date and time the file is created.

    d.  Click **Save** to return to the Sample Information file dialog.

8.  Click **Close** to close the dialog.

## Developer

A Developer's view of the sample information dialog is more flexible than that of an Analyst. A Developer is allowed to view and edit (if desired) all parameters of the file.

Perform the following steps to create a sample information file:

1. Select **File > New > Sample Information**; the Create a Sample Information File dialog containing the available templates is displayed.

2. Choose a template, then click **Create**; the Sample Information dialog is displayed.



3. Edit (or enter) the description in the **Sample** field; you can use up to 42 characters.

4. In the **Operator** field, enter the name of the Analyst who will be performing the analysis.

5. In the **Submitter** field, enter the name of the department, company, etc. submitting the sample for analysis.

6. Choose whether you are going to use manually entered data or have it automatically collected.

7. 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. This example shows unassigned parameters.

8. Click the following tabs to specify parameter values (refer to **Creating Parameter Files**, page **3-4** for assistance if needed):

   • Analysis Conditions
   • Material Properties
   • Report Options

9. After you have completed all parameters, click **Save**; the Save As Sample Information dialog is displayed.

   a. Choose the directory into which the file is to be saved.

   b. Edit the description; the DigiSizer Confirm program does not allow duplicate descriptions.

   c. Enter a comment in the **Comment** window; for example, you may wish to enter the date and time the file is created.

   d. Click **Save** to return to the Sample Information file dialog.

> **You can click Save As Template if you wish to save the values in this file as a sample file template.**

10. Click **Close** to close the dialog.

# 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 **5-26** for a 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 (enabled when a MasterTech is connected)

- **MasterTech then DigiSizer** - rinses the MasterTech first, then the liquid sample handler and DigiSizer as described above (enabled when a MasterTech is connected)

## DigiSizer

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

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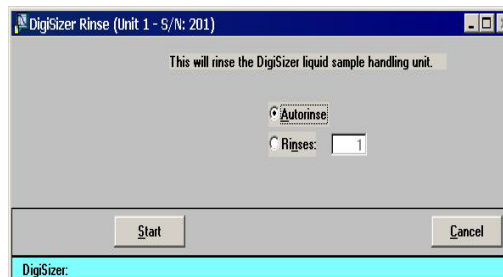


2. Choose **AutoRinse** to have the analyzer automatically determine how many rinse cycles to perform based on beam obscuration, or **Rinses** to specify an exact number of rinses.

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 Digi-Sizer and the MasterTech.

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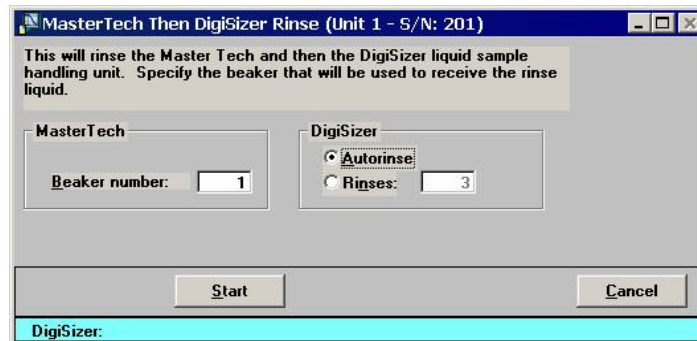


2. In the **MasterTech** group box, enter the position number of the beaker that is to catch the rinse liquid. Be sure the beaker contains a small amount (approximately 10 mL) of liquid; otherwise, its presence may not be detected by the MasterTech.

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 H,** page **H-1** for a discussion and examples of acceptable and unacceptable backgrounds.

Refer to **Background**, page **5-22** for a detailed description of the fields on this dialog.

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 **6-5**).

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 H, page H-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 8-4); then repeat this step. Appendix H, page H-1 provides guidelines for determining a good background.**

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

16. Perform another Background analysis.

    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.

# 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 **5-4** 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** to choose a file for your analysis, or **New** to create one; the Sample Analysis dialog containing the parameters of the selected file is displayed.
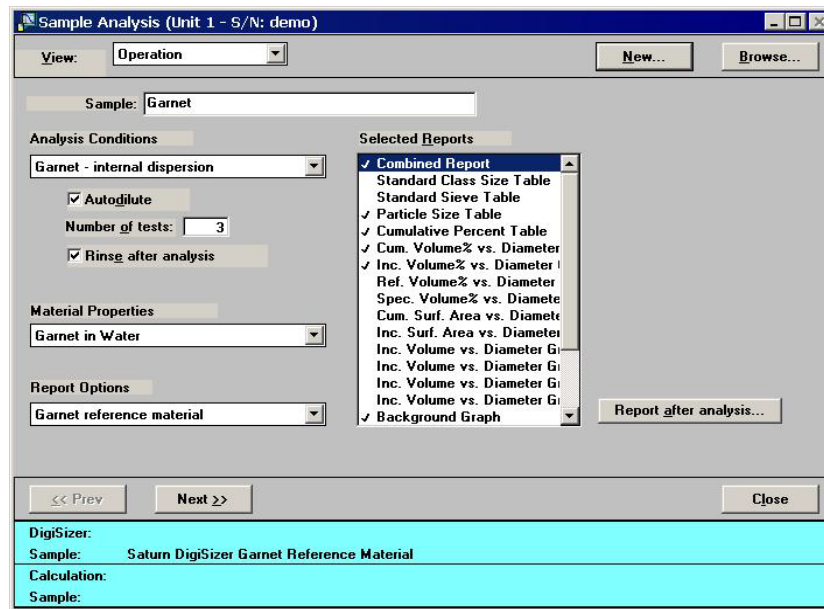
3. Verify analysis conditions, material properties, and report options; edit if needed.

4. Click **Next**; the User Log in dialog is displayed. The purpose for this dialog is to ensure that the person logged into the application is the same one performing the analysis.

5. Enter your password, then click **OK**; an analyzing view of the window is displayed so that you can view data as collected. A short delay is encountered before the port status changes from the *Idle* state. If desired, you can obtain a report on the data collected so far by selecting the appropriate push button; the report is printed to the screen.
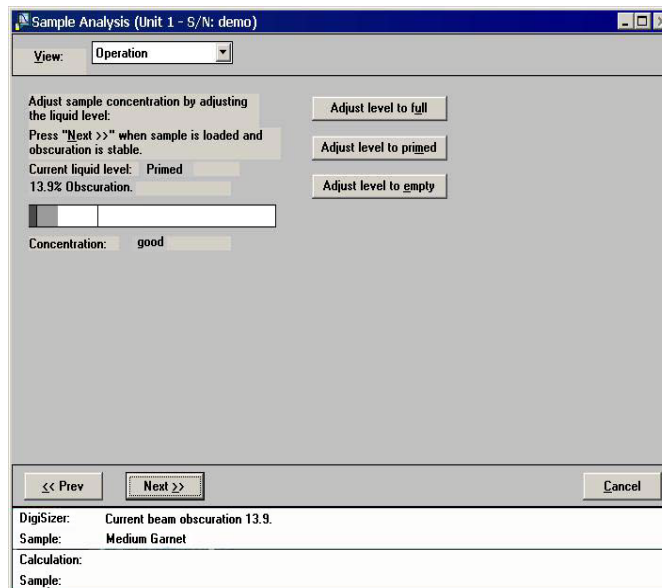
6.  While observing the beam concentration, slowly begin to add sample. Add enough sample to achieve the proper range for your material, using the following guidelines:

> **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 **5-10** 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.
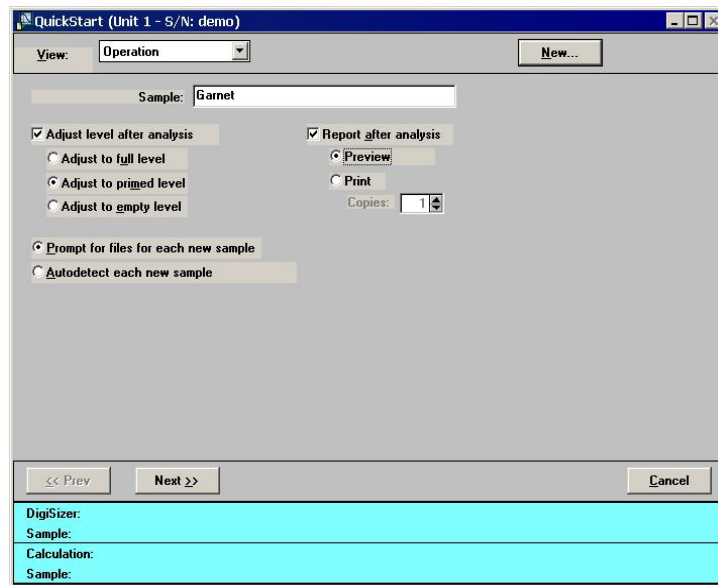


2.  Click **New** to create a file for this series of analyses; the Create a Sample File dialog containing available templates is displayed.

3.  Choose a template, then click **Create**; the QuickStart dialog is again displayed. The parameters specified in the template display in the fields. You can edit any of the parameters you wish to change as outlined in the next few steps. Or you can accept the defaults and proceed to step 4.

    a.  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.

    b.  Select report output; you can have reports printed to the screen (**Preview**) or to a printer. (**Print**).

      c.  Choose a file management option:

-  **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**.

-  **Autodetect each new sample**; a file is created by the system for each analysis and will be sequentially numbered. Analysis proceeds each time a new sample is added to the reservoir, creating a sample file automatically.

4.  Edit the description so this file won't be a duplicate.

5.  Click **Next**; the User Log in dialog is displayed. The purpose for this dialog is to ensure that the person logged into the application is the same one performing the analysis.

6.  Enter your password, then click **OK**; the liquid is adjusted as requested then a second view of the QuickStart dialog prompting you to add the sample is displayed. If you chose Prompt for files for each new sample, the  push button is included allowing you to choose a different file for the analysis.

7.  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 **5-15** 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. Click **New**; the Create a Sample File dialog containing available templates is displayed.

3. Choose a template, then click **Create**; the MasterTech Automatic dialog containing the parameters of the selected template is again displayed.



You can edit any of the parameters you wish, or you can accept the defaults and proceed to step 4.

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

b. 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.**

     c.  Select report output; you can have reports printed to the screen (**Preview**) or to a printer (**Print**).

4.    In the **Sample** field, edit the description for this series of samples. Be sure to include the $ symbol if you want sample numbers included as part of the identification.

> **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 #.**

5.    Click **Start**; the User Log in dialog is displayed. The purpose for this dialog is to ensure that the person logged into the application is the same one performing the analysis.

6.    Enter your password, then **OK** 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.

Refer to **MasterTech Schedule**, page **5-18** for a detailed description of the fields on this dialog.
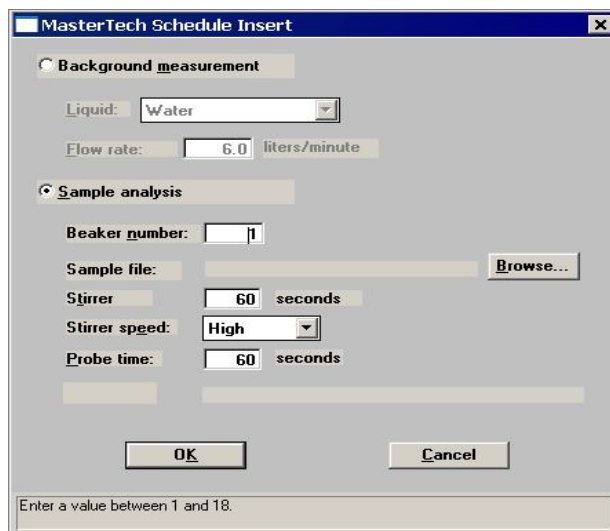
This mode of operation is used to analyze a series of samples that are different in size and shape and, consequently, require different analysis conditions. You also can schedule background measurements between samples.

Perform the following steps to use this mode of operation.

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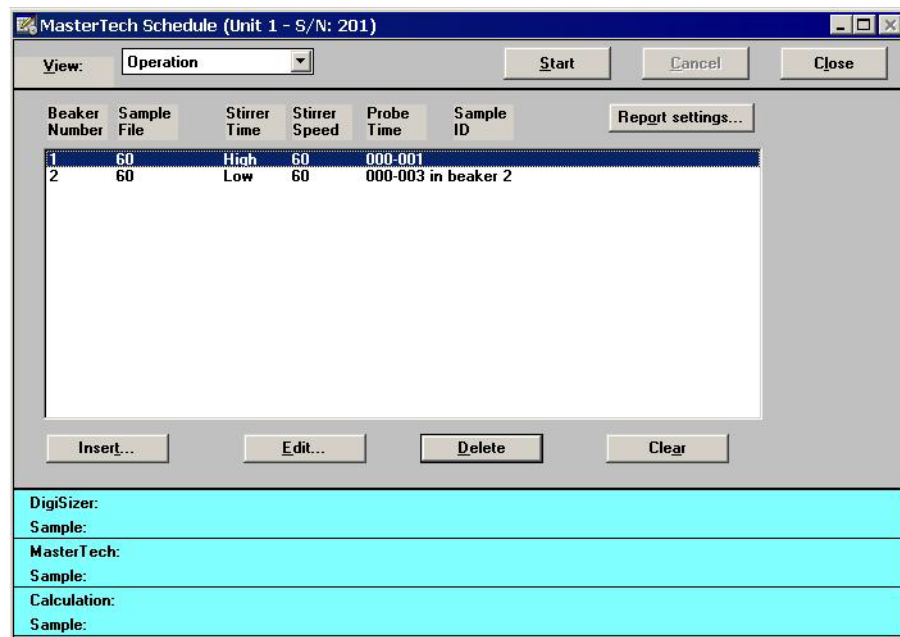


2.  Click **Insert**; the MasterTech Schedule Insert dialog is displayed.

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, or click **New** to create a file.

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; you can have reports printed to the screen (**Preview**) or to a printer (**Print**).

5. Click **Start**; the User Log in dialog is displayed. The purpose for this dialog is to ensure that the person logged into the application is the same one performing the analysis.

6. Enter your password, then click **OK** to begin analyses.

# Printing File Contents

You can print the contents of one or more sample file, parameter file, or file template. For example, if you print the contents of an analysis conditions file, you will receive the parameters used for the analysis conditions associated with the file.

- A Developer can print the contents of sample files, sample templates, parameter files, and parameter templates.

- An Analyst can print the contents of sample files, sample templates, and parameter templates (not parameter files).

Refer to **Print**, page **4-47** for a detailed description of the fields on this dialog.

## Sample Files and Sample Templates

1.  Select **File > Print > Sample Information (or Sample Template)**; a dialog similar to this one is displayed.

    These fields do not display for a sample template.

    

    Unavailable for an Analyst.
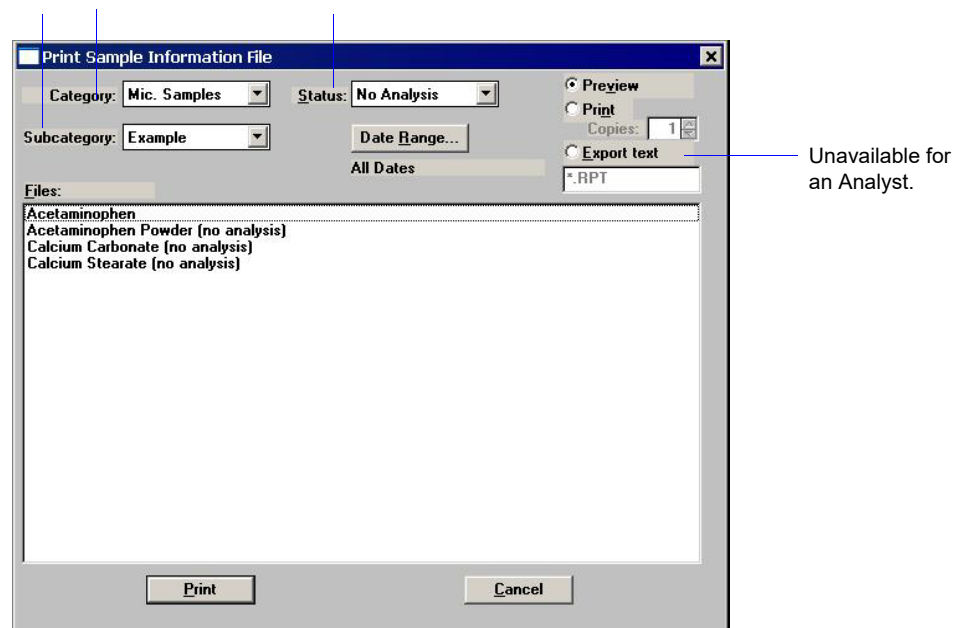
2.  From the **Files** window, select the desired file. If you plan to print the contents of multiple files, hold down **Ctrl** while selecting the files.

**You can use the Category, Subcategory, Status drop-down list and/or the Date Range push button to limit the files displayed in the Files window; refer to page Selecting Files, page 2-15 for details. Only the Date Range push button is available for sample templates.**

3.    Choose a destination for the output:

    **Preview**      Prints contents to the screen.

    **Print**          Prints contents to the default printer. Also enables the **Copies** field, allowing you to print up to four copies.

    **Export**      Prints contents to a file. Also enables the **File name** field so that you can enter a name (or you can accept the default). This option is not available for an Analyst.

4.    Click **Print**; the contents of the requested file(s) are sent to the selected destination. This example shows a sample information file sent to the screen (Preview).



**Close**: closes the dialog

**Print**: prints the report to the default printer

**Header**: toggles the header on and off

**Prev** and **Next**: enabled when the report contains multiple pages allowing you to advance to other pages

## Parameter Files and Templates

1. Select **File > Print > (parameter file)**; a dialog similar to this one is displayed.
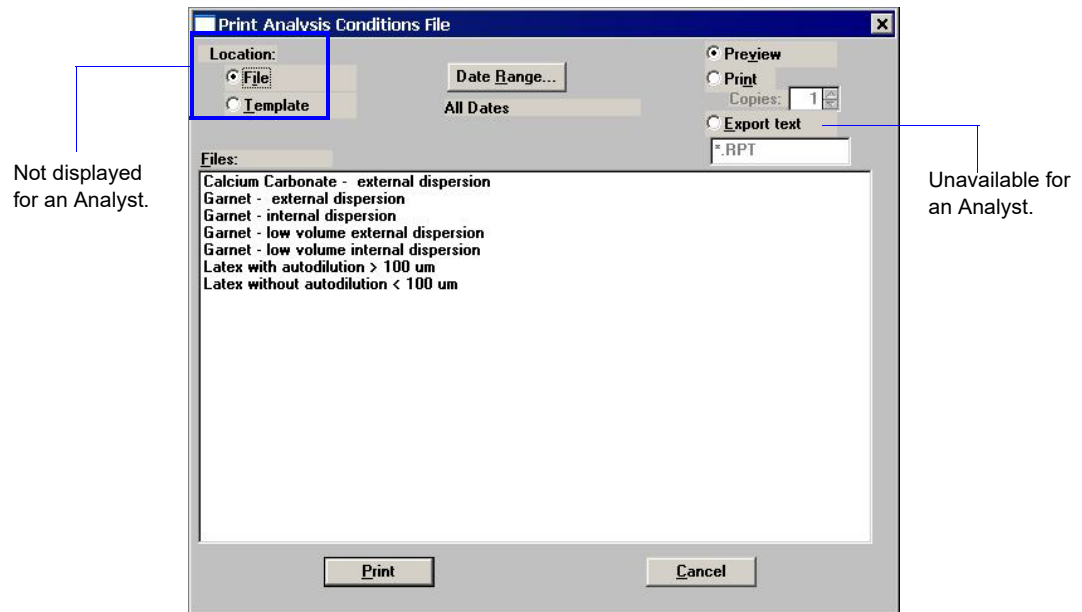
Not displayed for an Analyst.

Unavailable for an Analyst.

Only templates are displayed for an Analyst.

2. From the **Files** list window, select the desired file. If you plan to print the contents of multiple files, hold down **Ctrl** while selecting the files.

3. Choose a destination.

4. Click **Print**.

# Listing File Statistics

You can generate a list of the following information on one or more files to the screen, to a printer, or to a file.

- File name
- Date the file was created (or last edited)
- Time the file was created (or last edited)
- File identification
- Status (not applicable for parameter files)

Refer to **List**, page **4-50** for a detailed description of the fields on this dialog.

- A Developer can list statistics for sample files, sample templates, parameter files, and parameter templates.

- An Analyst can list statistics for sample files, sample templates, and parameter templates (not parameter files).

## Sample Files and Sample Templates

1. Select **File > List > Sample Information** (or **Sample Template)**; a dialog similar to this one is displayed.

These fields do not display for a sample template.



Unavailable for an Analyst.
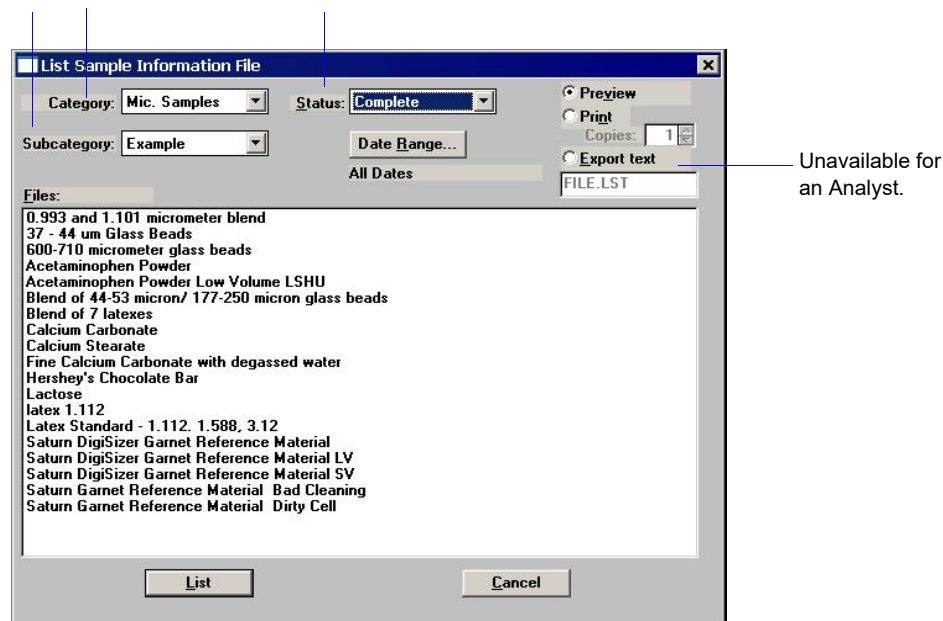
2. From the **Files** window, select the desired file. If you wish to have statistics for multiple files, hold down **Ctrl** while selecting the file

3.   Choose a destination for the output:

**Preview**     Prints contents to the screen.

**Print**       Prints contents to the default printer. Also enables the **Copies** field,
                allowing you to print up to four copies.

**Export**      Prints contents to a file. Also enables the **File name** field so that you can
                enter or a name (or you can accept the default). This option is not
                available for an Analyst.

4.   Click **List** to generate file statistics to the specified destination; this example shows
     statistics for a sample information file printed to the screen (**Preview**).
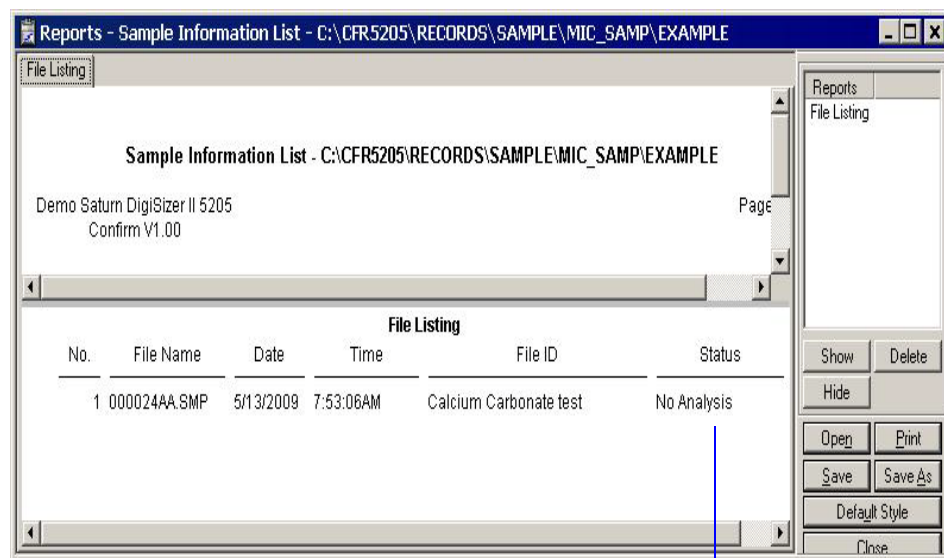


The Status column is not applicable for parameter files.

## Parameter Files and Templates

1.  Select **File > List > (parameter file)**; a dialog similar to this one is displayed.
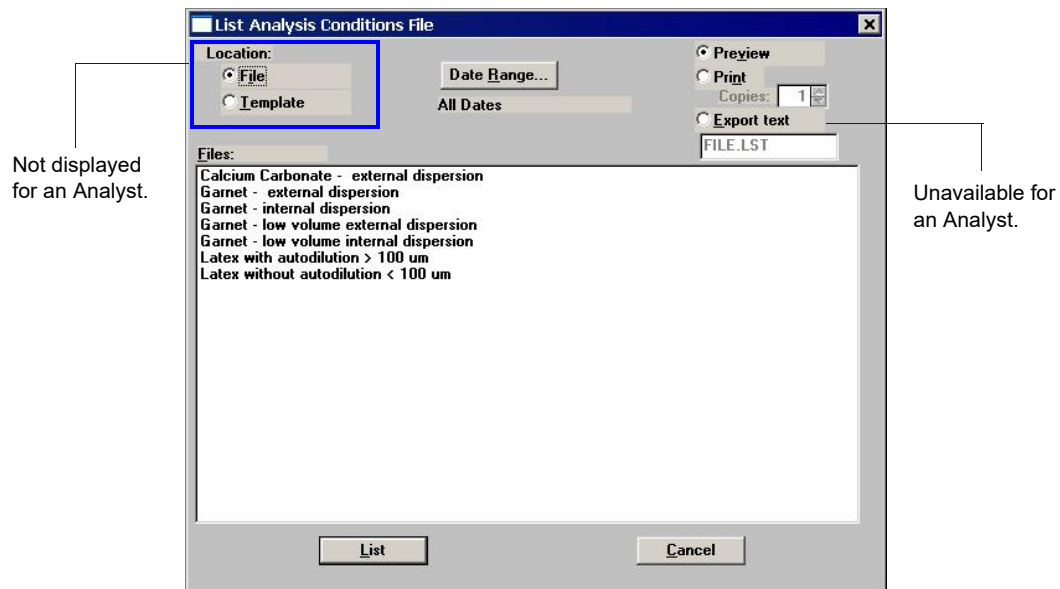


Not displayed for an Analyst.

Unavailable for an Analyst.

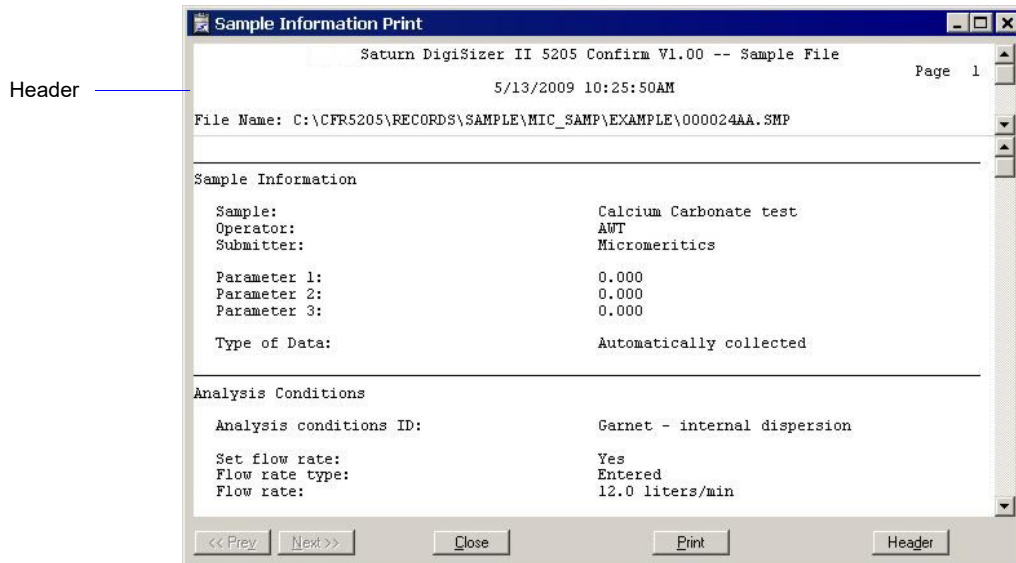Only templates are displayed for an Analyst.

2.  From the **Files** list window, select the desired file.  If you wish to have statistics for multiple files, hold down **Ctrl** while selecting the files.

3.  Choose a destination.

4.  Click **List**.

## Importing Sample and Parameter Files

> **An Analyst is not authorized to import sample or parameter files.**

The **Import** function allows you to import files which have been created on a computer other than the one controlling the analyzer and have them display in the **Files** list.

> **Review the Micromeritics PROGRAM License Agreement for restrictions on the use of another copy.**

Perform the following steps to import a file:

1.  Copy the file(s) you wish to import to the **Import** directory. Files must be copied into this directory; otherwise they will not display in the **Files** window of the Import File dialog.

2.  Select **File > Import**; a drop-down list containing file types is displayed.

3.  Choose the file type; a dialog similar to this one is displayed.
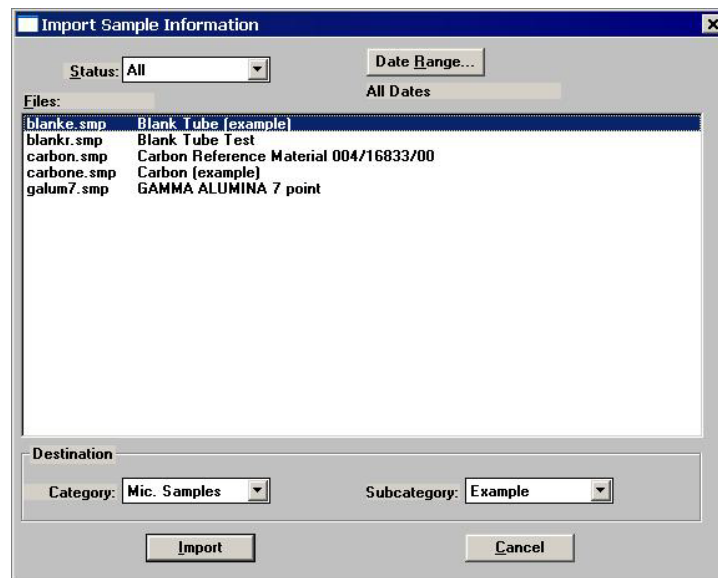


4.  Select the directory into which you wish to have the file imported. If you are importing a parameter file, the **Category** and **Subcategory** fields do not display. Parameter files are copied automatically into the directory assigned for parameter files.

5.  Select the file(s) you wish to import; this enables the **Import** push button.

6.  Click **Import** to import the file.

# Exporting a Sample Information File

| ✎ | **An Analyst is not authorized to import sample or parameter files.** |
|---|---|

**Export** allows a Developer to:

- export the entire sample file to the Export directory. For example, you may wish to use this option to transfer a sample file to another computer.

- 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.

Perform the following steps to export a sample information file or ASCII data:

1. Select **File > Export** menu. Then from the drop-down, choose **Sample information** or the type of data you wish to export. This example shows exporting a sample information file; the dialogs are the same.
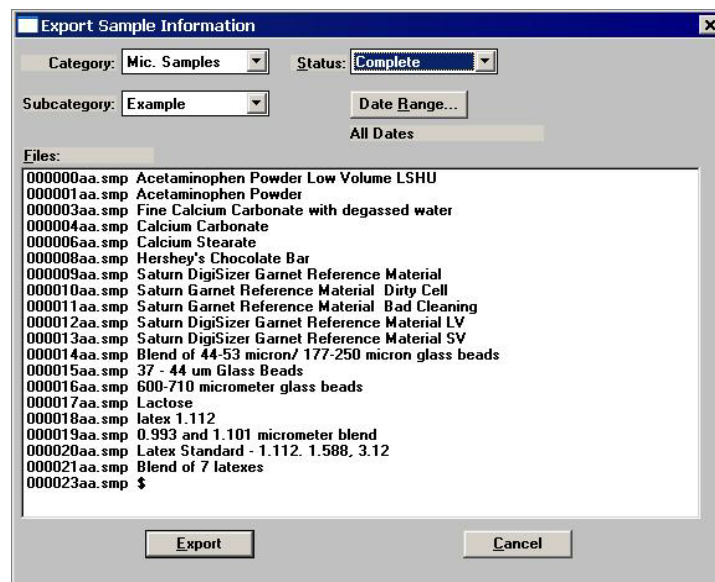


2. From the **Files** list window, choose the file you wish to export. You can select multiple files by holding down **Ctrl** while clicking on the desired files. Note that the confirm program has assigned a name with an smp extension for each file. Make a note of the smp file name(s) you are exporting. You will need this information when you retrieve the file from the Export directory.

| ✎ | **You can use the Status drop-down list and/or the Date Range push button to limit the files displayed in the Files list.** |
|---|---|

3.  Click **Export**; the file is exported automatically to the export directory.

4.  Access the **Export** directory to retrieve the exported file(s).

# 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 **Onscreen Reports**, page **6-20** 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.
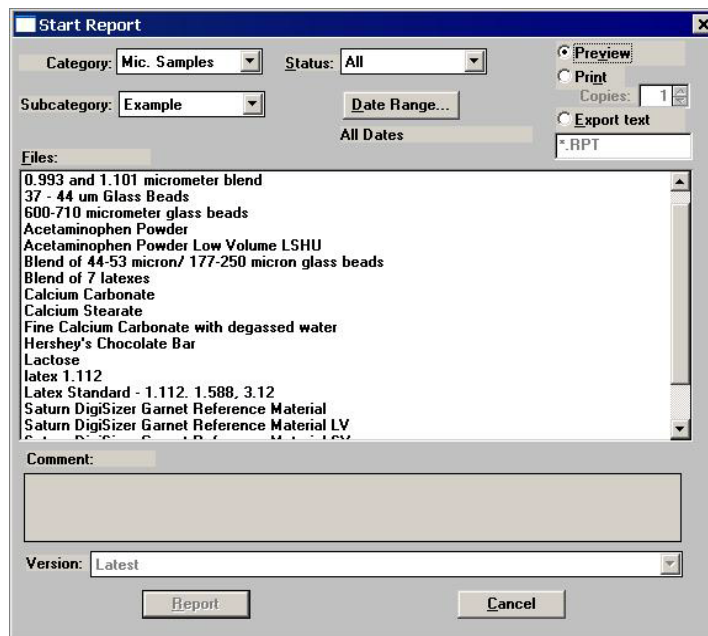


2.  From the **Files** list window, click on the name of the file(s) for which you wish to have reports generated.

3. Choose whether you wish to send report output to the screen (**Preview**) or to a printer (**Print**). If you choose **Print**, the **Copies** field is enabled allowing you to print up to four copies.

4. Click **Report**; the Selected Reports dialog is displayed.

> This dialog is not displayed if you choose multiple reports to generate. Reports selected in the sample file are generated.

Check marks indicate selected reports. ————

| Selected Reports |
|---|
| ✓ **Combined Report** |
| Standard Class Size Table |
| Standard Sieve Table |
| Particle Size Table |
| Cumulative Percent Table |
| ✓ Cum. Volume% vs. Diameter Graph |
| ✓ Inc. Volume% vs. Diameter Graph |
| Ref. Volume% vs. Diameter Graph |
| Spec. Volume% vs. Diameter Graph |
| Cum. Surf. Area vs. Diameter Graph |
| Inc. Surf. Area vs. Diameter Graph |
| Inc. Volume vs. Diameter Graph |
| Inc. Volume vs. Diameter Graph |
| Inc. Volume vs. Diameter Graph |
| Inc. Volume vs. Diameter Graph |
| Background Graph |
| ✓ Goodness of Fit Graph |
| Rosin Rammler |
| Log Probability |
| Summary Report |
| Sample Log |
| OK        Cancel |

5. The reports selected (preceded with a check mark) are the ones chosen in the sample file; you may edit choices if desired. Double-click on a report to select (or deselect) it; alternatively, you may highlight the report and press the **Spacebar**.

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

> If you select *Preview* to generate reports to the screen, there are many options for manipulating and customizing reports. Refer to **Onscreen Reports**, page **6-20** for information on these options.

## Background Reports

A graphical 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 **6-5** for detailed information on this option.

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

This destination is not available for an Analyst.
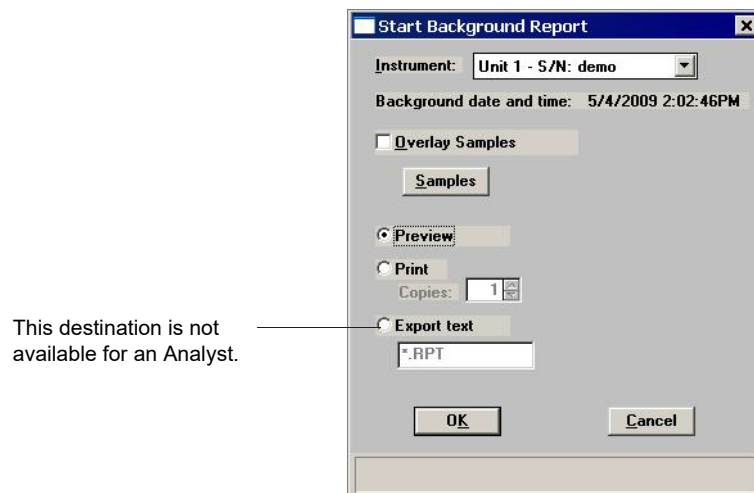
2. From the **Instrument** drop-down list, select the instrument on which you wish to have the background report generated.

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 specify the desired file(s).

4. Choose whether you wish to generate the report to the screen (**Preview**) or to a printer (**Print**). If you choose **Print**, the **Copies** field is enabled allowing you to print up to four copies.

5. 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

> **An Analyst is not authorized to choose SPC options.**

Refer to **SPC Report Options**, page **6-6** 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 Calculations 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 are reported.

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

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

5. Select whether you wish to have arithmetic (linear) or geometric (logarithmic) type of 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 **6-9** 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.  Choose whether you wish to generate the report to the screen (**Preview**) or to a printer (**Print**). If you choose **Print**, the **Copies** field is enabled allowing you to print up to four copies.

> **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 **6-13** 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 **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.

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

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

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

9.  Choose whether you wish to generate the report to the screen (**Preview**) or to a printer (**Print**). If you choose **Print**, the **Copies** field is enabled allowing you to print up to four copies.

> **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 **6-17** 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.
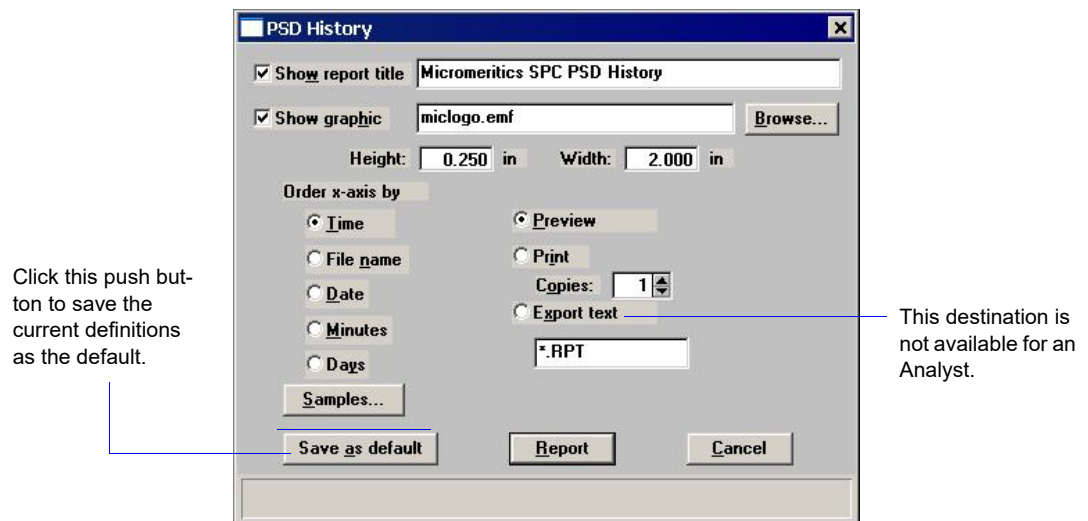
Click this push button to save the current definitions as the default.

This destination is not available for an Analyst.

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 bitmap (bmp) or an enhanced metafile (emf)  and you wish to have it display in the report header, select Show graphic. Then 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-Samples Overlay**
  Overlay up to eight plots of the same type with the current plot

- **Multiple-Tests Overlay**
  Overlay the same plot of all tests in one sample file

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

To overlay multiple graphs from the same sample file:

1.  Select **File > Open > Sample information**. Choose the desired sample file and click **Open**.

2.  Select the Report Options tab (an Analyst must click **Advanced**); 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 Selected Reports list, 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.

5. Select the desired file.

6. Choose whether you wish to generate the report to the screen (**Preview**) or to a printer (**Print**). If you choose **Print**, the **Copies** field is enabled allowing you to print up to four copies.

7. Click **Report**; the Selected Reports dialog is displayed, allowing you to change report selection if desired.

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

## Multiple-Sample Overlay

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

1. Select **File > Open > Sample information**. Choose the desired sample file and click **Open**.

2. Select the Report Options tab (an Analyst must click **Advanced**); 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 (analysis) of this sample file for which you wish to have results reported.<br><br>The graph(s) you select for this report will be overlaid with the corresponding graph(s) of the test designated in the Report Options file(s) of the sample file(s) you select in step 6. |
| | In the **Selected Reports** 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.
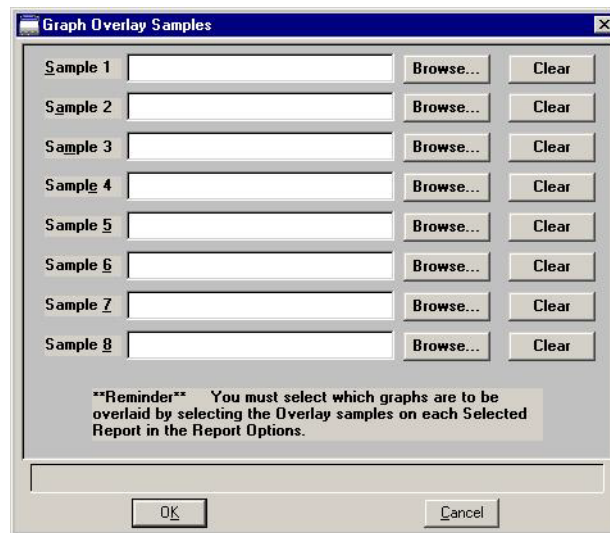


5.   Click **Browse**; the Graph Overlay Sample File Selection dialog is displayed.

6.   Choose the file 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; select the desired file.

8.   Choose whether you wish to generate the report to the screen (**Preview**) or to a printer (**Print**). If you choose **Print**, the **Copies** field is enabled allowing you to print up to four copies.

9.   Click **Report**; the Selected Reports dialog is displayed, allowing you to change report selection if desired.

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 (an Analyst must click **Advanced**); 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 Selected Reports list, 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; select the desired file.

5. Choose whether you wish to generate the report to the screen (**Preview**) or to a printer (**Print**). If you choose **Print**, the **Copies** field is enabled allowing you to print up to four copies.

6. Click **Report**; the Selected Reports 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.

# 4. 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.

**New**                          Allows you to create a sample information or parameter file. Page **4-3**.

**Open**                         Opens an existing sample information or parameter file. Page **4-38**.

**Save**                         Saves the file in the active window. Page **4-43**.

**Save As**                      Saves the file in the active window as a different name. You also can use this option to save a subset of the sample file as a parameter file. Page **4-43**.

**Save As Template**             Allows you to save the values from the open file as a template for a sample information or parameter file. Page **4-45**.

**Save All**                                Saves all open files. Page **4-45**.

**Close**                                   Closes the file in the active window. Page **4-45**.

**Close All**                               Closes all open files. Page **4-46**.

**Print**                                   Prints the contents of a sample or parameter file.  Page **4-47**.

**List**                                    Generates a list of certain information for sample or parameter files.  Page **4-50**.

**Import**                                  Allows you to import a sample information or parameter file into the assigned application directory. Page **4-51**.

**Export**                                  Allows you to export the data from a sample information file. Page **4-52**.

**Log in**                                  Allows you to log into the application. Page **4-53**.

**Log out**                                 Allows you to log out of the application. Page **4-53**.

**Exit**                                    Exits the analysis program. Page **4-54**.

# New

**New** allows you to create a sample information or parameter file. Regardless of the type of file you are creating, a dialog allowing you to choose a template is displayed.

Title bar indicates type
of file you are creating.
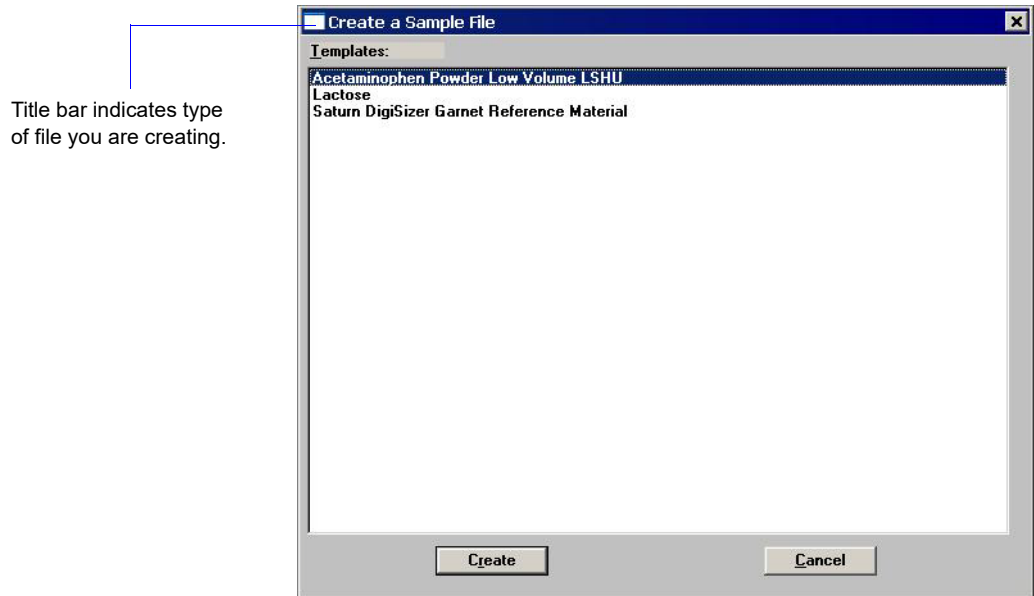
A Developer can create sample information and parameter files. An Analyst can create only a sample information file using predefined parameter files chosen from drop-down lists.

After you choose a template, click **Create** to display a dialog for the associated file.

## Sample Information

Sample information files contain information used to control the analysis. Therefore, an analysis cannot proceed until it has been assigned a sample information file. A sample information file consists of the following:

- sample identification
- analysis conditions
- material properties
- report options
- collected (after an analysis has been completed) or entered data

Parts of the sample information file can also exist as parameter files which are separate from the sample information file itself. Having these files exist independently allows you to use them as many times as you wish. For example, if you typically use the same analysis conditions for many of your analyses, you can create an analysis conditions file containing those conditions. Then when you create your sample file, select that file for your analysis conditions.

A sample information file can be created by an Analyst or a Developer. A Developer can create a sample file in its entirety, specifying values for all parameters; all fields on the dialogs are enabled for input. An Analyst can create a sample file by selecting predefined parameter files from drop-down lists.

### Analyst

The Sample Information dialog displays in this manner for the Analyst.
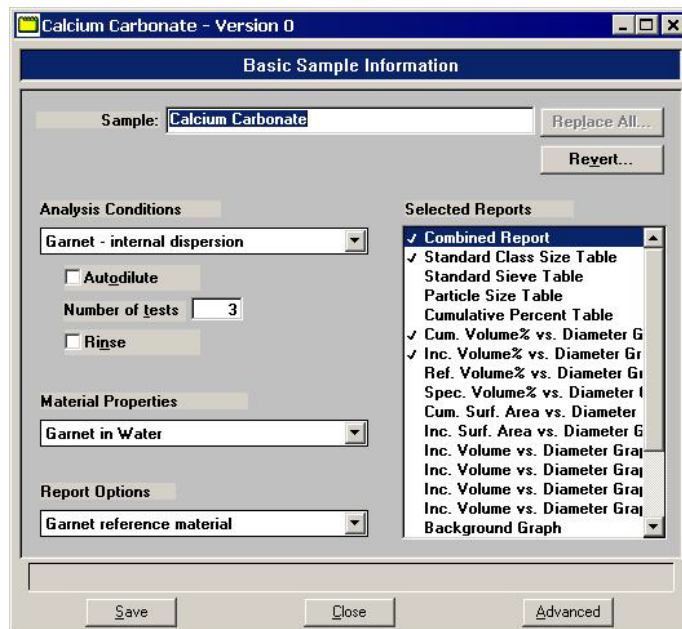
**Sample**                  Displays the description of the template. You may enter a
                            new description or add to the existing one. You can use up to
                            50 alphanumeric characters.  The description you enter in this
                            field appears in the **Files** list window on the Open Sample
                            Information dialog.

                            You can use up to 50 alphanumeric characters.

**Revert**                  Displays the Revert dialog allowing you to choose a previous
                            version (if any exist) of the sample file.
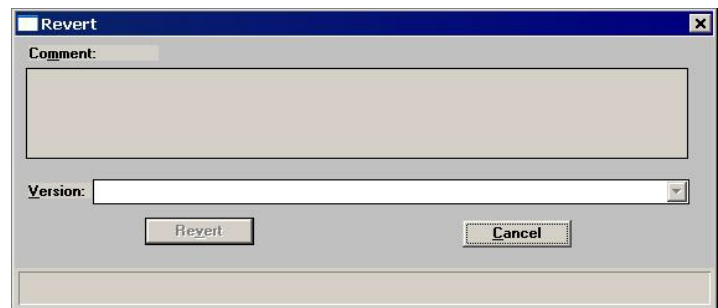


                            This dialog will list previous versions of the current file and
                            the comment entered for each one; it does not list the current
                            version. You can use the drop-down list to choose other
                            versions; each version's comments will be listed in the
                            **Comment** window.

**Analysis Conditions**     Contains the description of the current Analysis Conditions
                            file.

                            To choose a different file, click on the down arrow to the
                            right of the field. This drop-down list contains predefined
                            files created by the Developer. You can view the values of the
                            file you choose by clicking **Advanced**; however you cannot
                            edit them.

**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.

**Material Properties**        Contains the description for the current Materials Properties file.

                               To choose a different file, click on the down arrow to the right of the field. This drop-down list contains predefined files created by the Developer. You can view the values of the file you choose by clicking **Advanced**; however you cannot edit them.

**Report Options**             Contains the description for the current Report Options file.

                               To choose a different file, click on the down arrow to the right of the field. This drop-down list contains predefined files created by the Developer. You can edit some reports by clicking **Advanced**, then **Edit**.

**Selected Reports**           Displays a list of available reports. The reports selected for the current Report Options file are preceded with a check mark ($\checkmark$); these selections can be edited.

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

**Save**                                    Displays the Save As Sample File dialog.
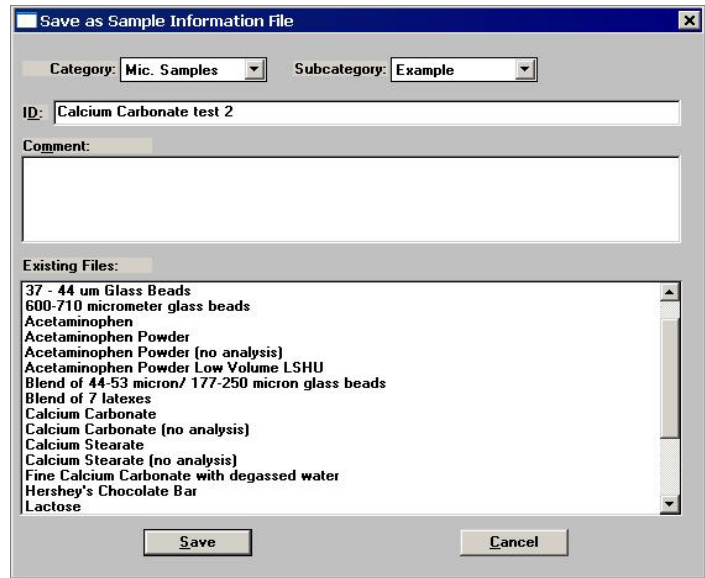


From this dialog, choose the directory in which to save the file. The **Save** push button becomes enabled allowing you to complete the save operation after you make an entry in the **Comment** window.

> **If Save does not become enabled after an entry is made in the Comments window, a file with the same ID currently exists in the selected directory. You must choose a different directory or edit the identification of the current file.**

**Close**                                   Closes the dialog. If the file contains unsaved changes, you are prompted to save before the dialog closes.

**Advanced**                                Displays the sample information file in the Developer's format. This format allows you to view details of the sample file and allows some fields to be edited. Refer to the next section for a description of the fields for the Developer's format.

## Developer

The Sample Information dialog displays in this manner for a Developer.



Some fields on the Developer's view of the Sample Information dialog are also enabled for the Analyst when **Advanced** is clicked from the Analyst Sample Information dialog.

| | |
|---|---|
| **Sample** | Displays the description for the current sample template. You may enter a new description or add to the existing one. You can use up to 50 alphanumeric characters. |
| **Operator Submitter** | Enter the name of the operator who will be using this file to perform the analysis and the name of the person (or department) submitting the sample for analysis. You can use up to 40 characters in each field. |
| **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 using the **Edit Labels** command on the Options menu.

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

You can use up to 40 characters in  this field. |

**Type of Data**

Choose whether you wish to enter the data or have it collected automatically by the analysis program.

If you choose **Manually entered**, an "Entered" tab is added so that you may enter the desired data. You cannot enter data if you are creating the file on a computer that is not attached to the analyzer.

**User Parameters**

These fields are used specifically for SPC (Statistical Process Control) reporting. The parameters on which you wish to report are specified by selecting **Edit Labels** from the Options menu (refer to **Edit Labels**, page **7-4** for additional information). The parameter(s) you specify will replace the User Parameter label(s) displayed here.

If SPC reporting is not desired, you can specify to have these fields 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**

Displays a dialog so that you may 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.

**Revert**

Displays the Revert dialog allowing you to choose a previous version (if any exist) of the sample file.
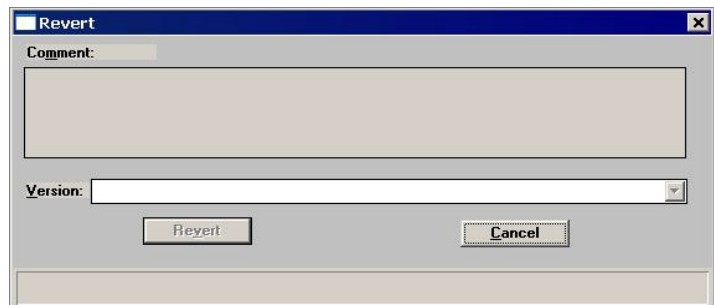


This dialog will list previous versions of the current file and the comment entered for each one; it does not list the current version. You can use the drop-down list to choose other versions; each version's comments will be listed in the **Comment** window.

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

**Save**                           Displays the Save As Sample File dialog. Refer to page
                                   **Save**, page **4-7** for an explanation of this dialog.

**Close**                          Closes the dialog. If the file contains unsaved changes, you
                                   are prompted to save before the dialog box closes.

**Save As Template**               Saves all parameters as a Sample File template.

**Basic**                          Displays the sample information file in the Analyst's format
                                   (explained in the previous section).

## Analysis Conditions

This dialog allows you to specify the analysis conditions for your sample. An analysis conditions file can be created as an independent parameter file or as part of the sample information file.



**Analysis Conditions**        Displays a description of the current Analysis Conditions template.

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**        Click this push button to choose a file containing parameters you wish to copy and use in the current file.

After the values have been copied into the file, you can edit them as desired. It does not affect the values of the file from which they were copied.

**Flow rate group box**        Displays the flow rate conditions for the current template.

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

Select **Enter rate**; 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 template.

**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. Select **On during test** to have the probe remain operating 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**

Allows you to enter the number of tests (analyses) you wish to perform using this 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.

**Save**                          Displays the Save As Analysis Conditions File dialog.

                                  After you enter a description, the **Save** push button becomes
                                  enabled allowing you to complete the save operation. If **Save**
                                  does not become enabled, a file with the same ID currently
                                  exists. The DigiSizer Confirm program does not allow
                                  duplicate descriptions. You must edit the identification before
                                  you can save the file.

**Close**                         Closes the dialog. If the file contains unsaved changes, you
                                  are prompted to save before the dialog box closes.

**Save As Template**              Allows you to create an analysis conditions template of the
                                  current file.

## 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.
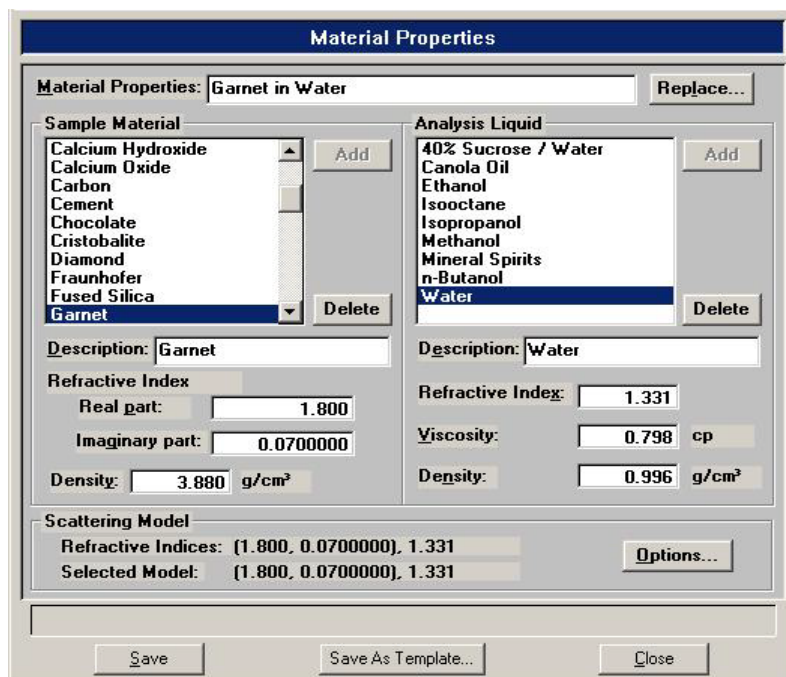


| **Material Properties** | Displays a description of the current Material Properties template. |
| --- | --- |
| | Enter a new description or add to the existing one if desired. Be sure to use an intuitive name (perhaps one that characterizes the sample's properties) so that it can be easily recognized when needed. |
| | *Range:      40 alphanumeric characters* |
| **Replace** | Click this push button to choose a file containing parameters you wish to copy and use in the current file. |
| | After the values have been copied into the file, you can edit them as desired. It does not affect the values of the file from which they were copied. |

**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

1.  In the **Description** field, enter the name of the sample material you wish to add.

2.  In the **Density** field, enter the density of the material you are adding.

3.  In the **Refractive Index** fields, enter the real (Re) and imaginary (Im) portions of the refractive index.

4.  Click **Add**.

---

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

---

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

1.  Select (highlight) the sample material you wish to edit.

2.  Enter the new value(s) in the appropriate field(s).

3.  Move the mouse pointer to another field; note that **Add** changes to **Change**.

4.  Click **Add**; 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. |
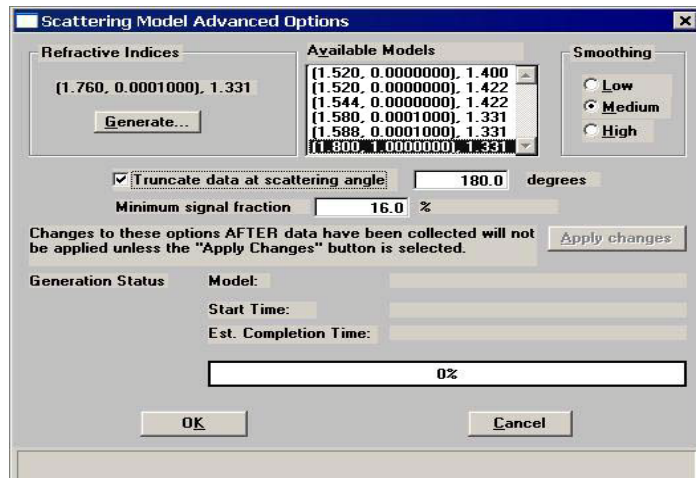
**Options**

*(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

**Save**                          Displays the Save As Material Properties File dialog.

After you enter a description, the **Save** push button becomes enabled allowing you to complete the save operation. If **Save** does not become enabled, a file with the same ID currently exists. The DigiSizers Confirm program does not allow duplicate descriptions. You must edit the identification before you can save the file.

**Close**                         Closes the dialog. If the file contains unsaved changes, you are prompted to save before the dialog closes.

**Save As Template**              Allows you to create an adsorptive properties template of the current file.

## Report Options

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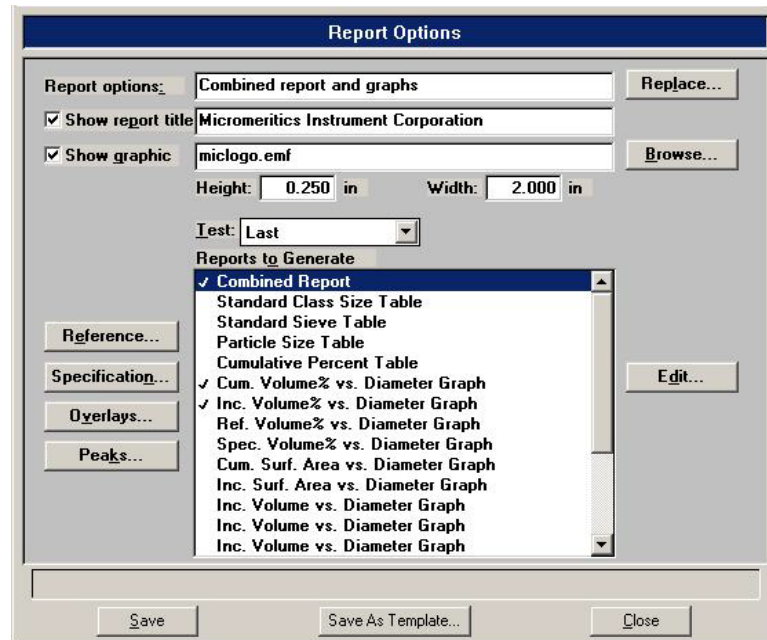


| **Report options** | Displays a description of the current Report Options template. |
| --- | --- |
| | Enter a new description or add to the existing one if desired. Be sure to use an intuitive name so that it can be easily recognized when needed. |
| | *Range:      40 alphanumeric characters* |
| **Replace** | Click this push button to choose a file containing parameters you wish to copy and use in the current file. |
| | After the values have been copied into the file, you can edit them as desired. It does not affect the values of the file from which they were copied. |

**Show report title**

This option allows you to enter a title for your report.

If this is a new file, the title you specified as the default is displayed. Accept the default title or enter a different one.

Deselect this option to omit the report title.

*Range:       40 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 the size.
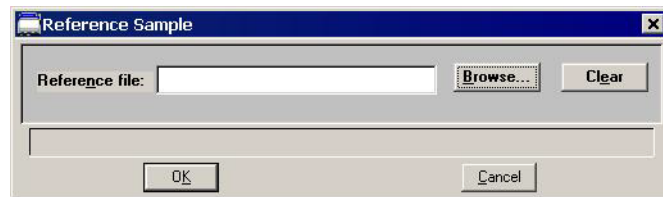
The image can also be edited from the report window.

**Test**

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

**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.
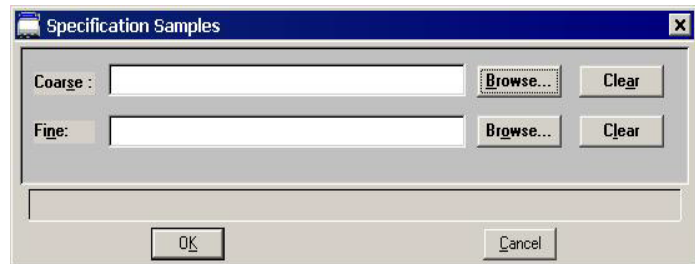


- Click **Browse** to the right of each field to display the Specification Sample File dialog containing a list of sample files from which to choose.

- 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.
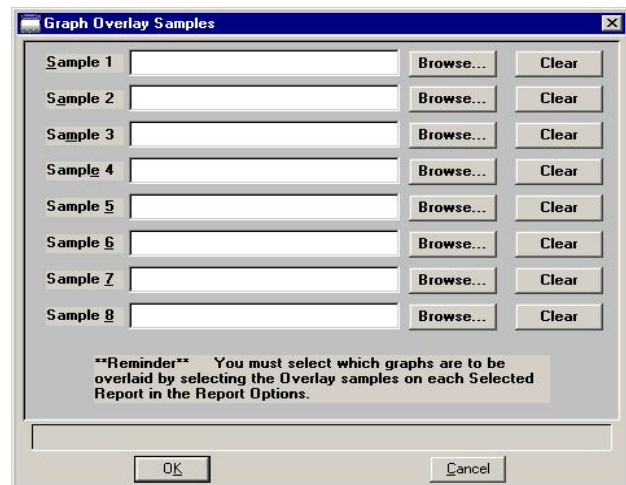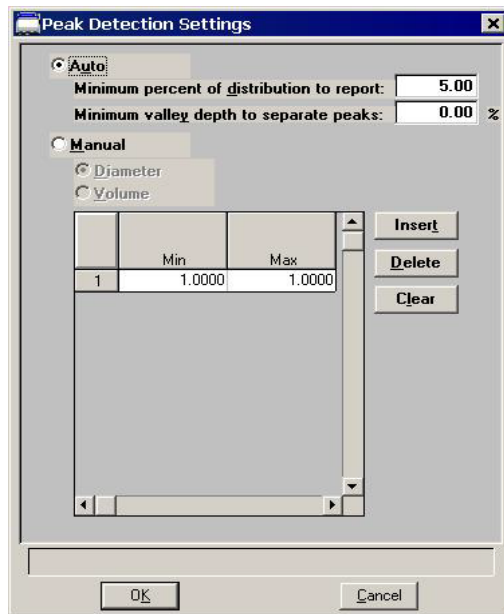


Click **Browse** to the right of the sample number field; choose the desired file, then **OK**.

You can select up to eight files. Refer to **Generating Overlays**, page **3-48** 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
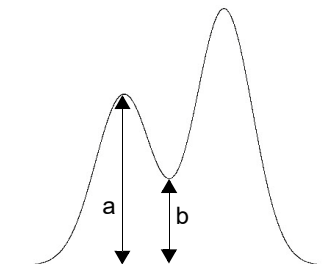


                                   If the depth is greater than the value you enter as the
                                   minimum, the two peaks are treated as separate; otherwise,
                                   they are treated as one peak.

| | |
|---|---|
| **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. |
| **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 (✓). |
| | 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 parameters of the selected report. |
| | This push button is disabled for the following reports; they cannot be edited: |
| | • Rosin Rammler<br>• Log Probability<br>• Sample Log |
| **Save** | Displays the Save As Report Options File dialog. |
| | After you enter a description, the **Save** push button becomes enabled allowing you to complete the save operation. If **Save** does not become enabled, a file with the same ID currently exists. The DigiSizer Confirm program does not allow duplicate descriptions. You must edit the identification before you can save the file. |
| **Close** | Closes the dialog. If the file contains unsaved changes, you are prompted to save before the dialog closes. |
| **Save As Template** | Allows you to create a report options template of the current file. |

**Combined Report**

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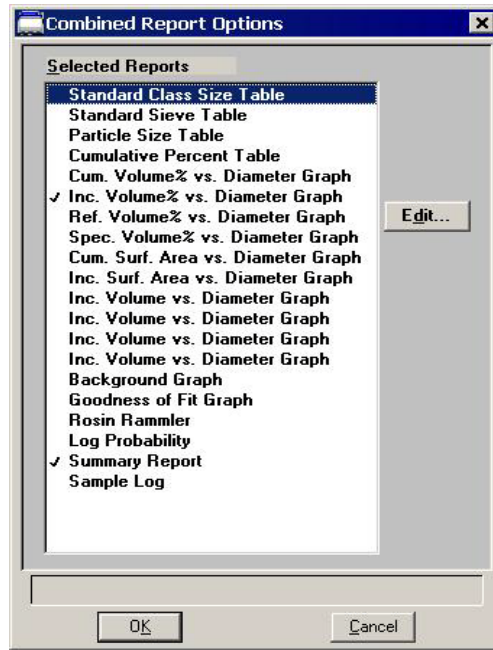


The list of reports for the Combined Report is almost identical (the Combined report, of course, is not included in this list) to the list of reports generated in the normal manner. The difference is that the reports generated from the selections on this dialog contain no page breaks or headings. And, 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 title bar displays the name of the table being edited.

These components do not display if you are editing the Standard Class Size Table or the Standard Sieve Table.
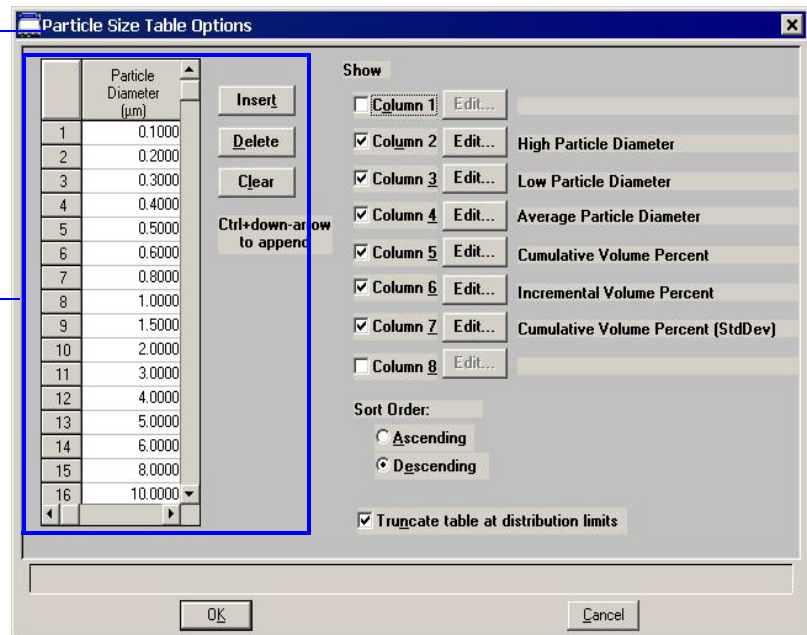
The Standard Class Size Table and the Standard Sieve Table are fixed and, therefore, do not contain a table nor push buttons.

- The Standard Class Size Table is fixed based on 40 classes per decade (refer to **Appendix F**, page **F-1** for data reduction information).

- The Standard Sieve Table is fixed based on the sieves you specify (refer to page **Sieve Table**, page **7-6**).

| **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]**                          Use the options from the drop-down lists to choose the type of data you wish to display in report columns.

    **Order of Sizes**               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.
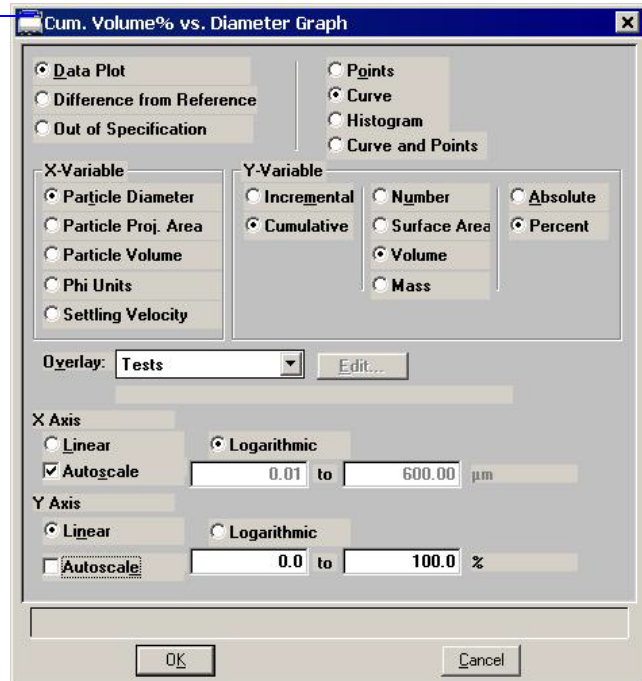


**Data Plot**
**Difference from Reference**
**Out of Specification**

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.
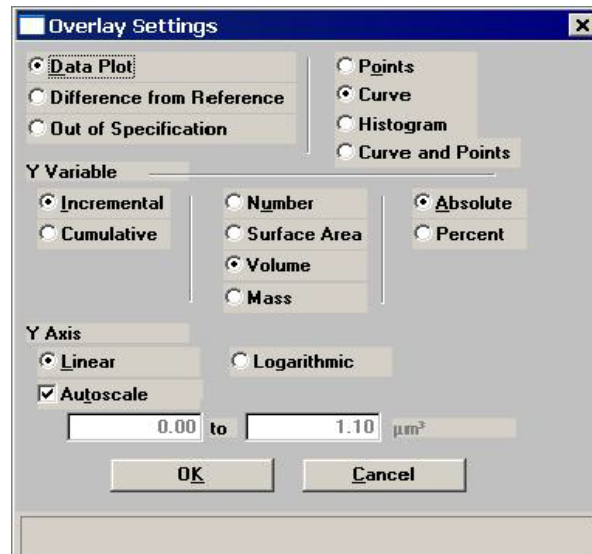


**X Axis**                Allows you to choose between a Linear or Logarithmic scale
**Y Axis**                as well as autoscale options.

**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.
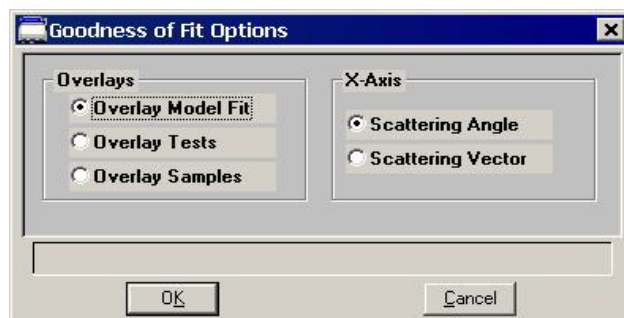
**Overlay Samples**

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.



The options on this dialog allow you to specify the X-axis variable as well as the type of overlay.

**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**            Choose whether you wish to have the X-axis display the Scattering Angle or Scattering Vector.

## Rosin Rammler

The Rosin Rammler report depicts the collected data as applied to the Rosin Rammler[1] theory; this report cannot be edited.
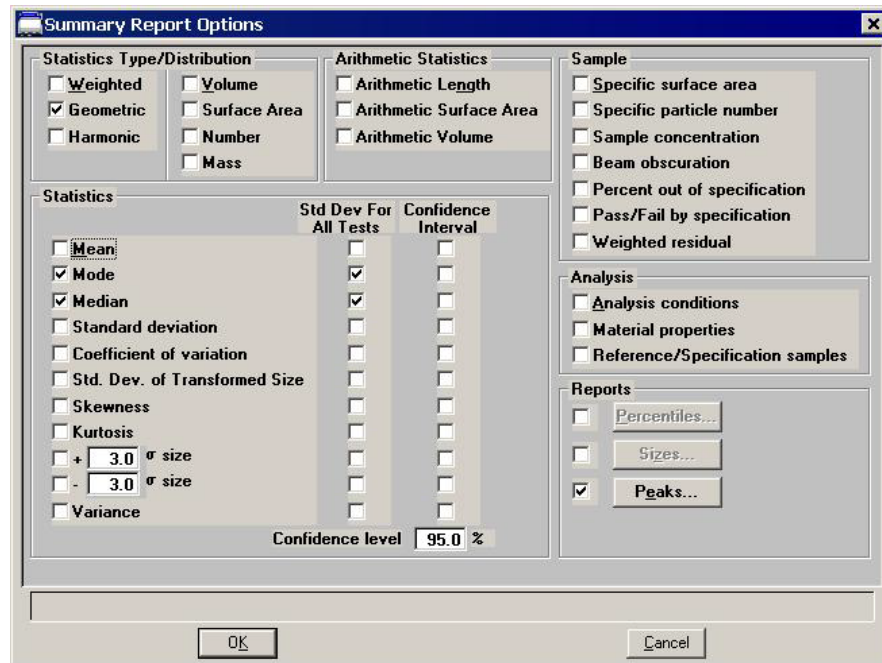
1. Rosin, P. and Rammler, E., *J. Inst. Fuel*, 7, 20 (1933)

### 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.
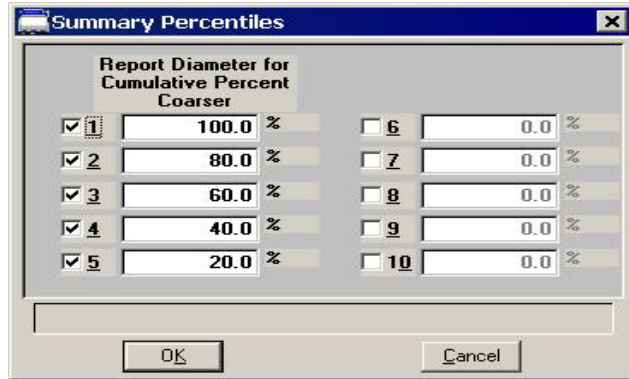


This dialog allows you to report the particle diameter (or radius) corresponding to each specified coarser (or finer) percentile. You can enter up to 10 values in any order. If you enter zero (0.00), a blank line is shown on the report.
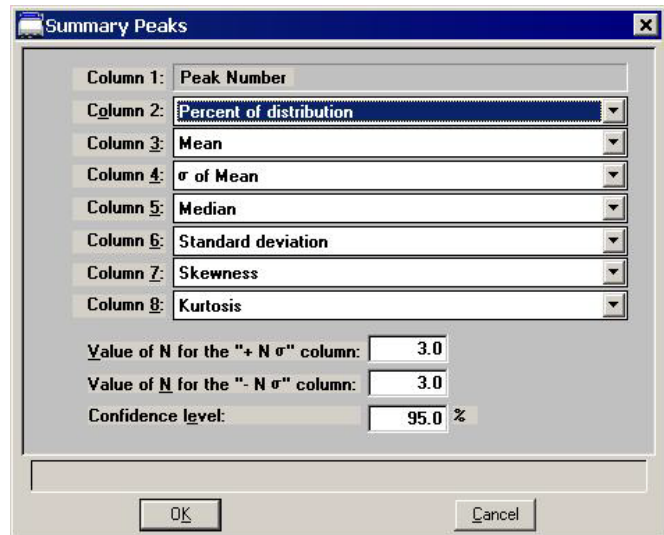
**Sizes**                       Displays the Summary Sizes dialog.
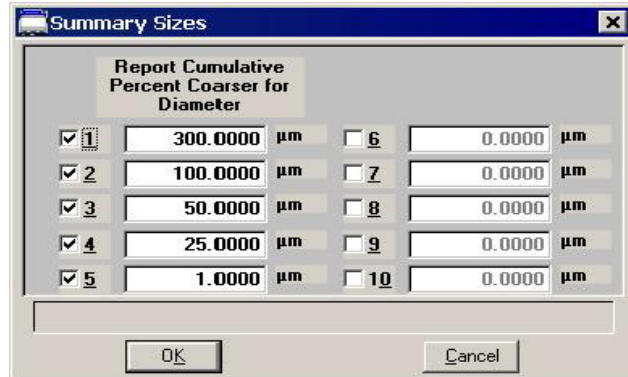


This dialog allows you to report the cumulative percent (or fraction) coarse (or finer) for each specified diameter (volume). You can enter up to 10 values in any order. If you enter zero (0.00), a blank line is shown on the report.

**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
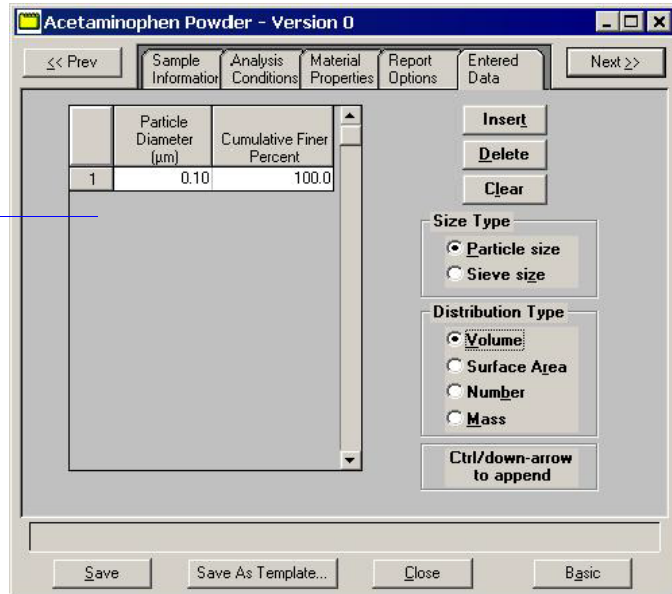- warnings and/or errors that occurred during analysis

## Entered Data

The Entered Data tab displays when you choose **Entered** as the type of data on the Sample Information dialog. This dialog allows you to enter the data manually.

> **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.**

This type of table displays if you choose **Sieve size** for the size type.

| | Pressure table | Allows you to enter data for the size type you choose; **Particle size** or **Sieve size**. |

**Pressure table**        Allows you to enter data for the size type you choose; **Particle size** or **Sieve size**.

**Insert**                Inserts a row into the pressure table.

**Delete**                Deletes the selected row.

**Clear**                 Clears the table of all rows except one; one is required.

> **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 size data you wish to enter.

**Particle size**            Allows you to enter the particle diameter and the cumulative coarser (or finer) percent for the sample.

**Sieve size**            Allow you to enter the percent passed through each specified sieve.

**Distribution Type**            Allows you to choose the type of distribution data you  plan to enter. You can choose to report by **Volume**, **Area**, or **Number**.

# Open

**Open** allows you to open an existing sample or parameter file, or a sample template.

## Sample Information File

The following dialog displays for the Analyst and Developer when you select **File >Open > Sample information**.
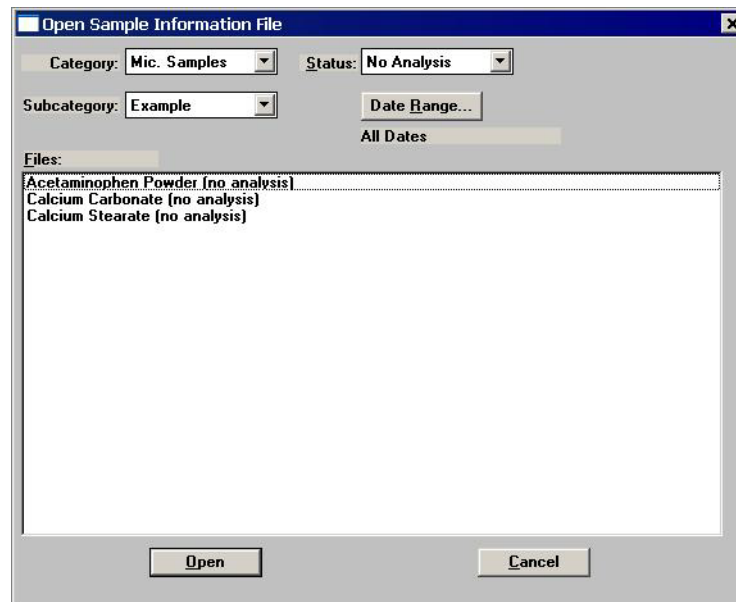


A sample file can be edited by a Developer or an Analyst. The changes can also be saved. If you do choose to save the changes, a dialog prompting for a reason is displayed. After you enter a reason in the **Comments** field, **Save** is enabled so that you can complete the save operation. These changes are saved as a version of the sample file, becoming part of the sample file history. All versions of the sample file (of the Status selected) can be viewed when you click **Revert** on the Sample file dialog.

| | |
|---|---|
| **Category/Subcategory** | These drop-down lists contain existing archive locations (directories) in which files have been stored. The directory labels shown in this example are defaults. Many laboratories use the Year/Month system. A Developer can edit these labels if desired (refer to **Edit Labels**, page **7-4**). |
| **Status** | This drop-down list allows you to choose the types of sample files to display in the **Files** window. All files of the type you choose, within the range of dates, and in the current directory are displayed. Refer to **Table 2-2. File Status and Description**, page **2-16** for a description of file types. |

**Date Range**                Click this push button to display files created within a
                              specified range of dates; the Select Dates dialog is displayed.
                              Refer to **Selecting Files**, page **2-16** for information on this
                              dialog.

**Files window**              Lists the file(s) of the type selected in the **Status** list within
                              the selected directory and range of dates.


## Analyst

When an Analyst opens a sample information file, the dialog displays in this manner:
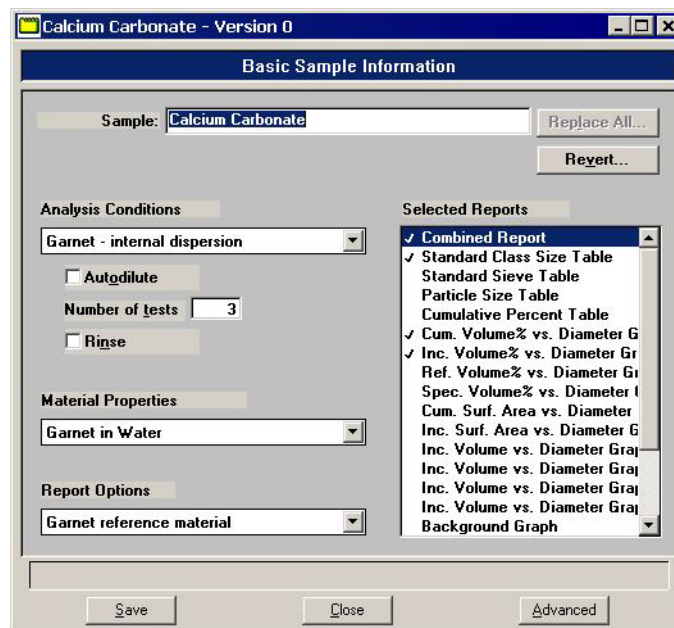


If desired, an Analyst can click **Advanced** to access the Developer's view of the dialog. This
view allows him to review the parameters used in the analysis. He/she can edit certain param-
eters of the sample file; the fields for those parameters are enabled. Report options can also be
edited and reports generated.

## Developer

When a Developer opens a sample information file, the dialog displays in this manner:
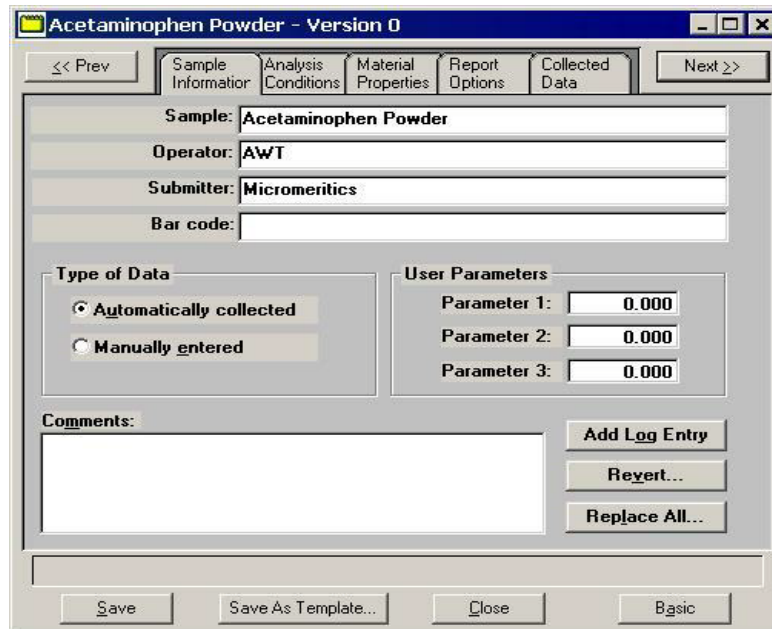


A Developer can view all parameters of the file, as well as edit certain parameters; those parameters are enabled. Report options can also be edited and reports generated.
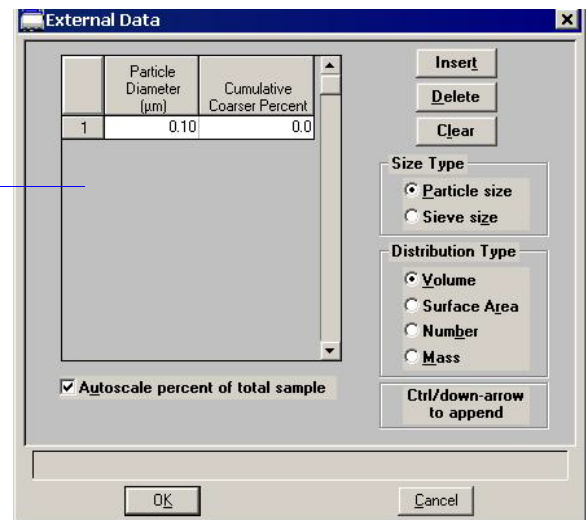
A Developer's view of the dialog includes a **Collected Data** tab (post-analysis) which allows you to view the points collected during analysis.
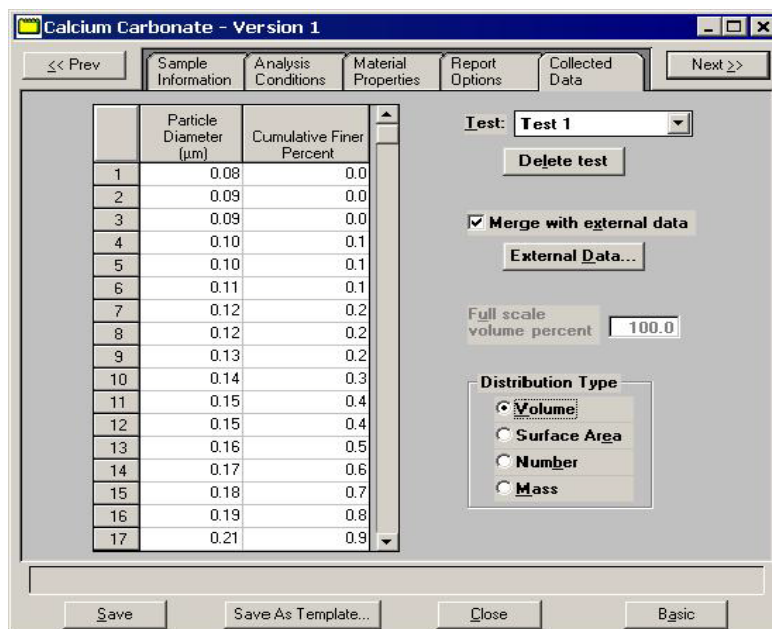
| Table | Displays the data points collected for the current test. |
|---|---|
| Test | Displays the current test for this sample file. If you wish to view data for another test, click on the down arrow to select the desired test.<br><br>This drop-down list contains all tests performed using the current sample file. |
| Delete Test | Enables you to delete the test shown in the **Test** field. |
| 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. |

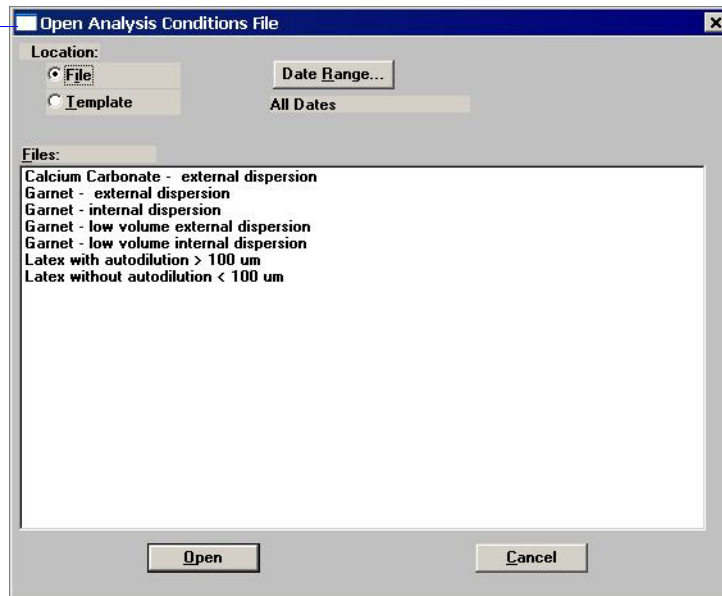This type of table displays if you choose **Sieve size** for the size type.

## Templates

Sample and Parameter templates can be opened and their contents viewed by a Developer or an Analyst. You cannot make changes to an existing template. If you wish to make changes, the Developer will have to create a new template. The Analyst is not authorized to create templates.

## Parameter Files

Parameter files (Analysis Conditions, Material Properties, and Report Options) can be opened only by a Developer. When you select **File > Open > (parameter file)**, an Open (parameter) dialog is displayed.

Title bar displays the type of file you are opening.

| | |
|---|---|
| **Open Analysis Conditions File** | ☒ |

Location:
- ⦿ File
- ○ Template

Date Range...

All Dates

Files:
Calcium Carbonate - external dispersion
Garnet - external dispersion
Garnet - internal dispersion
Garnet - low volume external dispersion
Garnet - low volume internal dispersion
Latex with autodilution > 100 um
Latex without autodilution < 100 um

Open            Cancel

**Location**          Allows you to open a parameter **File** or a **Template** for a parameter file.

You can open a template and view the details but you cannot edit the values. If you wish to make changes, you will have to create a new template. You can edit and save changes in a parameter file.

**Date Range**        Allows you to choose a range of dates in which to display files in the **Files** window. Refer to **Selecting Files**, page **2-16** for information on this dialog.

## 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

**An Analyst is not authorized to use the Save As function.**

A Developer can use this function to:

- save a sample file in the active window as another sample file with a different name. The sample file must have a **No Analysis** status if you plan to edit parameters. If you use the Save As function with a file of a **Complete** status, you will not be able to edit the values of the new file.

  When you select this option, this type of dialog is displayed.



Enter a description in the **ID** field; you can use up to 50 characters. You must also enter a comment in the **Comment** window to enable the **Save** push button. The new file is saved as specified, but does not remain in the active window. Be sure to open the new file before making any changes.

- save a parameter file in the active window with a different name. The parameter file must be of the same type; for example, you can save an Analysis conditions file only as another Analysis conditions file.

When you save as a parameter file, this type of dialog is displayed.
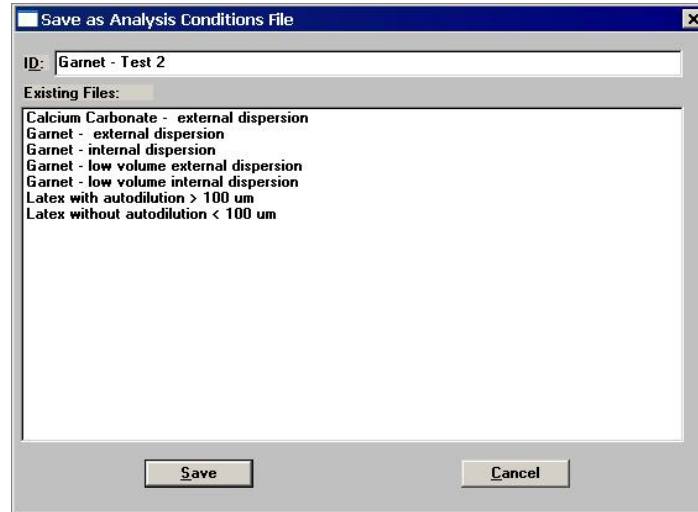


Enter a description in the **ID** field; you can use up to 50 characters. If the **Save** push button does not become enabled, a file with the same description already exists. The confirm program disallows duplicate file descriptions. Edit the description to enable the Save push button.

- save a subset (parameter) of the sample file in the active window as a standalone parameter file. For example, select **File > Save As > Analysis Conditions** to create a standalone parameter file of the analysis conditions portion of the active sample file.

When you save a subset of a sample as a parameter file, the same type of dialog as shown above is displayed.

## Save As Template

**Save As Template** allows the Developer to:

- save the values of the sample file in the active window as a sample template.

- save a subset (parameter) of the sample file in the active window as a parameter file template.

- save the values of a parameter file in the active window as a parameter file template.

## 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.

A dialog prompting for a reason for the current change version of each file is displayed.

## Close

**Close** enables you to close the file in the active window. If the file contains changes that have not been saved, the following message is displayed:

**(file name) has been changed. Save changes before closing?**

**Yes**              **No**              **Cancel**

Click **Yes**; a dialog prompting for a reason for the change is displayed before the file closes.

Click **No** to close the file without saving the changes.

Click **Cancel** to return to the active file.

# Close All

**Close All** enables you to close all open files under their current names. The following message displays for every file containing changes that have not been saved:

**(file name) has been changed.**
**Save changes before closing?**

**Yes          No          Cancel**

Click **Yes**; a dialog prompting for a reason for the change is displayed before the file closes.

Click **No** to close the file without saving the changes.

Click **Cancel** to return to the active file.

# Print

Print enables you to print details of a sample file, sample template, 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.

## Sample Information

Contents of a Sample Information file can be printed by a Developer or an Analyst; the Print Sample Information dialog is displayed.
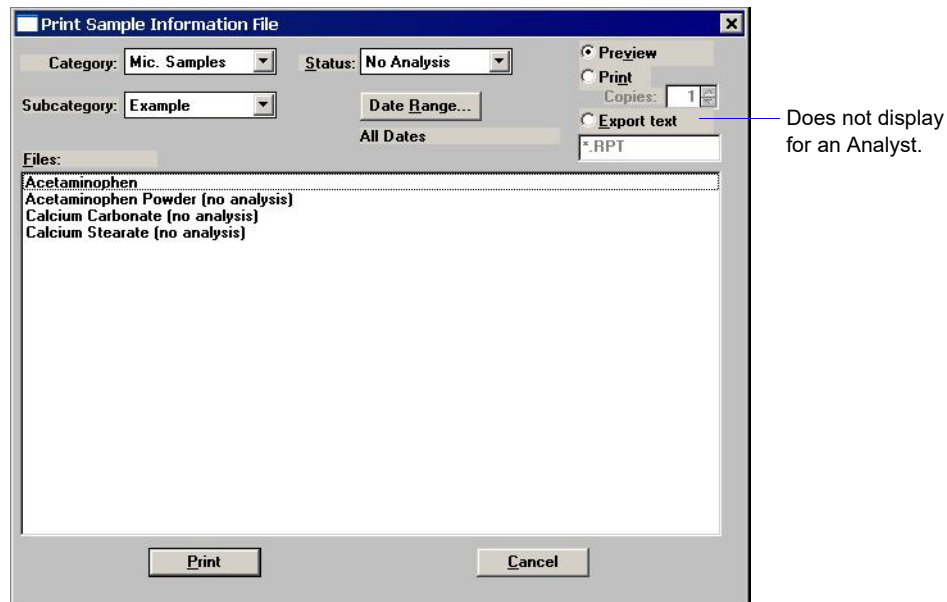
| Category/Subcategory | These drop-down lists contain the existing directories in which files are stored. |
|---|---|
| **Status** | This drop-down list allows you to choose the types of sample files to display in the **Files** window. (Refer to **Table 2-2. File Status and Description**, page **2-16** for a description of the status types.) All files of the type you choose, within the range of dates, and in the current directory are displayed. |
| **Date Range** | Allows you to specify a range of dates for the files you wish to display in the **Files** list window, or you can choose **All** for all files to display. The range you choose is displayed below the push button. (Refer to page **Selecting Files**, page **2-15** for information on this push button.) |

**Preview**
**Print**
**Export**

Choose **Preview** to view the file on the computer screen; you can then print the file from the preview window.

Choose **Print** to send the file directly to the printer; you can print up to four copies.

Choose **Export** to print to a file; use the field below the Export option to enter a name. The Export option is not available for an Analyst.
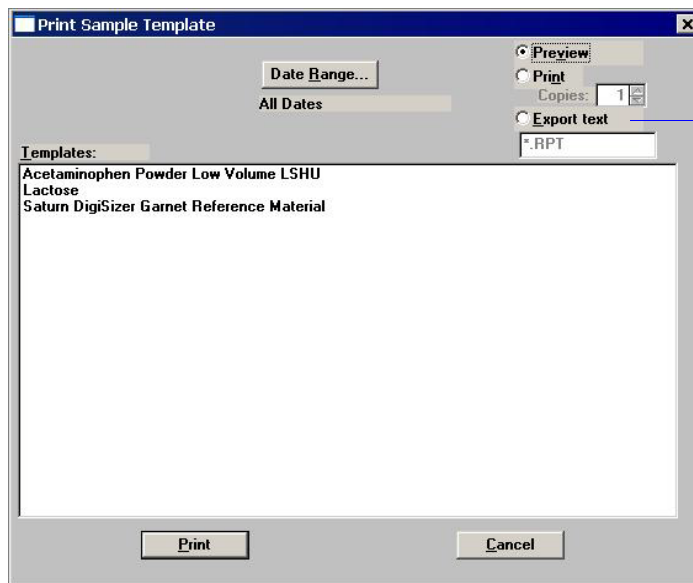
**Files window**

Displays the file(s) of the type selected in the **Status** list within the selected directory and range of dates.

You may print the contents of multiple files by holding down **Ctrl** while selecting files.

## Sample Template

Contents of a Sample Template can be printed by a Developer or an Analyst; the Print Sample Template dialog is displayed.

```
┌─ Print Sample Template ──────────────────────────[X]─┐
│                                    ⦿ Preview           │   ─── Does not display
│              Date Range...         ○ Print             │       for an Analyst.
│              All Dates               Copies:  [ 1 ]    │
│                                    ○ Export text       │
│  Templates:                          [*.RPT        ]   │
│  Acetaminophen Powder Low Volume LSHU                  │
│  Lactose                                               │
│  Saturn DigiSizer Garnet Reference Material            │
│                                                        │
│                                                        │
│                                                        │
│                                                        │
│                                                        │
│                                                        │
│                                                        │
│                                                        │
│                                                        │
│         [  Print  ]              [  Cancel  ]          │
└────────────────────────────────────────────────────────┘
```

Refer to the previous page for an explanation of the fields on this dialog.
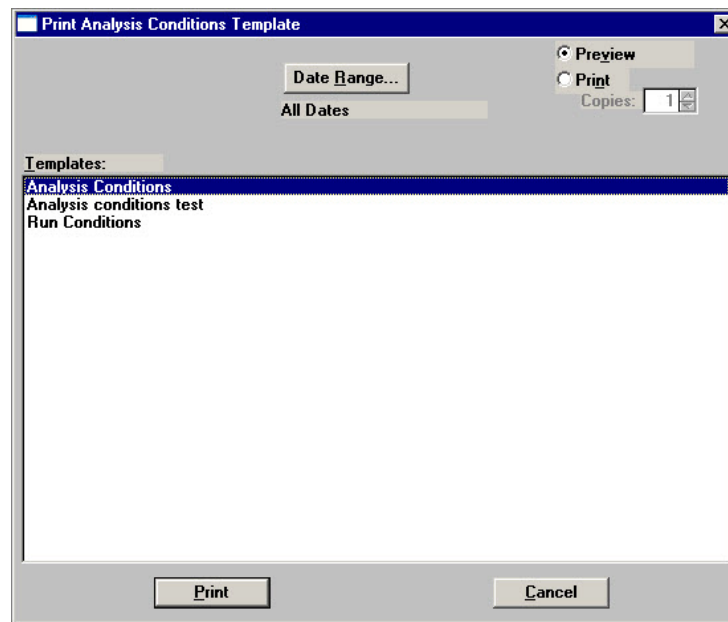
## Parameter Files and Parameter Templates

The contents of a parameter file can be printed only by a Developer. The contents of parameter file templates can be printed by a Developer or an Analyst. This type of dialog displays for a Developer. A Developer simply selects **File** or **Template**.

Select File for parameter files or Template for parameter templates.
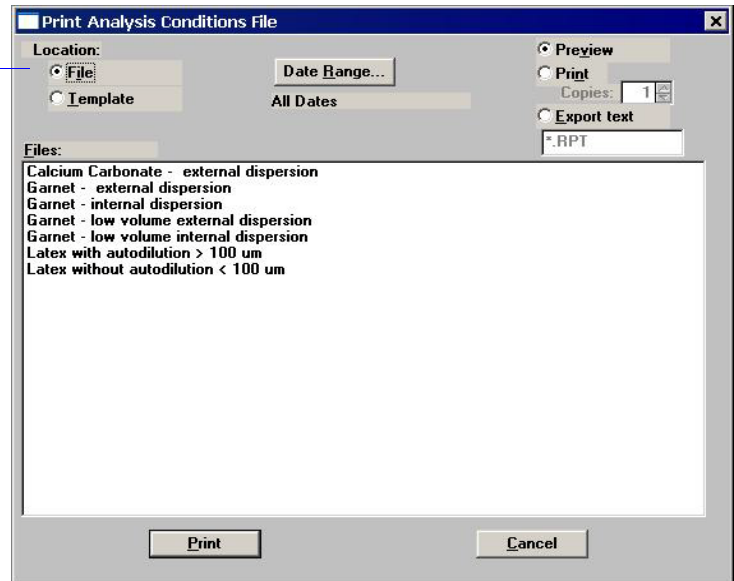


Refer to page **4-47** for an explanation of the fields on this dialog.

An Analyst can print the contents of parameter file *templates* (not parameter files) by selecting **File > Print > (parameter file)**. In this example, **Analysis Conditions** is selected as the parameter; the Print Analysis Conditions *Template* dialog is displayed.
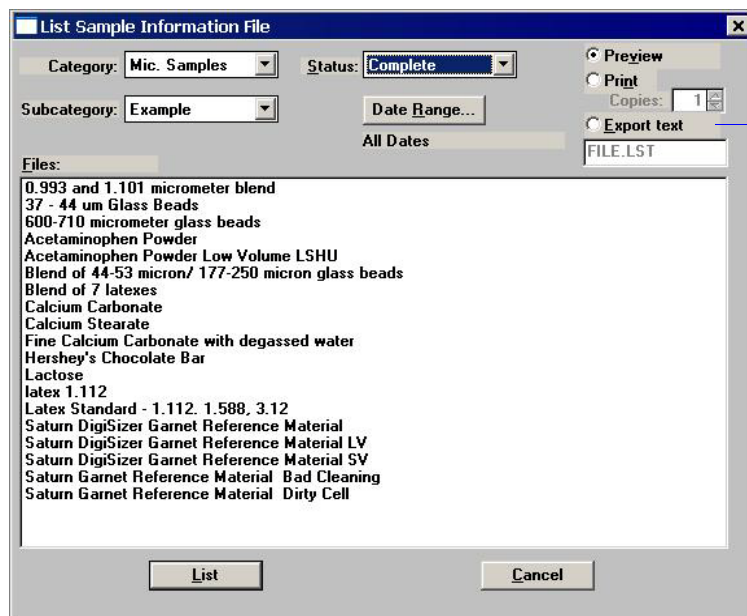
# List

List enables you to generate a listing of the following information on a selected sample file, parameter file, or a sample template.

- 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 for which you have requested statistics.



Permissions for listing statistics are the same as for the printing file contents. For example, an Analyst can list statistics for parameter file templates, but not for parameter files.

The behavior of the List dialog is the same as the Print dialog; refer to **Print**, page **4-47** for an explanation of the fields on this dialog.

You may request a list of multiple files by holding down **Ctrl** while selecting files. If no files are selected, a list is generated for *all* files.

# Import

An Analyst is not authorized to import sample or parameter files.

The Developer can use this option to import files that have been created external to the Confirm software and copied into the Import directory. If the files are not copied into the **Import** directory, they will not display in the **Files** window. Use Windows Explorer to copy the files into the **Import** directory.
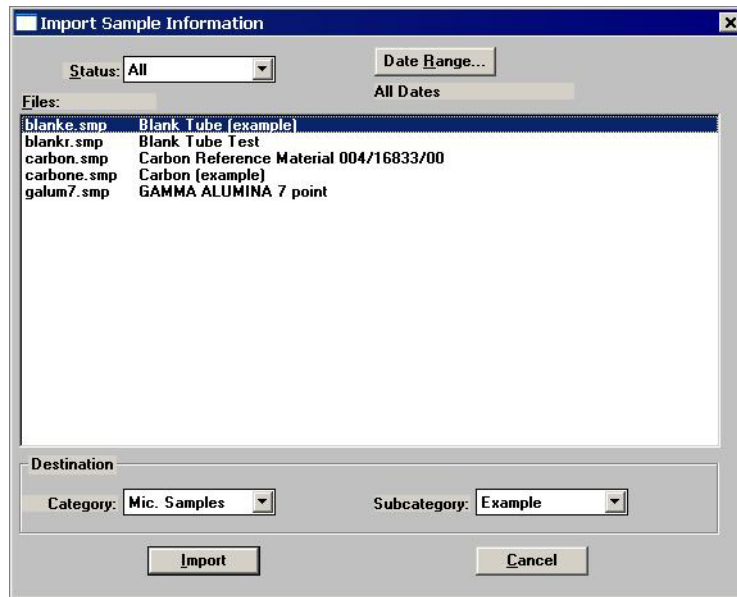


| Category Subcategory | Use these drop-down lists to choose the directory into which you wish to import the file. Refer to **Edit Labels**, page **7-4** for information on creating directories. |
|---|---|
| | These drop-down lists do not display when importing parameter files. Parameter files are imported into an assigned directory. |

| Status Date Range | Use these two options to limit the files displayed in the **Files** window. The **Status** drop-down list does not display when importing parameter files. |
|---|---|
| | Refer to **Selecting Files**, page **2-15** if you need assistance on the Status types and the **Date Range** push button. |

# Export

An Analyst is not authorized to export sample files.

A Developer can use the **Export** option to:

- export the entire sample file. For example, you may wish to use this option to transfer a sample file to another computer.

- 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.

All files are exported to the **Export** directory. Make a note of the automatically generated file number (shown in the dialog below) for retrieval.

When exported as ASCII text, the particle size and intensity data can be imported into other applications (such as spreadsheets) accepting ASCII format. The data are exported in a comma-delimited format. Refer to **Appendix G**, page **G-1** for the exporting format.
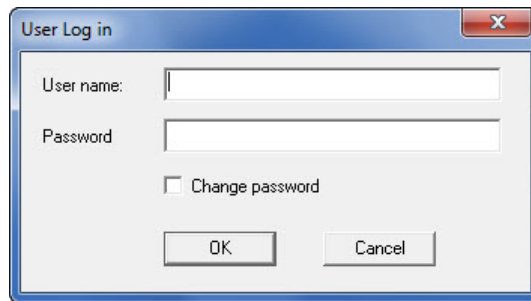
You may select multiple files by holding down **Ctrl** and clicking the left mouse button once on each file.
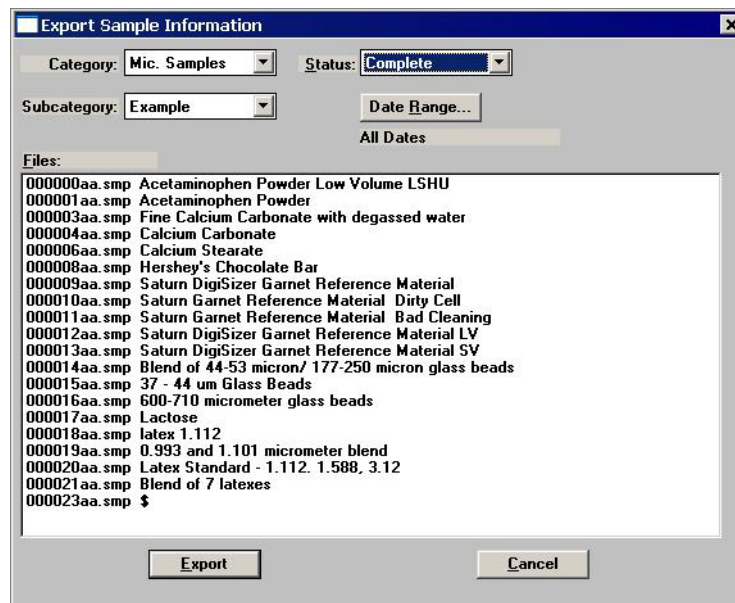


All fields on this dialog function in the same manner as other dialogs, such as the **Import** and **Print** dialogs. Refer to the **Print**, page **4-47** if you need information on these fields.

## Log In

Log in enables you to log into the application; the User Logon dialog is displayed.



Simply enter your user name and password, then click **OK**.

| | |
|---|---|
| **User name** | Typically in this field, you should enter your Windows User name, unless your Administrator has specified a different user name. |
| **Password** | Enter your password. If you enter your password incorrectly a specified number of times (your Administrator determines the number when setting up system options; the default is three), the application will lock and you will not be allowed to proceed. Contact the Administrator to unlock the application and assign a new password. |
| | The first time you log into the application after the Confirm software is installed, you will be prompted to change your password to one of personal preference. You must enter at least six characters. |
| **Change password** | Select this option to change your password after you have logged in; the Set password dialog allowing you to change your password is displayed. |

## Log Out

Select this option to log out of the system. If files are open and contain changes that have not been saved, you are prompted to save or discard them before log out is completed.

# 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 analyzer 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.

# 5. 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 **5-4**.

**QuickStart Analysis**          Use this mode of operation to perform successive sample analyses. Page **5-10**.

**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 **5-15**.

**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 **5-10**.

**Background**                  Allows you to perform a background measurement. Page **5-22**.

**Load from MasterTech**        Allows you to load a sample from the MasterTech into the analyzer. Page **5-25**.

**Rinse**                       Allows you to perform a rinse operation on the DigiSizer, MasterTech, or the MasterTech and the DigiSizer. Page **5-26**.

**Drain**                       Allows you to drain liquid from the Saturn DigiSizer system. Page **5-31**.

**Initialize MasterTech**       Allows you to start the MasterTech or realign the MasterTech turntable. Page **5-31**.

**Enable Manual Control**       Allows you to control the system manually. Page **5-32**.

**Show Instrument Schematic**   Displays a schematic of the analyzer. Page **5-40**.

**Show Results**                Allows you to have results displayed as data are collected when performing multiple analyses. Page **5-41**.

**Show Status**                 Displays the status window of the operation in progress. Page **5-41**.

**Show Instrument Log**    Displays a log of recent analyses, calibrations, and error messages. Page **5-42**.

**Unit Configuration**    Displays the configuration of the analyzer. Page **5-44**.

**Calibration**    Enables you to perform calibration functions. This option is enabled only with the direction of a Micromeritics service representative. Page **5-46**.

**Service Test**    Enables you to perform certain troubleshooting procedures. This option is enabled only with the direction of a Micromeritics service representative. Page **5-46**.

# 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). You must use the **New** push button to create a new file or the **Browse** push button to select an existing one. You can choose a **Complete** file if all tests have not been run; up to eight tests can be performed using a single file.

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 defaults from the template.
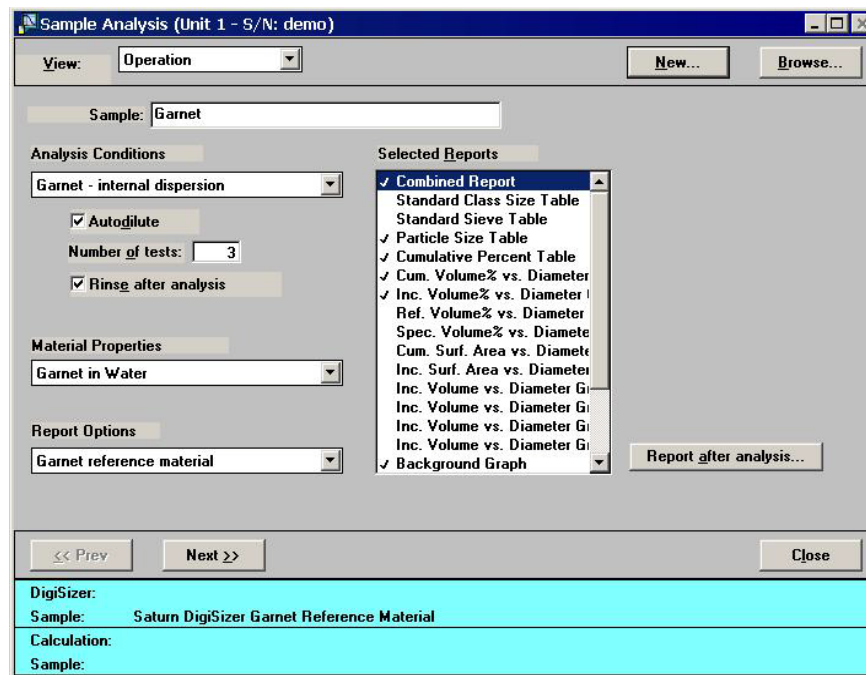


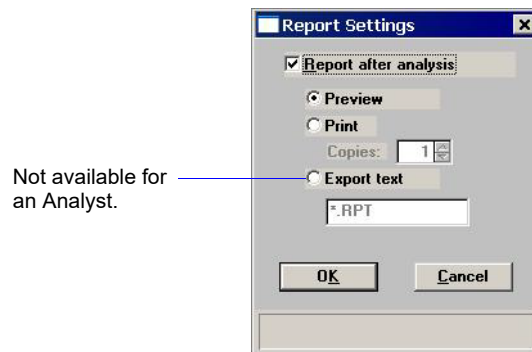| | |
|---|---|
| **View** | Allows you to view one of the following in the current window: |
| | • the current operation |
| | • the instrument schematic (refer to **Show Instrument Schematic**, page **5-40** for additional information) |
| | • the instrument log (refer to **Show Instrument Log**, page **5-42** for additional information) |
| **Browse** | Displays the Open File for Analysis dialog allowing you to select a different sample file for your analysis. |

**New**                                 Displays the Create a File for Analysis dialog allowing you to choose a sample template to create a file for the current analysis.

**Sample**                              Contains the description of the current sample file.

                                        If this is a new file, this field contains description of the sample template. Edit the description as desired.

                                        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.

                                        The drop-down list contains a list of predefined parameter files. Click on the down arrow to choose a different file.

**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**                 Contains the name of the Material Properties file for the current sample file.

                                        The drop-down list contains a list of predefined parameter files. Click on the down arrow to choose a different file.

**Report Options**            Contains the name of the Report Options file for the current sample file.

The drop-down list contains a list of predefined parameter files. Click on the down arrow to choose a different file.

**Selected Reports**          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.

**Report after analysis**     Select this option to have reports generated automatically after analysis, then choose a destination.

**Preview**                   Prints the report to the monitor screen. This option allows you to customize reports with details such as font and column placement. Refer to **Onscreen Reports**, page **6-20** for the options available for onscreen reports.

**Print**                     Prints the report to the printer.

**Copies**                    Enabled when you choose **Print** as the destination for reports, allowing you to generate up to four copies.

**Export**

Exports report data to a file; files are exported as their assigned name. This option is unavailable for an Analyst.

**Next**

Click this push button to advance to the next view of the Analysis dialog; a log in dialog is displayed.



This dialog is used to verify that the logged-in user is performing the analysis. Select the **Log out after start** option to have the system log you out automatically after the analysis starts. For example, you may wish to use this option if you plan to start the analysis at the end of your workshift.

After verification of the user, this view of the Sample Analysis dialog is displayed.
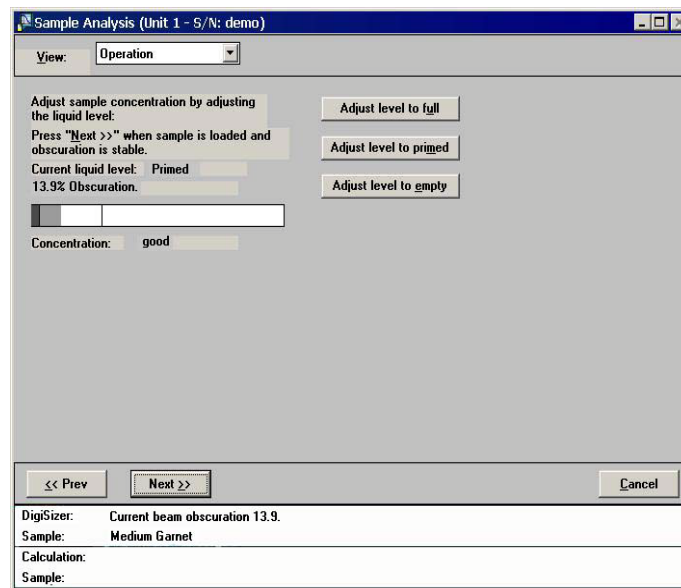


This view of the window shows beam obscuration of the sample as it is being loaded. Add only enough sample to achieve the proper range for your material; use the following guidelines:

| 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, click **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.

**Cancel**                          Click to cancel the current analysis; a confirmation dialog is displayed. If you choose to proceed with the cancellation, the Cancel Analysis dialog prompting for a reason for the cancellation is displayed. After you enter a reason and click **OK**, the analysis is cancelled.

**Next**                            Click this push button to advance to the next view of the Analysis dialog; this view contains the results of the current test.
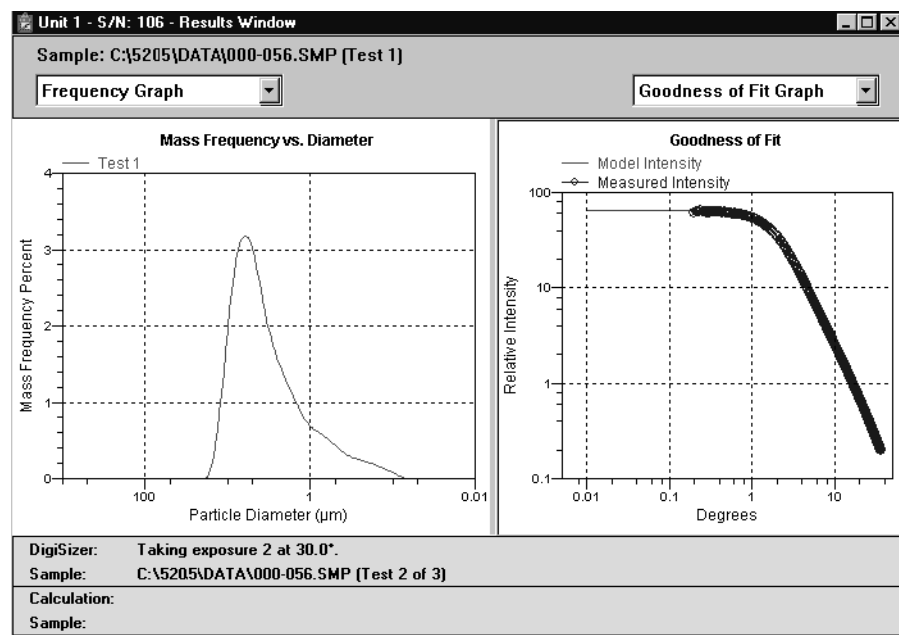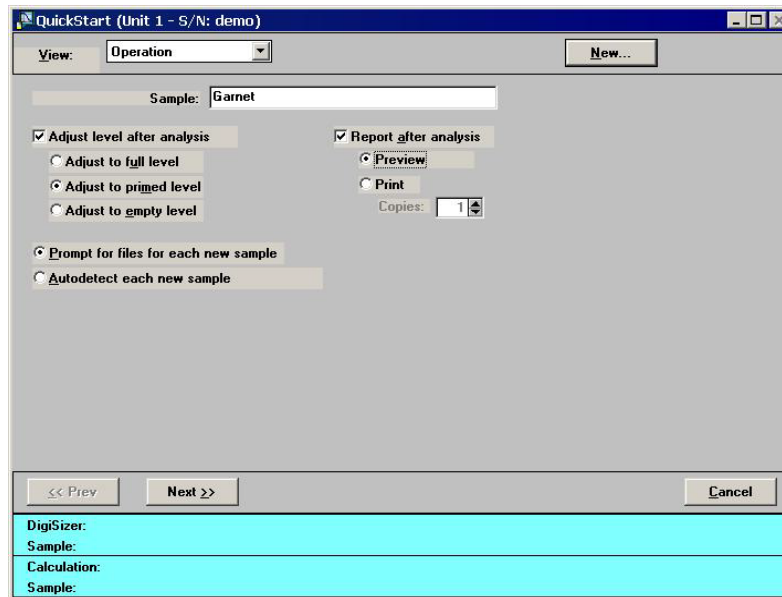


The results window contains two panes. Each pane has a drop-down list (positioned just above the pane) containing the report options specified in the sample file.

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. Refer to **Shortcut Menus**, page **6-23** for additional information.

# 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.



| View | Allows you to view one of the following in the current window: |
|---|---|
| | • the current operation |
| | • the instrument schematic |
| | • the instrument log |
| | • Results |
| **New** | Displays the Create a File for Analysis dialog allowing you to choose a sample template to create a file for the analysis on the selected port. |
| **Sample** | Contains the identification of the current file; the $ symbol is appended automatically allowing a numerical sequence of the generated files. |
| **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* |

**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**         Select this option to have a report(s) generated automatically after each analysis

**Preview**                       Prints the report to the monitor screen. This option allows you to customize reports with details such as font and column placement. Refer to **Onscreen Reports**, page **6-20** for the options available for onscreen reports.

**Print**                         Prints the report to a selected printer.

**Copies**                        Enabled when you choose **Print** as the destination for reports, allowing you to generate up to four copies.

**Export**                        Exports report data to a file; files are exported as their assigned name. This option is unavailable for an Analyst.

**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.

                                  If you use this method, be sure that **Rinse after analysis** is selected in the analysis conditions. Otherwise, the previous sample will not be rinsed from the reservoir; however, the system will detect its presence and analyze it repeatedly.

**Next**

Click this push button to advance to the next view of the Analysis dialog; a logon dialog is displayed.

This dialog is used to verify that the logged-in user is actually performing the analysis. Select the **Logout after start** option to have the system log you out automatically after the analysis starts. For example, you may wish to use this option if you plan to start the analysis at the end of your workshift.

Click **OK**; 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.
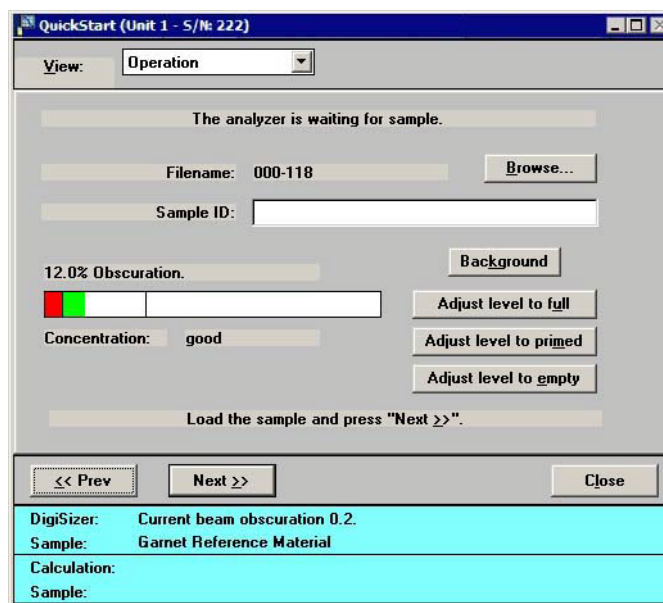


**Browse**

Displays a dialog so that you may select the sample file you wish to use with this analysis. If you do not choose a different file, the values specified in the template you chose on the first screen 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**                    These push buttons allow you to adjust the beam obscuration
**Adjust level to primed**                  to the appropriate range for your sample as it is being added
**Adjust level to empty**                   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 as the sample is being added. When the concentration is in the recommended range for the type of sample you are analyzing (refer to the following guidelines), click **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, select **Cancel** to close the dialog.

- If you choose **Autodetect each new sample**, this view of the QuickStart dialog is displayed:



Use these push buttons to adjust the sample concentration.
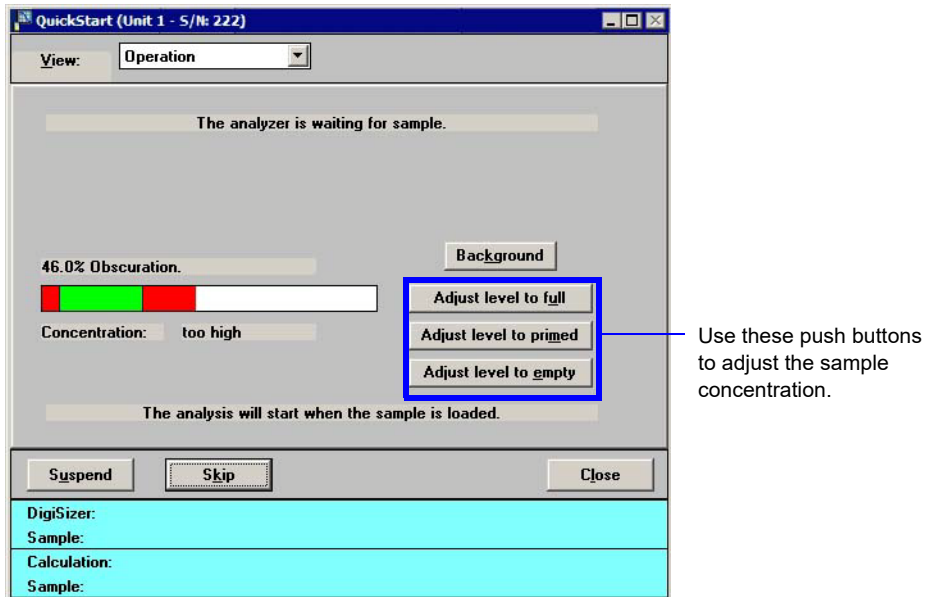
After you add your sample to the reservoir, its presence is detected and the remainder of the analysis proceeds automatically. The obscuration must exceed the minimum recommended obscuration on the Analysis conditions window for the analysis to start automatically. If you wish to use a lower obscuration, 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.

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 Mode dialog is displayed.



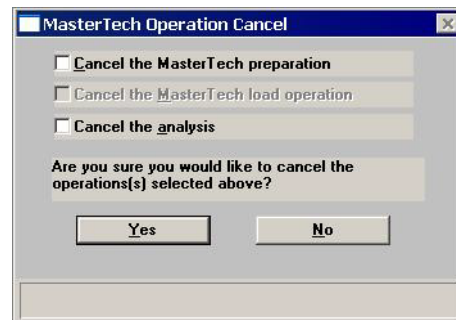| Sample | Contains the identification of the file you choose; the $ symbol is appended automatically allowing a numerical sequence of the generated files. A # (number) symbol representing the beaker is also appended. |
|---|---|
| New | Displays the Create a File for Analysis dialog allowing you to choose a sample template to create a file for the analysis. |
| 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. |
| **Preview** | Prints the report to the monitor screen. This option allows you to customize reports with details such as font and column placement. Refer to **Onscreen Reports**, page **6-20** for the options available for onscreen reports. |
| **Print** | Prints the report to a selected printer. |
| **Copies** | Enabled when you choose **Print** as the destination for reports, allowing you to generate up to four copies. |
| **Export** | Displays for a Developer only, allowing export of report data to a file; files are exported as their assigned name. |

**Start**                              The User Logon Dialog is displayed. This dialog is to assure that the current logged-in user is the one performing the analysis. After you enter your password and click **OK**, the analysis begins.

                                       This push button changes to **Stop** 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**                              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.

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.
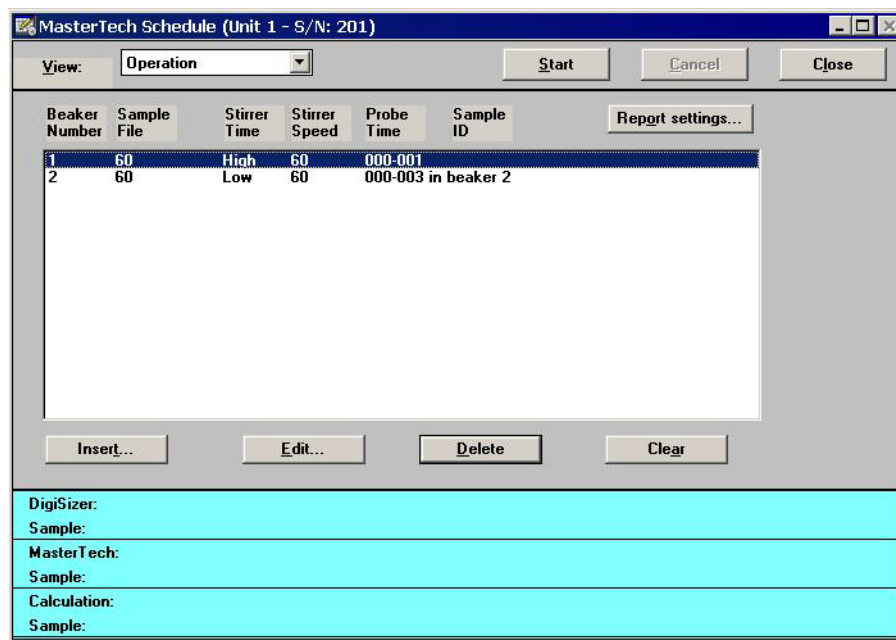
# MasterTech Schedule

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

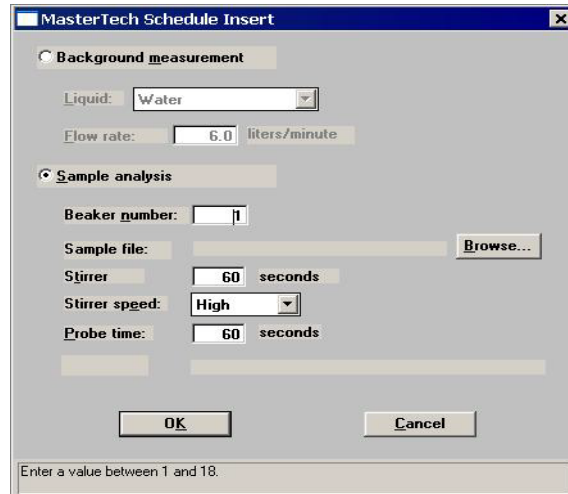Use this mode of operation to:

- 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. |
|---|---|

**Insert**

*(continued)*

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**
Displays the description of the selected sample file. Click **Browse** to choose the sample file or **New** to create a new one.

**Stirrer**
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.

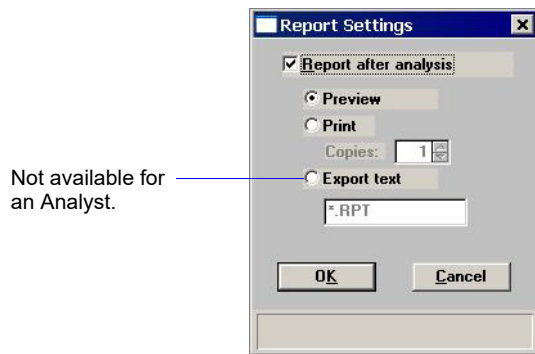**Edit**                            Displays the MasterTech Schedule Edit dialog so that you can edit the sample file or dispersion conditions.

                                    This dialog is identical to the MasterTech Schedule Insert dialog explained on the previous page.

**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**                 Displays the Report Settings dialog so that you can specify report output.



Not available for an Analyst.

                                    Select the option presented on this dialog to have reports generated automatically after each analysis.

**Report after analysis**           Select this option to have reports generated automatically after analysis, then choose a destination.

**Preview**                         Prints the report to the monitor screen. This option allows you to customize reports with details such as font and column placement. Refer to **Onscreen Reports**, page **6-20** for the options available for onscreen reports.

**Print**                           Prints the report to a selected printer.

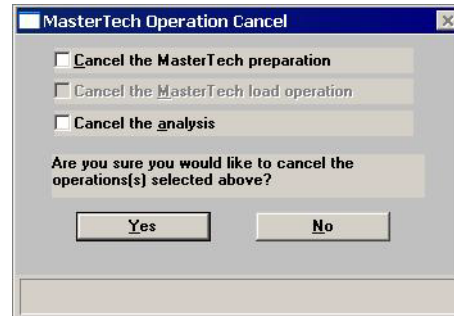**Copies**                          Enabled when you choose **Print** as the destination for reports, allowing you to generate up to four copies.

      **Export**                               Exports report data to a file; files are exported as their assigned name. This option is unavailable for an Analyst.

      **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 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 H**, page **H-1** for a discussion and illustrations on background quality.

When you select **Unit [n] > 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.
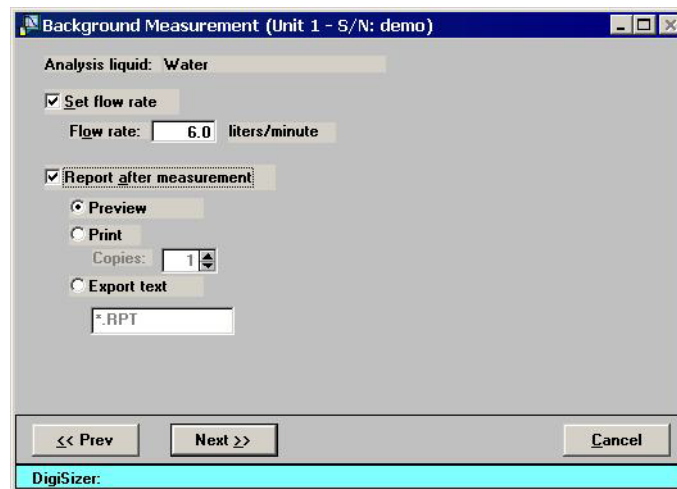


**Analysis Liquid**

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.

**Preview**

Prints the report to the monitor screen. This option allows you to customize reports with details such as font and column placement. Refer to **Onscreen Reports**, page **6-20** for the options available for onscreen reports.

**Print**                          Prints the report to a selected printer.

**Copies**                         Enabled when you choose **Print** as the destination for reports, allowing you to generate up to four copies.

**Export**                         Exports report data to a file; files are exported as their assigned name. This option is unavailable for an Analyst.

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.
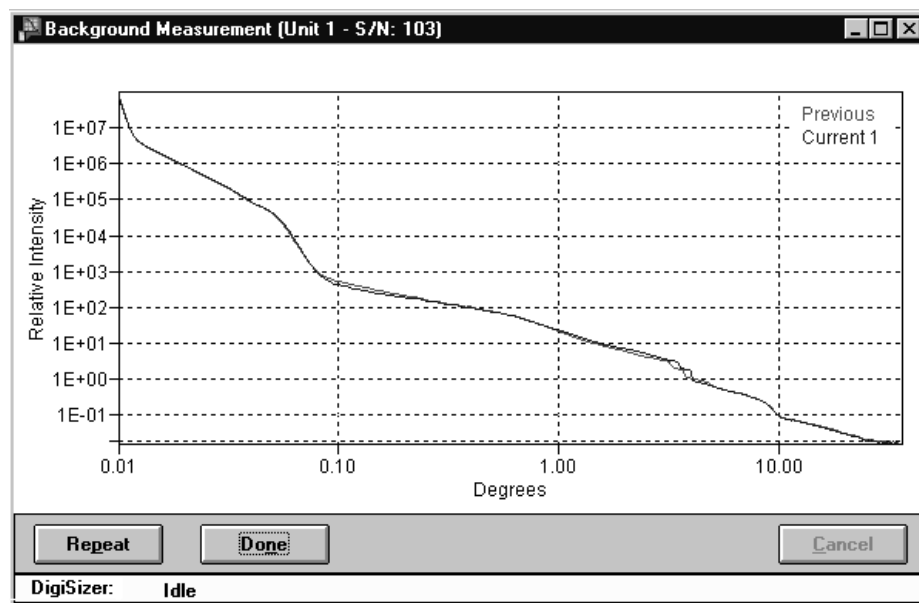


**Repeat**                         Select to perform another measurement. This push button becomes disabled after eight measurements. Refer to **Appendix H**, page **H-1** for information on determining a suitable background.

**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
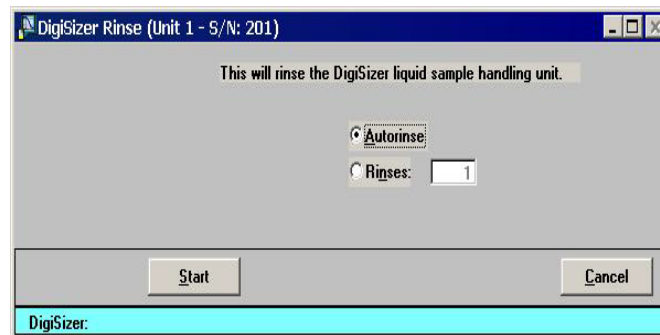


**Rinse Cycles**

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.

- The system has performed 10 rinses and was unable to attain 0.1 or less; an error message is displayed.

**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. 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.

## 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.<br><br>**If your analysis and rinse liquids are the same**, rinsing stops when:<br><br>• No significant decrease in beam obscuration is attained twice in a row, displaying an error message.<br><br>• 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.
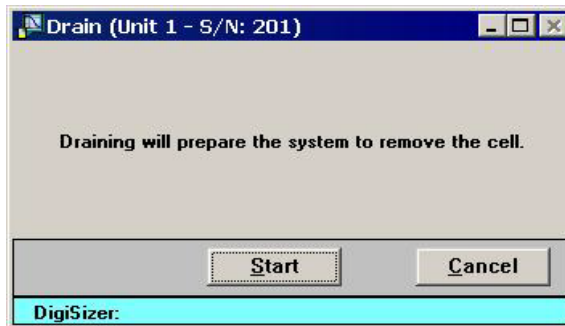


| Start | Begins the draining process; when all liquid has been drained from the system, the dialog closes automatically. |
|---|---|

## 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.

Displayed when a MasterTech is installed.

Displayed when an ultrasonic probe is installed.
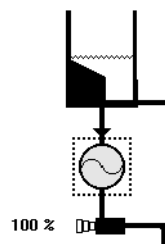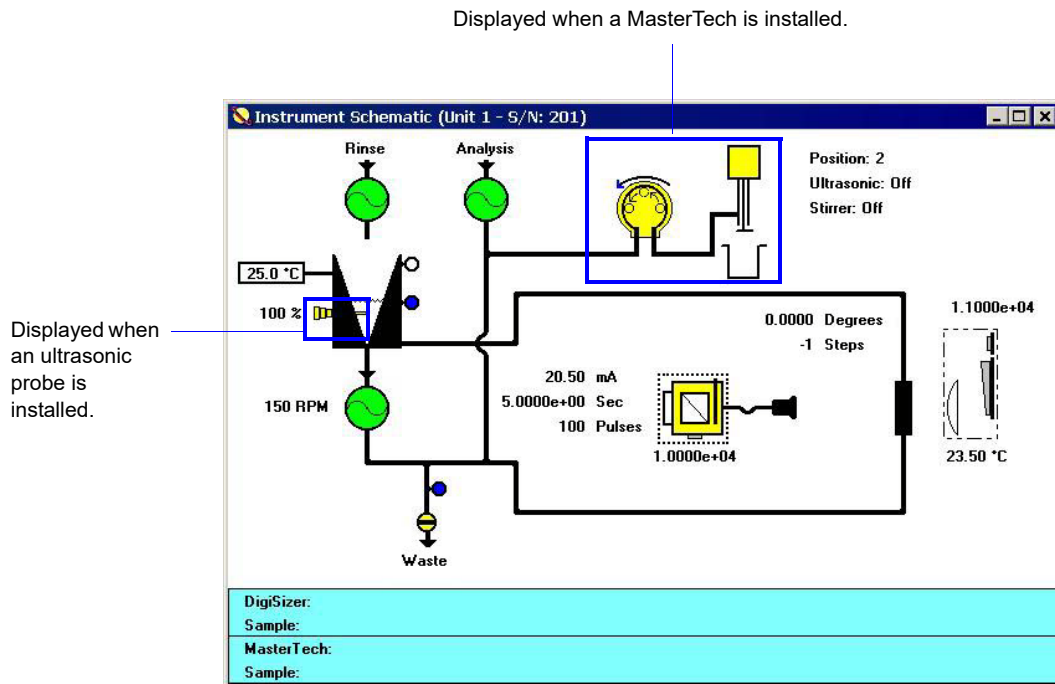
The reservoir portion of the schematic displays in this manner when using the Low-volume sample handler.

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 has a pop-up 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 pop-up 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**
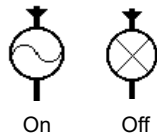
On       Off

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.
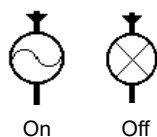
*Colors:     Green = On*
*            Yellow = Off*

*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:

Pump Speed Setting

Pump speed:          150   RPM

OK          Cancel

Enter a value between 1 and 1600.
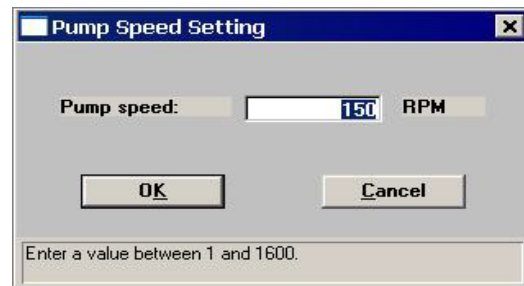
**Rinse pump**

On       Off

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.
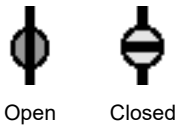
**Analysis liquid pump**

On          Off
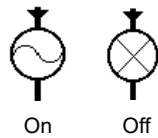
Pumps analysis liquid into the reservoir.

*Colors:*     *Green (light) = On at high speed*
                  *Green (dark) = On at low speed*
                  *Yellow = Off*

*Actions:*     *High, Low, Off*

**Waste Valve**

Open          Closed

When open, allows the sample and analysis liquid to be flushed from the system.

*Colors:*     *Green = Open*
                  *Yellow = Closed*

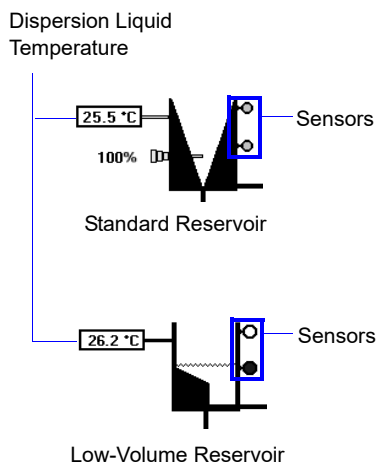*Actions:*     *Open, Close*

**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.

*C**olors:**     *Blue = Liquid sensed*
                  *Gray = No liquid sensed*

*Actions:*     *None available; display component only*

**Reservoir**

Dispersion Liquid
Temperature

25.5 °C — Sensors

100%

Standard Reservoir

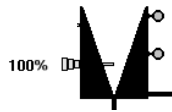26.2 °C — Sensors

Low-Volume Reservoir
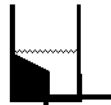
Holds the dispersed sample.

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**

100%

The probe is displayed in this position when using the standard sample handler.

100 %

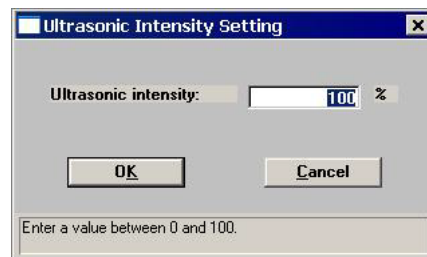The probe is displayed in this position when using the low-volume sample handler.

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*
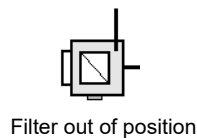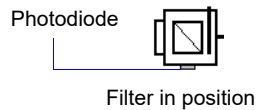             *Yellow = Off*

*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.

**Ultrasonic Intensity Setting**

Ultrasonic intensity:        100   %

OK        Cancel

Enter a value between 0 and 100.

**Laser assembly**

Photodiode

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,*
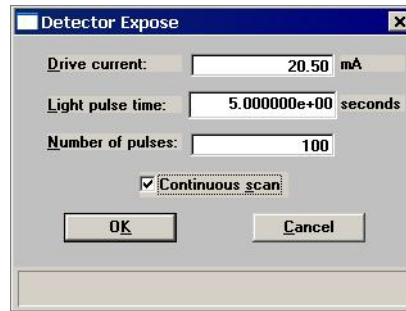             *Stop exposure, Display*

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 **Snap** 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*

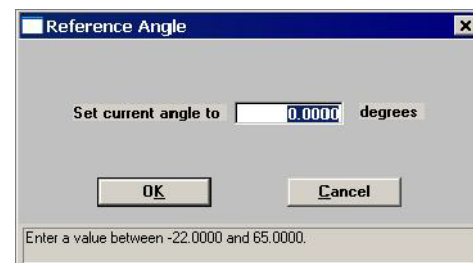Select **Move** to change the arm position; the Rotation Move dialog is displayed.
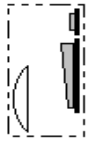
**Rotation Move**

Move

○ Angle   Move to        5.0000   degrees

● Steps   Move                 0   steps

OK          Cancel

Enter a value between -8000000 and 7999999.

**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.

**Reference Angle**

Set current angle to     0.0000   degrees

OK          Cancel

Enter a value between -22.0000 and 65.0000.

**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**, **Unnumbered Messages**, page **A-35** for causes and actions.

**MasterTech pump**

Load         Rinse
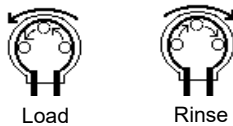
Displayed only when a MasterTech is installed. Flow direction is indicated by the direction of the arrows between the rollers and the one above the pump.

*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.
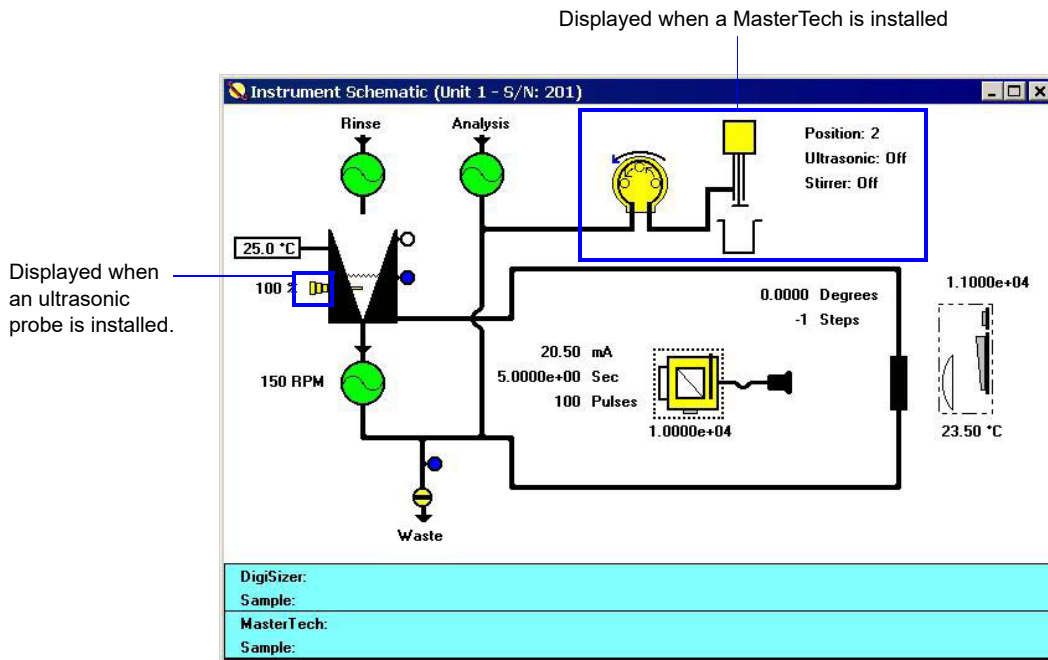


*Schematic of Saturn DigiSizer with the Standard liquid sample handler installed.*
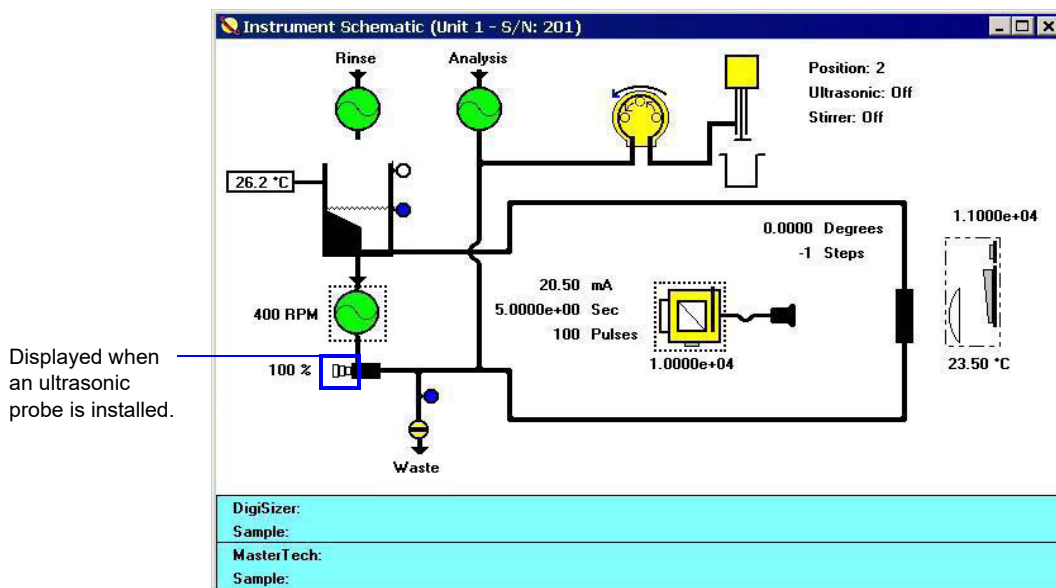


*Schematic of Saturn DigiSizer with the Low-volume liquid sample handler installed.*

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.

| Status (Unit 1 - S/N: 106) | |
|---|---|
| DigiSizer: | Rotating to angle -19.1°. |
| Sample: | Medium Garnet (Test 1 of 3) |
| Calculation: | Calculation iteration 81 |
| Sample: | Medium Garnet (Test 4) |
| MasterTech: | |
| Sample: | |

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 cfr5205.INI file.
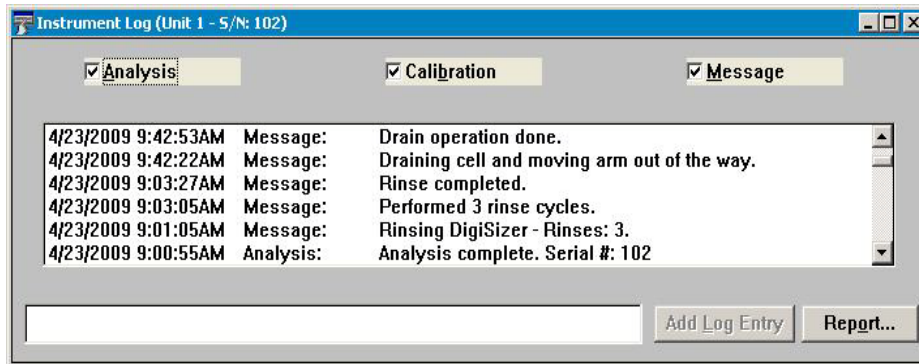


You can choose the type of information to display in the window by selecting only the desired item(s). For example, select only the **Analysis** check box to display only analysis information.

| | |
|---|---|
| **Analysis** <br> **Calibration** <br> **Messages** | These options allow you to choose which entries are displayed in the window. |
| **Add Log Entry** | Allows you to enter information pertinent to the instrument that is not automatically recorded by the software. For example, you may wish to make an entry when you clean the analysis cell. The information you enter here is contained in the log report; it does not display in the Instrument Log window. |
| **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 [n] > Unit Configuration**, 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.
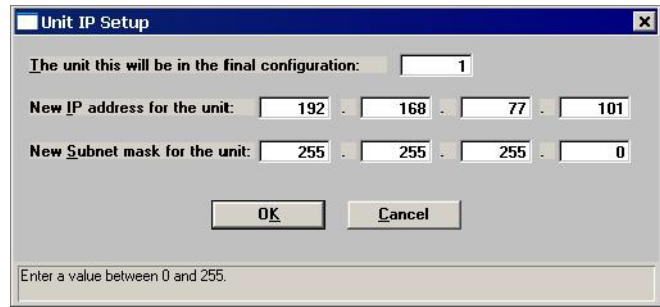


This dialog shows the IP address and Subnet mask that were assigned during installation. Do not edit these fields unless directed by a Micromeritics service representative.

**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.
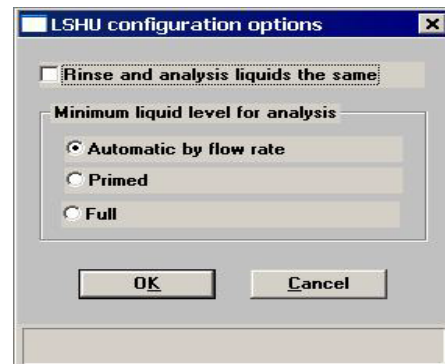


**Auto Sampler**                Displays the type of autosampler being used (if any) and its software versions.

# 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.

# 6. 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 sample copies of generated reports.

## 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 **6-2**. |
| **Close Reports** | Closes all open report window(s). Page **6-4**. |
| **Open Report** | Enables you to open a report that was saved from the report window. Page **6-4**. |
| **Background** | Initiates a report on the current background for the selected unit. Page **6-5**. |

**SPC Report Options**         Allows you to specify the sample data to be included in SPC
                               reports. Page **6-6**.

**Regression report**          Allows you to generate a regression report. Page **6-9**.

**Control chart report**       Allows you to generate a control chart report. Page **6-13**.

**PSD history**                Allows you to generate a particle size distribution history
                               report. Page **6-17**.

# Start Report

Select this option to generate a report on a sample analysis. Select **Reports > Start report** to
display the Start Report dialog.
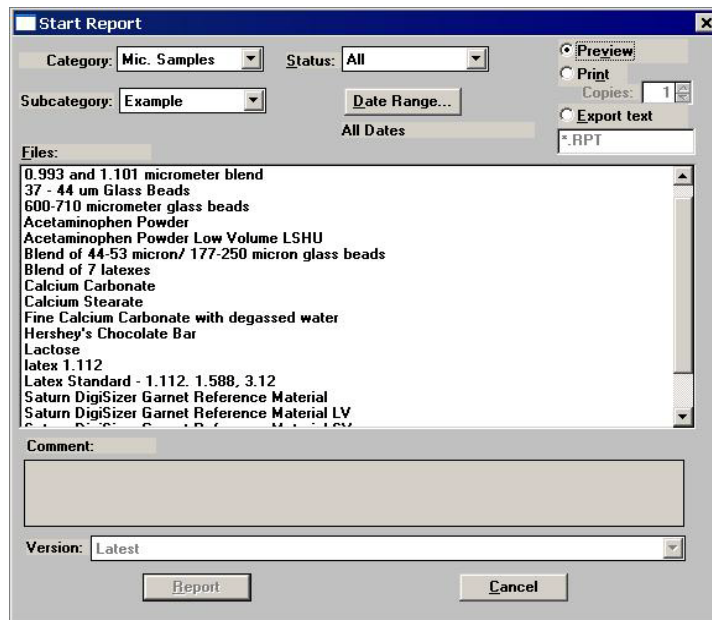
**Category/Subcategory**     Use these drop-down lists (directories) to navigate to the desired file(s).

- If you select multiple files on which to have reports generated, the reports specified in each sample file are printed to the output destination.

- If you choose a single file, the Selected Reports dialog containing the available reports is displayed. This dialog allows you to verify or edit selections.
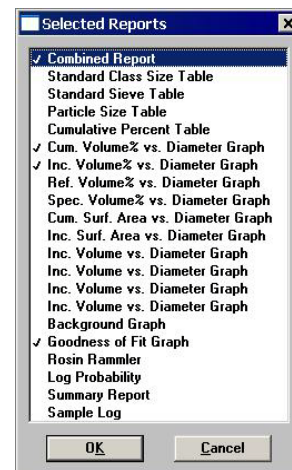


Select (or deselect) reports by double-clicking on the desired report (reports are selected when they are preceded with a check mark). Alternatively, you can highlight the report and press the **Spacebar**.

**Status**     This drop-down list determines the type of sample files that display in the **Files** list window in the specified directory for all dates, or within the specified range of dates (using **Date Range** push button).

*Choices:     All, Analyzing, Complete, Entered*

Refer to **Table 2-2.  File Status and Description**, page **2-16** for a description of the status types.

**Date Range**     Displays the Select Dates dialog so that you may specify a range of dates. Refer to **Selecting Files**, page **2-16** for a description of this push button.

| | |
|---|---|
| **Preview** | Choose this option to have the report(s) generated to the screen. If a printed copy is desired, you can print the report from the report window. |
| **Print** | Choose this option to have the report(s) generated directly to the printer without reviewing them first. If you choose this option, the **Copies** field is enabled allowing you to print up to four copies. |
| **Files window** | Displays a list of the available sample files for the choice shown in the **Status** field and within the range of dates specified in the **Dates** dialog. |

## 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.
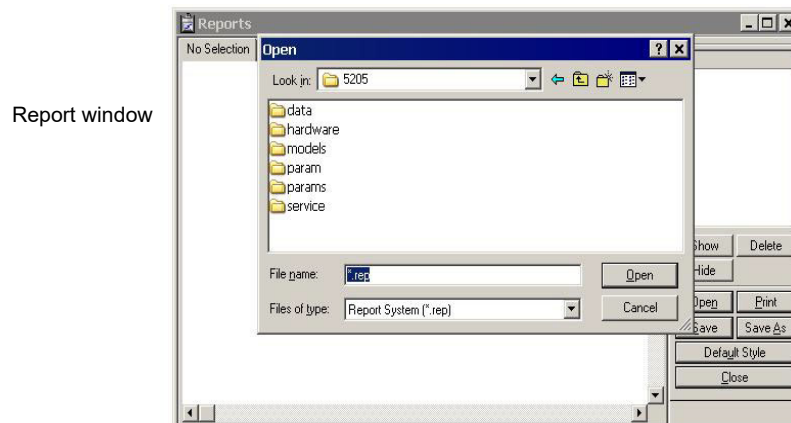
Report window



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 a specified instrument's background. When you select **Reports > Background**, the Start Background Report dialog is displayed.
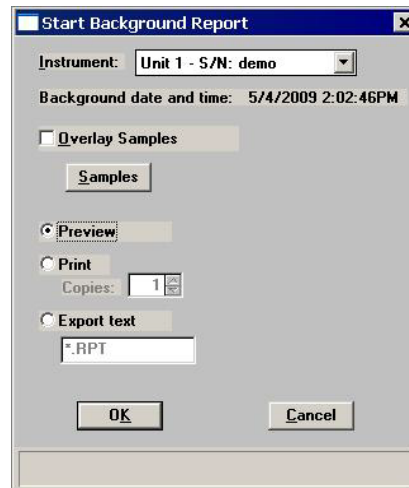


| Instrument | Displays a drop-down list of the attached instruments, allowing you to choose the instrument on which to have a background report generated. |
|---|---|
| **Background date and time** | Displays the date and time the current background was performed on the selected instrument. |
| **Overlay 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). |
| **Preview** | Prints the report to the monitor screen. This option allows you to customize reports with details such as font and column placement. Refer to **Onscreen Reports**, page **6-20** for additional information. |
| **Print** | Prints the report to a selected printer. |
| **Copies** | Enabled when you choose **Print** as the destination for reports, allowing you to generate up to four copies. |
| **Export** | Displays for a Developer only, allowing export of report data to a file; files are exported as their assigned name. |

# SPC Report Options

| | An Analyst is not authorized to specify SPC 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 Calculations dialog is displayed.
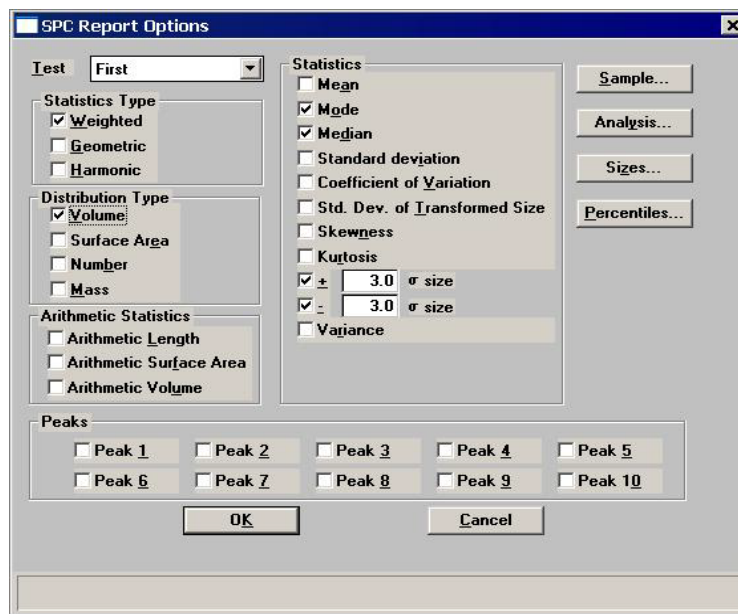


| | |
|---|---|
| **Test** | Drop-down list containing analysis choices for SPC calculations. |
| | **Last** reports statistics for the last analysis. |
| | **First** reports statistics for the first analysis. |
| | **Average** reports an average based on all tests in the sample file(s). |
| **Statistics 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 SPC Sample Options dialog, allowing you to select the sample parameters you wish to have reported.

Specific parameters can be designated in these fields.
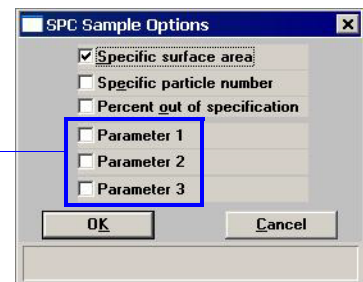
**Analysis**                   Displays the SPC Analysis Options dialog, allowing you to select the analysis conditions you wish to have reported.
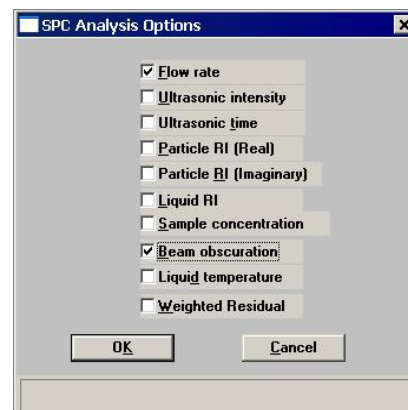
**Sizes**

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.
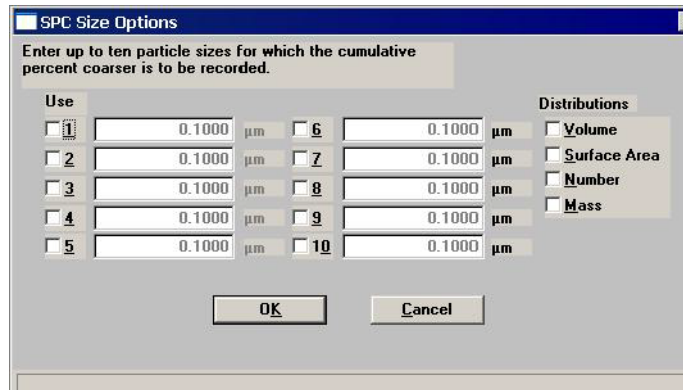


**Percentiles**

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.
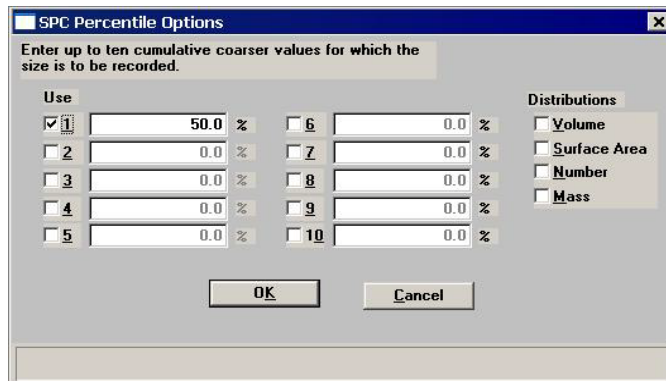


**Peaks**

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. |
| --- | --- |
| | Deselect this option to omit the report title. |
| | *Range:     40 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. The image can also be edited from the report window. |

**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.

**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.

**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.
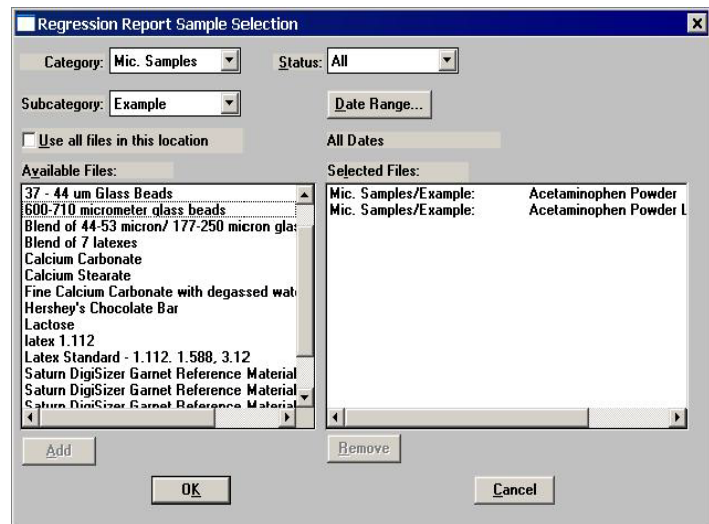


**Category**                   Drop-down lists containing current directories. The
**Subcategory**                **Category** represents the Directory, and the **Subcategory** represents the Subdirectory of the selected Directory.

**Status**                     This drop-down list determines the type of sample files that display in the **Files** list window in the specified directory for all dates, or within the specified range of dates (using **Date Range** push button).

                               Choices:    All, Analyzing, Complete, Entered

                               Refer to **Table 2-2.  File Status and Description**, page **2-16** for a description of the status types.

**Date Range**                 Displays the Select Dates dialog so that you may specify a range of dates. Refer to **Selecting Files**, page **2-16** for a description of this push button.
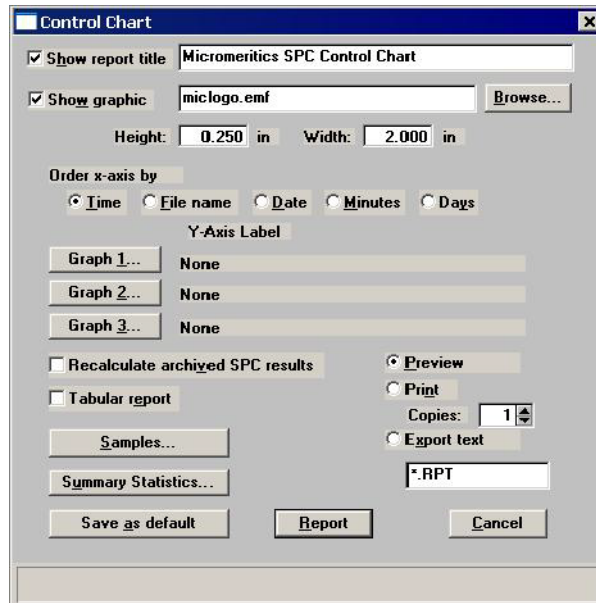
**Use all files in**           Select this option to include all files from the selected
**this location**              directory in the Regression report.

**Available Samples
Selected Samples**

The Available Samples pane contains the sample files residing in the selected directory and within the selected range of dates. The Selected Samples pane contains the files you select to include in the Regression report.

**Add**

Moves the selected file to the **Selected Samples** panel. 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.

**Delete**

Removes the selected file from the **Selected Samples** list and moves it back to the **Available Samples** list.

**Preview**

Prints the report to the monitor screen. This option allows you to customize reports with details such as font and column placement. Refer to **Onscreen Reports**, page **6-20** for additional information.

**Print**

Prints the report to a selected printer.

**Copies**

Enabled when you choose **Print** as the destination for reports, allowing you to generate up to four copies.

**Export**

Displays for the Developer only, allowing export of report data to a file; files are exported as their assigned name.

**Save as default**

Saves the current definition of the report as the default.

**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.

Deselect this option to omit the report title.

*Range:    40 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. The image can also be edited from the report window.

**Order x-axis 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.
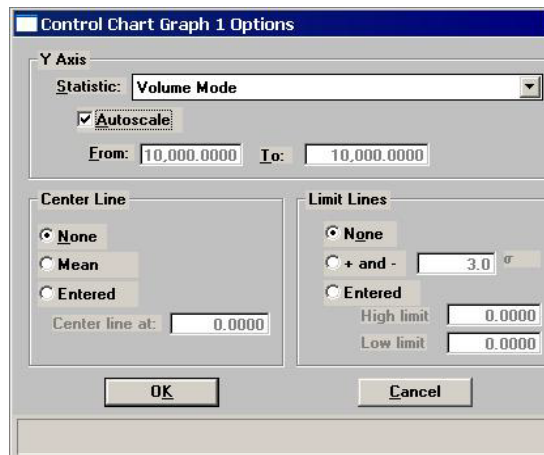


**Statistic**                 This drop-down list displays the SPC variables selected on the SPC Report Options dialog. The variable you choose will be plotted against time.

**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 ($\sigma$) or at specified positions (**Entered**).

**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.

**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.

**Samples**          Displays the Control Chart Sample Selection dialog, allowing you to choose the sample files on which you wish to report.
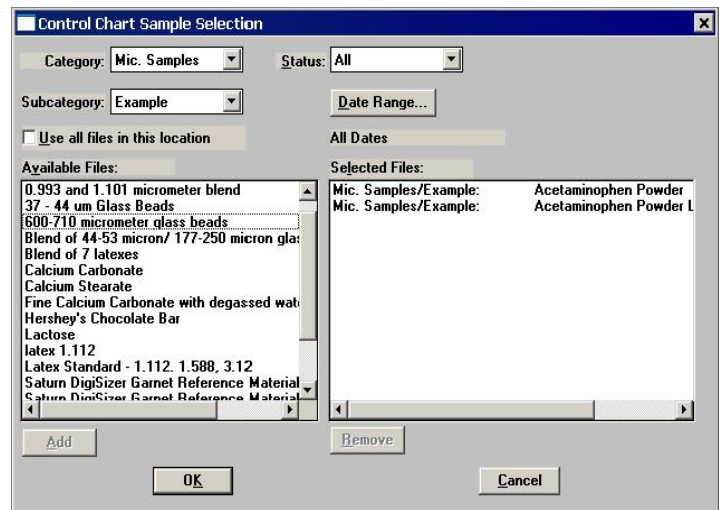


This dialog functions in the same manner as the Regression Report Sample Selection dialog explained previously.

**Preview**          Prints the report to the monitor screen. This option allows you to customize reports with details such as font and column placement. Refer to **Onscreen Reports**, page **6-20** for additional information.

**Print**                    Prints the report to a selected printer.

**Copies**                   Enabled when you choose **Print** as the destination for reports, allowing you to generate up to four copies.

**Export**                   Displays for a Developer only, allowing export of report data to a file; files are exported as their assigned name.

**Summary Statistics**       Allows you to select the statistics to display in the report.
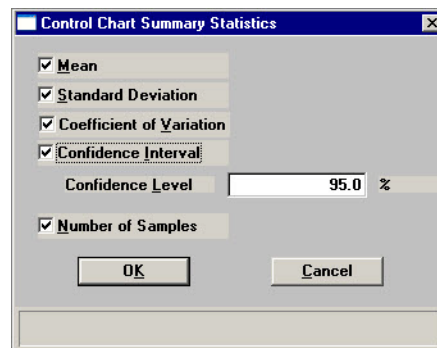


*Coefficient of Variation* is the Standard Deviation divided by the Mean.

*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.

**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 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. The image can also be edited
                             from the report window.

**Order x-axis  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 **6-14** 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
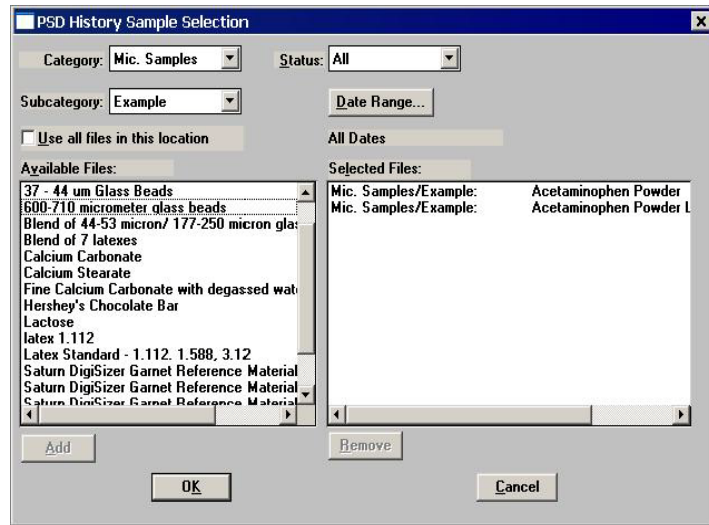


This dialog functions in the same manner as the Regression Report Sample Selection dialog (refer to **Regression Report**, page **6-9**).

**Preview**                Prints the report to the computer screen. This option allows you to customize reports with details such as font and column placement. Refer to **Onscreen Reports**, page **6-20** for additional information.

**Print**                  Prints the report to a selected printer.

**Copies**                 Enabled when you choose **Print** as the destination for reports, allowing you to generate up to four copies.

**Export**                 Displays for the Developer only, allowing export of report data to a file; files are exported as their assigned name.

**Save as default**        Saves the current definition of the report as the default.

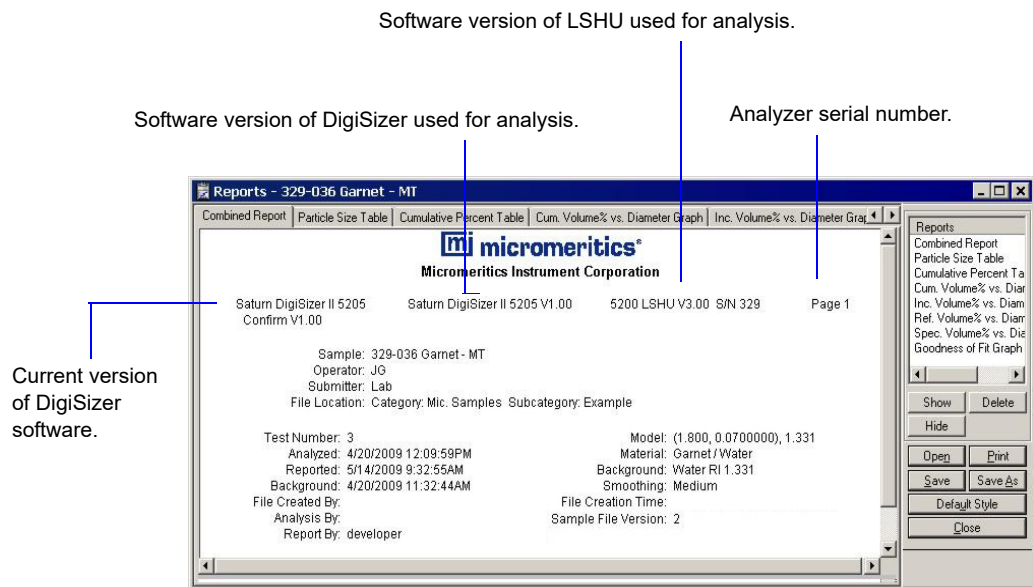**Report**                 Generates the report.

# 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, and background data.

  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.

Software version of LSHU used for analysis.

Software version of DigiSizer used for analysis.

Analyzer serial number.

Current version of DigiSizer software.

## Onscreen Reports

The report window containing onscreen reports provides many options for customizing and manipulating reports:

- a tool bar
- short-cut 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**.
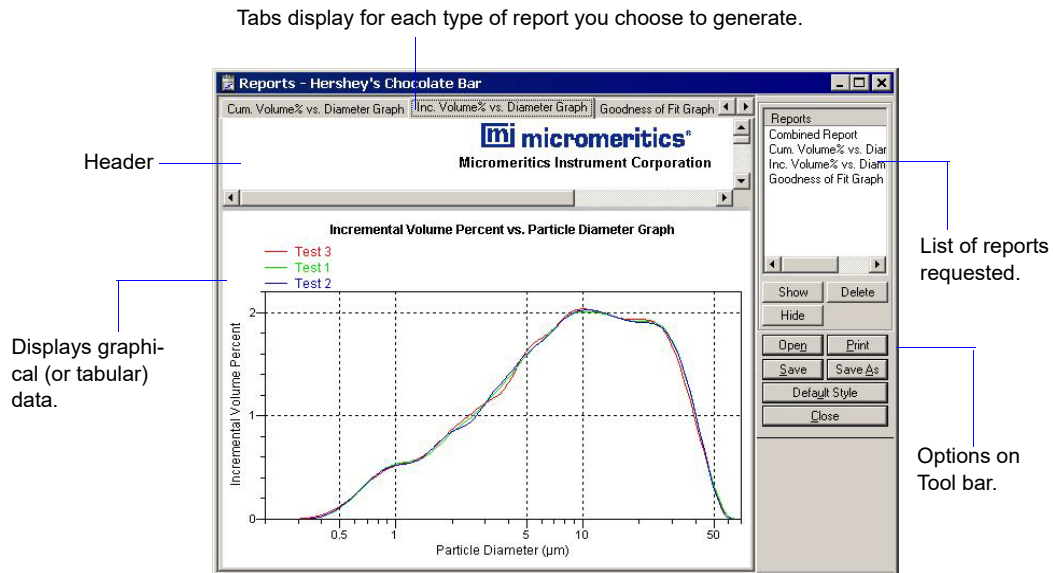


### Tool Bar

**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.
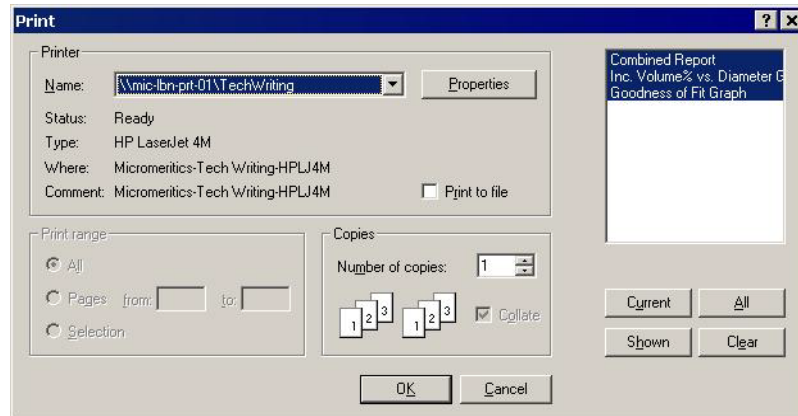


For convenience in selecting reports to print, push buttons are
provided beneath the report window. Or, you can make your
selection by clicking on the desired reports.

**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.
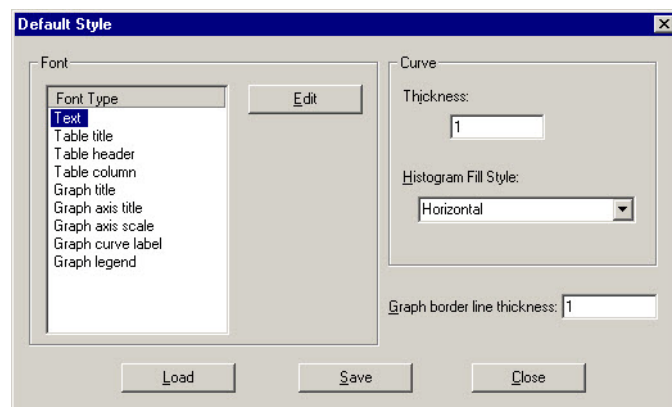


**Fonts**                             Contains a list of report elements for which the font can be
                                      edited. Simply highlight the desired element and click **Edit**; a
                                      font dialog is displayed so that you can specify the desired
                                      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**                      Enables you to specify a thickness for the border of the graph.
**line thickness**

**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**
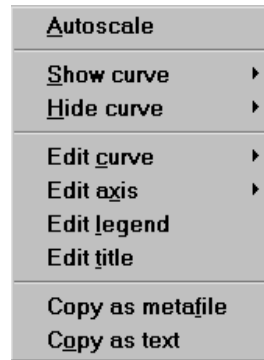


| | |
|---|---|
| **Autoscale** | Autoscales all axes of the graph. This function is useful for returning to a full view after having zoomed in. |
| **Redraw** | Sets axis boundaries to its original view. You can also use this function to remove cross-hairs. |
| **Show curve** | Allows you to show curves 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. |
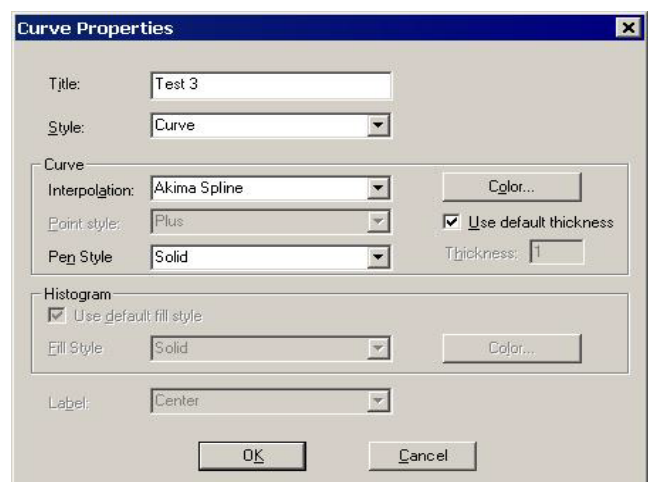
**Title**                    Displays the title of the curve you are editing.

**Style**                    Drop-down list containing styles in which collected data can be displayed.

                             *Choices:    Curve, Histogram, Points, Curve and Points*

**Curve**                    Contains options for curves and points. You can edit the
**group box**                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**                Allows you to specify the type of fill as well as the color if
**group box**                **Histogram** is chosen as the style for collected data.

**Edit axis**                Displays the Axis Properties dialog, allowing you to edit axis properties.
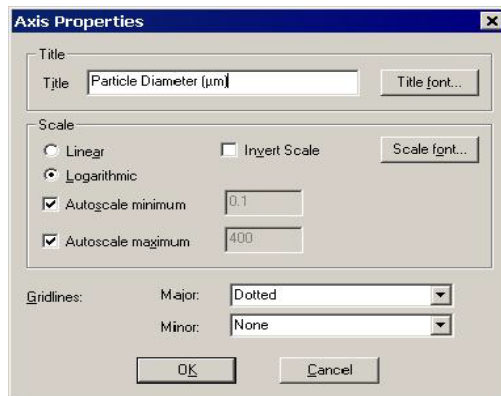


**Edit legend**              Displays the Legend Properties dialog, allowing you to edit the placement of the legend.
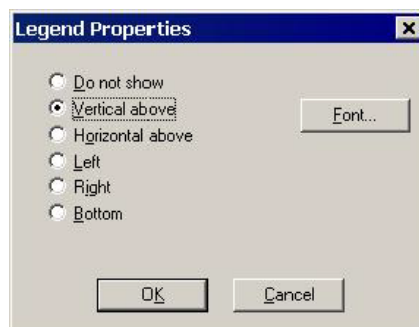
**Edit title**                  Displays the Title Properties dialog, allowing you to edit the current graph's title and font.
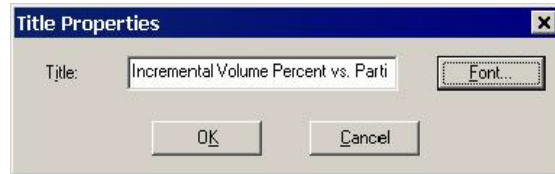


**Copy as metafile**            Copies the graph and places it on the clipboard, allowing you to paste it into other applications accepting Windows metafiles.

**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.
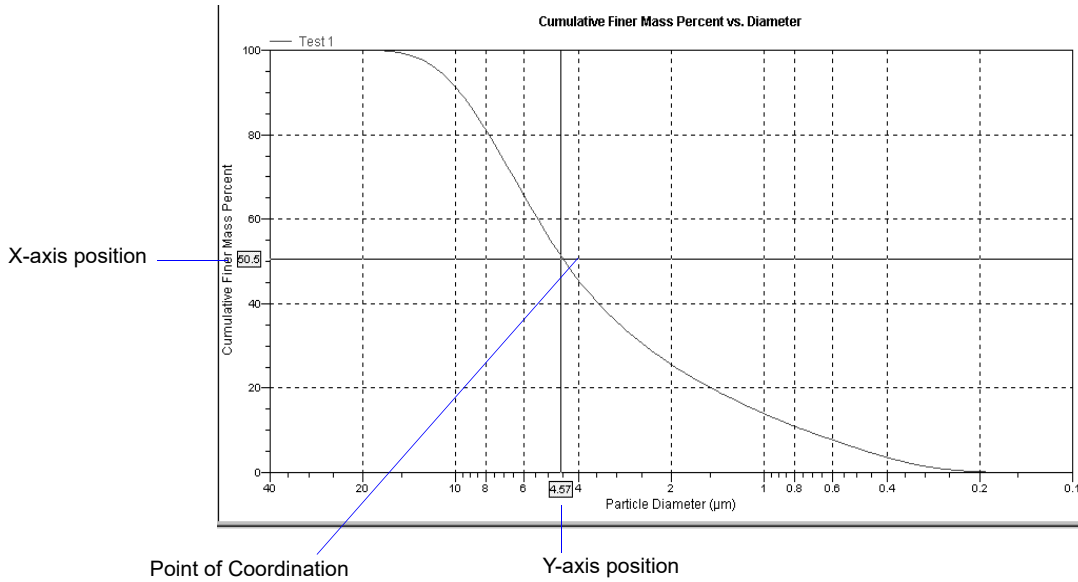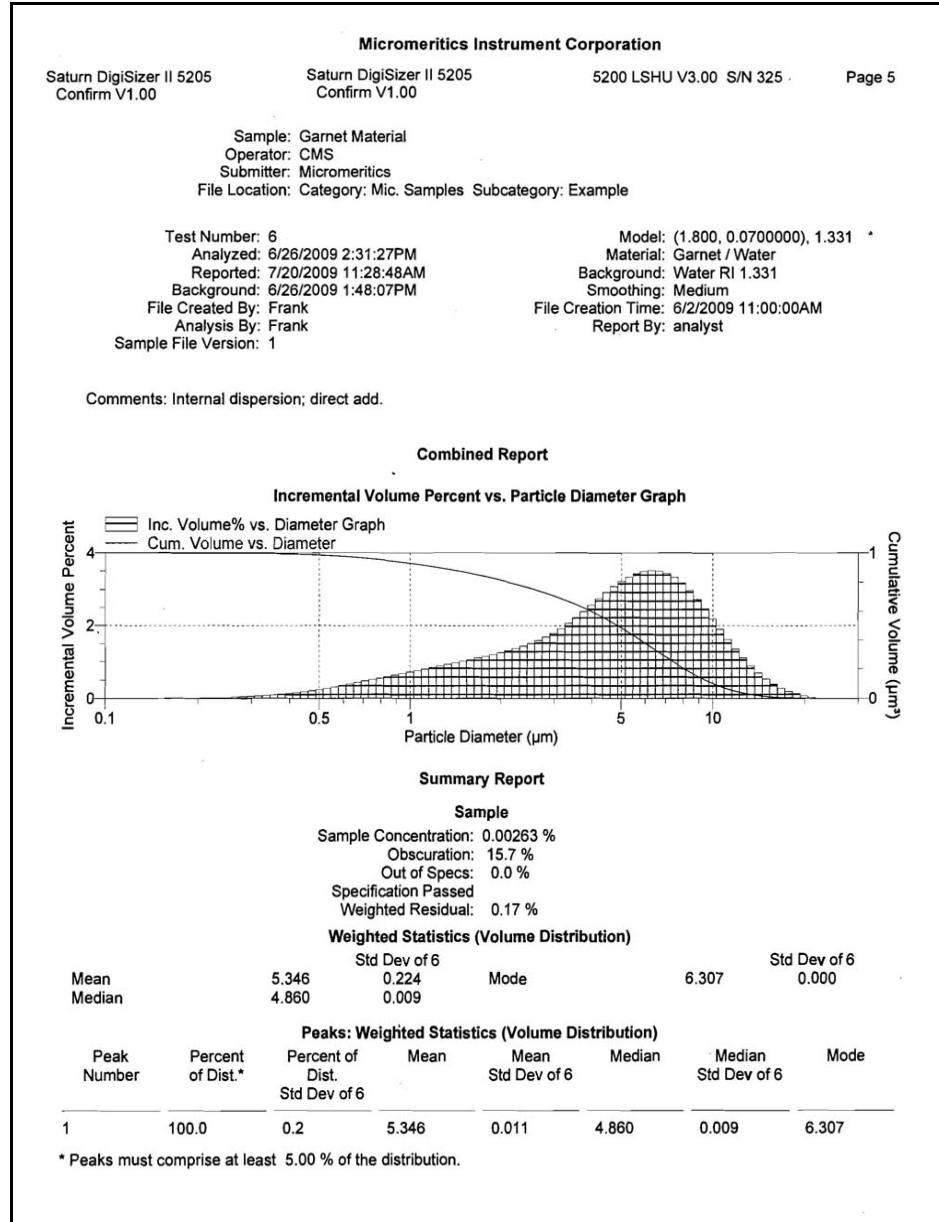


You can remove cross-hair lines and return to the normal view by right-clicking on the graph and selecting **Autoscale**, or clicking out of the graph area.

# 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 Confirm V1.00     Saturn DigiSizer II 5205 Confirm V1.00     5200 LSHU V3.00   S/N 325     Page 5

Sample: Garnet Material
Operator: CMS
Submitter: Micromeritics
File Location: Category: Mic. Samples  Subcategory: Example

Test Number: 6
Analyzed: 6/26/2009 2:31:27PM
Reported: 7/20/2009 11:28:48AM
Background: 6/26/2009 1:48:07PM
File Created By: Frank
Analysis By: Frank
Sample File Version: 1

Model: (1.800, 0.0700000), 1.331
Material: Garnet / Water
Background: Water RI 1.331
Smoothing: Medium
File Creation Time: 6/2/2009 11:00:00AM
Report By: analyst

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        Saturn DigiSizer II 5205        5200 LSHU V3.00  S/N 325        Page 5
Confirm V1.00                        Confirm V1.00
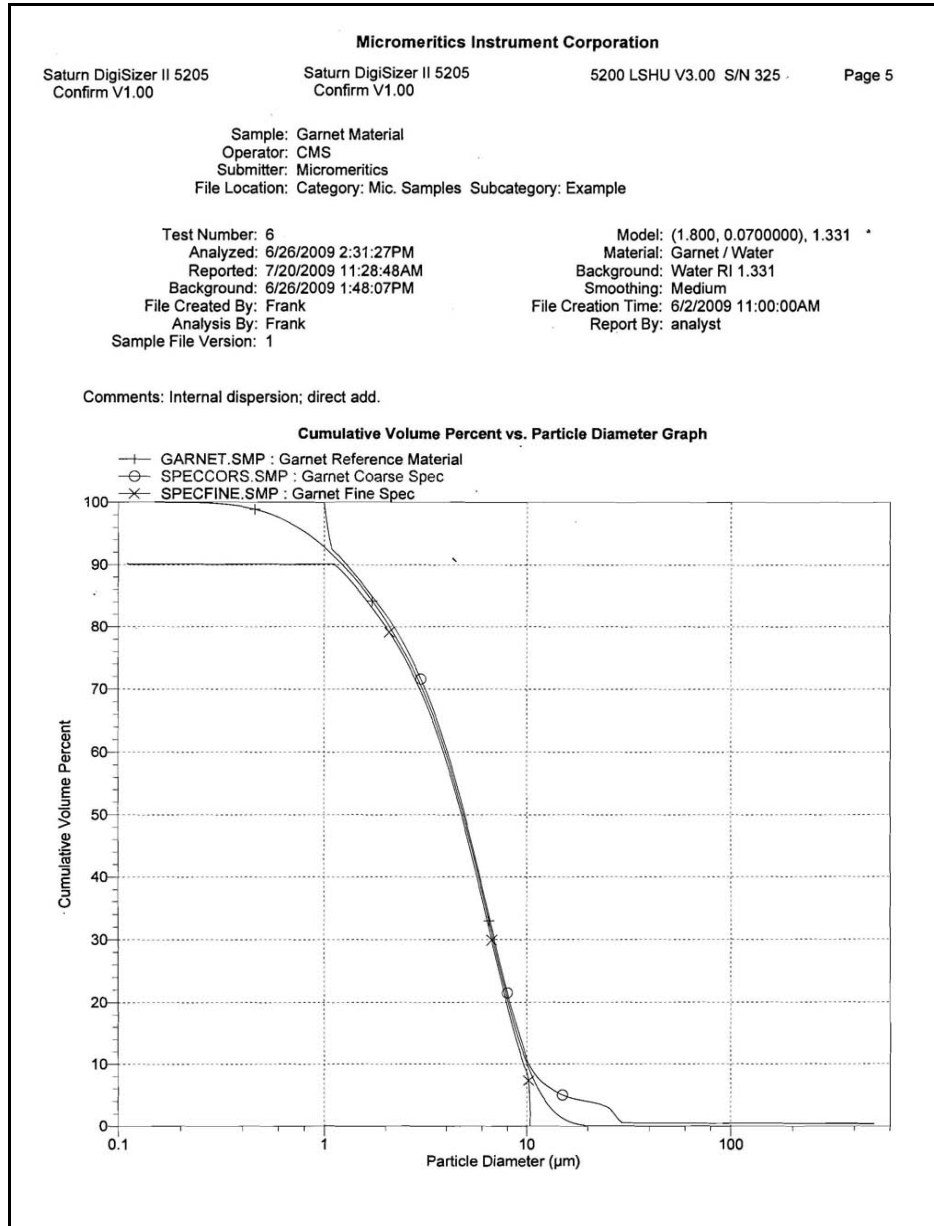
Sample: Garnet Material
Operator: CMS
Submitter: Micromeritics
File Location: Category: Mic. Samples  Subcategory: Example

Test Number: 6                                                Model: (1.800, 0.0700000), 1.331
Analyzed: 6/26/2009 2:31:27PM                        Material: Garnet / Water
Reported: 7/20/2009 11:28:48AM                      Background: Water RI 1.331
Background: 6/26/2009 1:48:07PM                    Smoothing: Medium
File Created By: Frank                          File Creation Time: 6/2/2009 11:00:00AM
Analysis By: Frank                                   Report By: analyst
Sample File Version: 1

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          Saturn DigiSizer II 5205          5200 LSHU V3.00  S/N 325          Page 5
Confirm V1.00                     Confirm V1.00

Sample: Garnet Material
Operator: CMS
Submitter: Micromeritics
File Location: Category: Mic. Samples  Subcategory: Example

Test Number: 6                                    Model: (1.800, 0.0700000), 1.331
Analyzed: 6/26/2009 2:31:27PM                     Material: Garnet / Water
Reported: 7/20/2009 11:28:48AM                    Background: Water RI 1.331
Background: 6/26/2009 1:48:07PM                    Smoothing: Medium
File Created By: Frank                             File Creation Time: 6/2/2009 11:00:00AM
Analysis By: Frank                                Report By: analyst
Sample File Version: 1

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          Saturn DigiSizer II 5205          5200 LSHU V3.00  S/N 325          Page 5
Confirm V1.00                     Confirm V1.00

Sample: Garnet Material
Operator: CMS
Submitter: Micromeritics
File Location: Category: Mic. Samples  Subcategory: Example

Test Number: 6                                          Model: (1.800, 0.0700000), 1.331
Analyzed: 6/26/2009 2:31:27PM                        Material: Garnet / Water
Reported: 7/20/2009 11:28:48AM                     Background: Water RI 1.331
Background: 6/26/2009 1:48:07PM                      Smoothing: Medium
File Created By: Frank                         File Creation Time: 6/2/2009 11:00:00AM
Analysis By: Frank                                 Report By: analyst
Sample File Version: 1

Comments: Internal dispersion; direct add.

**Cumulative Volume Percent vs. Particle Diameter Graph**

—+— GARNET.SMP : Garnet Reference Material
—O— SPECCORS.SMP : Garnet Coarse Spec
—X— SPECFINE.SMP : Garnet Fine Spec

## Incremental Volume Percent vs. Particle Diameter

**Micromeritics Instrument Corporation**

Saturn DigiSizer II 5205          Saturn DigiSizer II 5205          5200 LSHU V3.00  S/N 325          Page 5
Confirm V1.00                     Confirm V1.00

Sample: Garnet Material
Operator: CMS
Submitter: Micromeritics
File Location: Category: Mic. Samples  Subcategory: Example

Test Number: 6                                      Model: (1.800, 0.0700000), 1.331
Analyzed: 6/26/2009 2:31:27PM                       Material: Garnet / Water
Reported: 7/20/2009 11:28:48AM                      Background: Water RI 1.331
Background: 6/26/2009 1:48:07PM                     Smoothing: Medium
File Created By: Frank                              File Creation Time: 6/2/2009 11:00:00AM
Analysis By: Frank                                  Report By: analyst
Sample File Version: 1

Comments: Internal dispersion; direct add.



**Incremental Volume Percent vs. Particle Diameter Graph**

## Difference from Reference

## Out of Specification

## Background Report

**Micromeritics Instrument Corporation**

Saturn DigiSizer II 5205          Saturn DigiSizer II 5205          5200 LSHU V3.00  S/N 325          Page 5
Confirm V1.00                     Confirm V1.00

Sample: Garnet Material
Operator: CMS
Submitter: Micromeritics
File Location: Category: Mic. Samples  Subcategory: Example

Test Number: 6                                    Model: (1.800, 0.0700000), 1.331  *
Analyzed: 6/26/2009 2:31:27PM                   Material: Garnet / Water
Reported: 7/20/2009 11:28:48AM               Background: Water RI 1.331
Background: 6/26/2009 1:48:07PM               Smoothing: Medium
File Created By: Frank              File Creation Time: 6/2/2009 11:00:00AM
Analysis By: Frank                            Report By: analyst
Sample File Version: 1

Comments: Internal dispersion; direct add.

**Background Intensity vs. Angle**

## Goodness of Fit



**Micromeritics Instrument Corporation**

Saturn DigiSizer II 5205
Confirm V1.00

Saturn DigiSizer II 5205
Confirm V1.00

5200 LSHU V3.00  S/N 325          Page 5

Sample: Garnet Material
Operator: CMS
Submitter: Micromeritics
File Location: Category: Mic. Samples Subcategory: Example

Test Number: 6
Analyzed: 6/26/2009 2:31:27PM
Reported: 7/20/2009 11:28:48AM
Background: 6/26/2009 1:48:07PM
File Created By: Frank
Analysis By: Frank
Sample File Version: 1

Model: (1.800, 0.0700000), 1.331
Material: Garnet / Water
Background: Water RI 1.331
Smoothing: Medium
File Creation Time: 6/2/2009 11:00:00AM
Report By: analyst

Comments: Internal dispersion; direct add.

**Goodness of Fit**

Weighted Residual = 0.17%

—○— Measured Intensity          —— Model Intensity

## 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 Confirm V1.00 | Saturn DigiSizer II 5205 Confirm V1.00 | 5200 LSHU V3.00  S/N 325 | Page 5 |
|---|---|---|---|

Sample: Garnet Material
Operator: CMS
Submitter: Micromeritics
File Location: Category: Mic. Samples  Subcategory: Example

| | |
|---|---|
| Test Number: 6 | Model: (1.800, 0.0700000), 1.331 * |
| Analyzed: 6/26/2009 2:31:27PM | Material: Garnet / Water |
| Reported: 7/20/2009 11:28:48AM | Background: Water RI 1.331 |
| Background: 6/26/2009 1:48:07PM | Smoothing: Medium |
| File Created By: Frank | File Creation Time: 6/2/2009 11:00:00AM |
| Analysis By: Frank | Report By: analyst |
| Sample File Version: 1 | |

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.

# 7.  OPTIONS MENU

The Options menu contains commands which allow you to configure the system to your laboratory's requirements. With the options on this menu, you can:

- Add directories
- Edit labels for sample files and directories
- Specify data presentation modes

The only function available to the Analyst on the Options menu is to add an archive location. All other operations are initiated by the Developer or an Administrator.

## Description

Listed below are brief descriptions of the commands contained on the Options menu. Detailed descriptions follow this section.

**Add archive location**          Allows you to add a directory. Page **7-3**.

**Edit labels**          Allows you to edit the labels for the directories that appear on some file dialogs. Page **7-4**.

**Update file list**          Allows you to update the cache file for the sample or parameter file directory. This operation has to be initiated by an Administrator. Page **7-5**.

**Data Presentation**          Allows you to choose the way in which data are presented on the screen and in printed reports. Page **7-6**.

**Service Test Mode**             Enables you to perform certain troubleshooting procedures.
                                  This option is available only under the direction of a
                                  Micromeritics service representative. Page 7-7.

## Add Archive Location

New archive locations (directories) can be created by an Analyst or a Developer; the Add Archive Location dialog is displayed.



Existing directories and subdirectories.
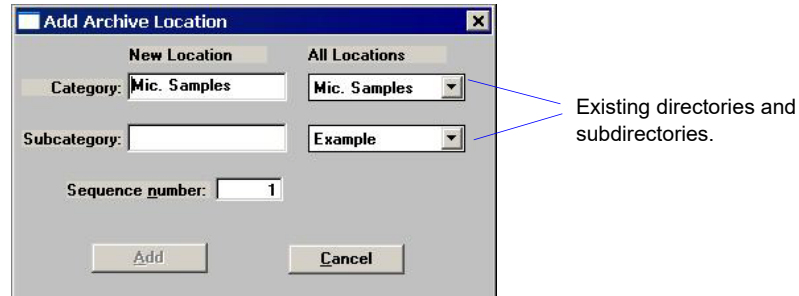
**Category**
**Subcategory**

These fields allow you to create new directories and/or subdirectories for the repository.

The drop-down lists in the **All Locations** column contain the existing directories and subdirectories.

The fields in the **New Location** column allow you to enter new directories. **Category** represents the "Directory," and **Subcategory** represents the "subdirectory." You can add a subdirectory to an existing directory by choosing the directory from the drop-down list, then entering the new directory name in the **Subcategory** field.

The labels for the directories can be changed by the Developer (see following section). Many laboratories use the month/year combination for organizing files.

---

**These directories and their contents cannot be seen through use of Windows Explorer; they can only be viewed through use of the analysis program.**

---

**Sequence number**

Allows you to enter a new sequence number for the directory you create. This number is incrementally sequenced for each sample file you create and displays as part of the identification if the sample template included a $ symbol when it was created.

**Add**

Enabled when you make an entry in the **Subcategory** field, allowing you to add the new directory and close the dialog.

# Edit Labels

**Edit labels** allows the Developer to edit the labels that display on the sample file editor; the Edit Labels dialog is displayed.

| Repository Levels | Sample Information Prompts | User Parameters |
|---|---|---|
| **Top Level:** Category: | Sample: | Parameter 1: ☐ Omit |
| **Second Level:** Subcategory: | Operator: ☐ Omit | Parameter 2: ☐ Omit |
| | Submitter: ☐ Omit | Parameter 3: ☐ Omit |
| | ☑ Omit | |

**OK**          **Cancel**
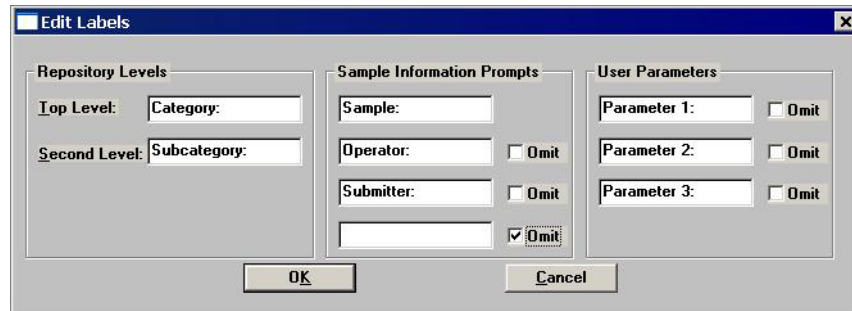
**Repository Levels**

The Top and Second Levels represent the directory and subdirectory for the location of sample files. Many laboratories use the Year/Month file storage system.

**Sample Information Prompts**

These are the labels that appear on the sample information dialog.

If you do not wish to have the **Operator** and **Submitter** (or other specified names) lines, you can click **Omit** to have them excluded.

A third line is available for other information as desired; for example, for entering (or scanning) bar code information.

**User Parameters**

These fields 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. Enter Motor speed as a Parameter. The value can be added in the sample file. When you add the value in the sample file, you can save the file as a Template, making it available when desired. Specified parameters display in the SPC Sample Options dialog (accessed through the SPC Calculations dialog).

You can omit these fields from displaying on the sample file dialog by selecting **Omit**.

## Update File List

This function cannot be performed by the Analyst nor the Developer, unless the Developer has Administrator rights. This is an Administrator function only; details for performing this operation are covered in the Administrator's Guide.

This option allows the directory to be updated when files have been added outside of the application. For example, if you need to restore the directory with a backup file.

# Data Presentation

The options on the Data presentation drop-down menu allow a Developer to specify the manner in which tabular and graphical data display on screen and in printed reports.



| **Size in diameter/radius** | Allow you to choose the manner in which data display on the |
|---|---|
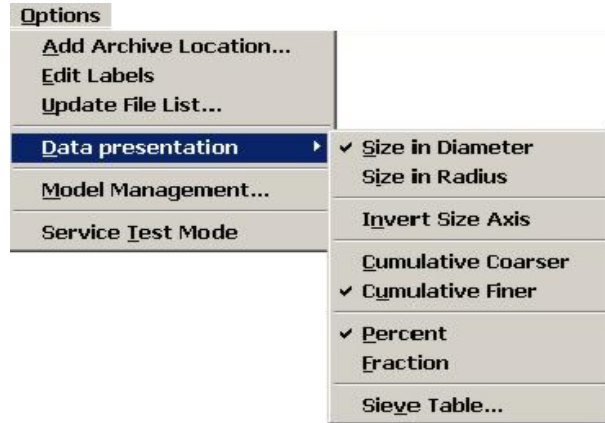
**Size in diameter/radius**
**Invert size axis**
**Cumulative coarser/finer**
**Percent/Fraction**

Allow you to choose the manner in which data display 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.
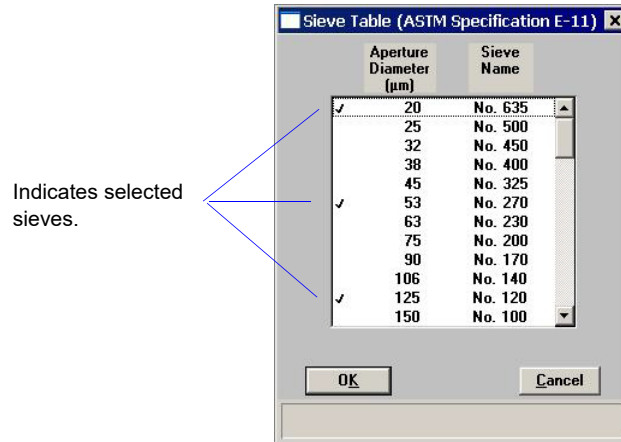


A sieve size is selected when it is preceded by a check mark (✓). Make your selection(s) by double-clicking on the desired sieve(s), or highlight the desired sieve and press **Spacebar.**

## 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 prompting you to enter a password is displayed. This password will be provided by your service representative. You will not be able to perform these tests without the guidance of your service representative. After Service Test Mode has been activated, the tests can be accessed from the Unit menu.

# 8.  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 messages. Listed below are some troubleshooting tips when operational problems occur.

*Table 8-1.  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 **8-11**.) |
| | 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 **8-9**). |
| | 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 **Cleaning the Optics**, page **8-4**). |
| | 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 I**, page **I-1**.) |
| 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 Saturn 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 H**, Page **H-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.

Knurled Nuts
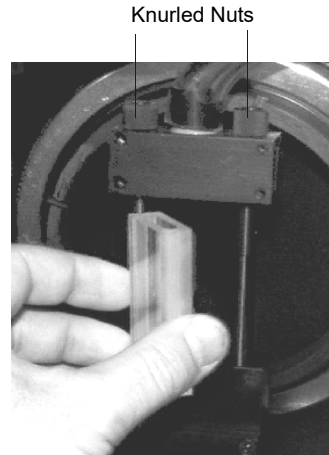


5.  Grasp the sample cell by its side edges and place on a sheet of lens paper while performing the next two steps.

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.
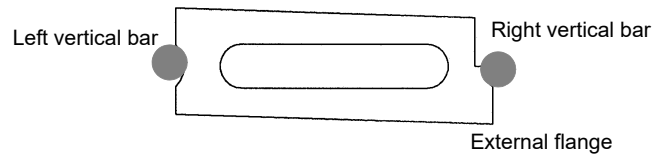


    c. Rotate the sample cell toward the right vertical bar; ensure that the cell is seated properly between the two vertical bars.

    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.
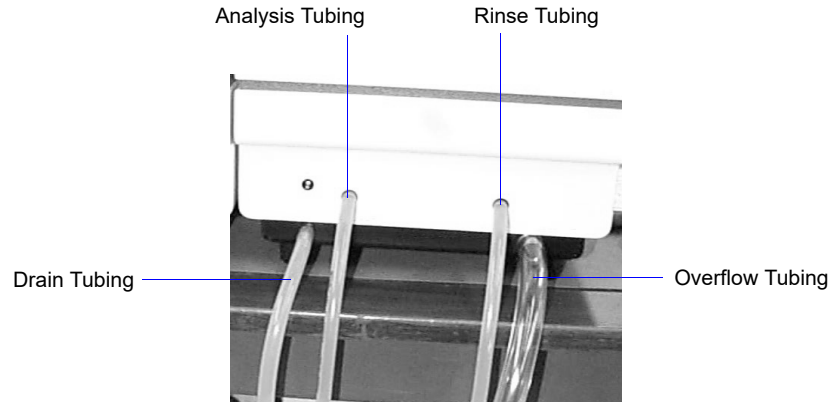


The tubing on the liquid sample handler should be replaced as needed. Refer to Chapter 10 for part numbers and ordering information. All tubing is removed and replaced in the same manner. The rinse and analysis tubing are the same type tubing. The drain tubing is the same color and very close to the 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, page  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.
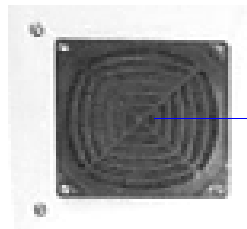


Insert screw driver here.

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.
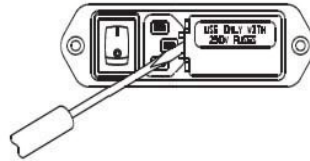


3.  Gently lift up until the cover lifts up approximately 1/4 inch, then swing the cover to the left; the cover is hinged and cannot be removed.

4.  Remove the fuse block (you may have to use needle-nose pliers to grasp the fuse block).
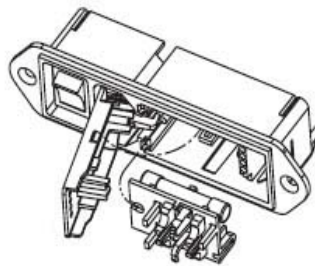


5.  Remove the blown fuse and replace with a new one. Be sure to use the appropriate fuse for the input power source.

 **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.

# 9.  ORDERING INFORMATION

Components and accessories for the Saturn DigiSizer 5205 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 |
| 520-42812-00 | 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 $\mu$m |
| 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 ———————— | |
| 003-51131-00 | Fuse, 3AG,  Slow-Blow, 2 Amp |
| 003-51197-01 | 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. |
| 051-61702-01 | Beaker, molded, 125 mL without spout, PE |
| 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

### 2200 Series

#### 2201-  Cannot execute report subsystem

*Cause:*  A system or application problem has occurred and has prevented output of the requested report(s).

*Action A:*  Close the analysis program, then restart it and request the report(s) again.

*Action B:*  Close the analysis program and all other applications, then restart the analysis program and request the report(s) again.

*Action C:*  Close all applications and shut down Windows. Restart Windows and the analysis program, then request the report again.

If you continue to get this message, contact your Micromeritics service representative.

## 2300 Series

### 2331- Logged-in Windows user is not an application user.

*Cause:*          You attempted to log into the application but the user logged into Windows is not an application user.

*Action A:*      Close the application, restart Windows, and log in as the Windows user. Then log into the application.

*Action B:*      Contact your Administrator to assign application rights to the current logged-in Windows user.

### 2333- You did not enter user name or password.

*Cause:*          You attempted to access the application without entering your user name or password.

*Action:*        Enter your Windows OS user name and password in the User Logon dialog.

### 2334- Incorrect user name or password.

*Cause A:*      You entered an incorrect user name or password in the User Logon dialog.

*Action A:*      Reenter your user name and password. Ensure that **Caps Lock** is not enabled; entries are case-sensitive.

*Cause B:*      You entered your user name but failed to enter your password.

*Action B:*      Enter your password in the **Password** field.

*Cause C:*      You entered your password in the **User name** field.

*Action C:*      Enter your windows OS user name in the **User name** field.

### 2335- Attempt of unauthorized access was detected. Please contact administrator.

*Cause:*          You have exceeded the allowed number of log-on attempts.

*Action:*        Contact your Administrator.

**2336-   This user account is locked. Please contact administrator.**

*Cause:*          You entered an incorrect password more than the allowed number of times (by default, this is three), and your account has been locked (disabled).

*Action:*         Contact your Administrator to unlock your account.

**2337-   The user is not an administrator.**

*Cause:*          You attempted to log in and perform a task that only the Administrator is allowed to perform.

*Action:*         Contact your Administrator to complete the task.

**2338-   Your password has expired or needs to be changed. You will not be able to log in without changing the password.**

*Cause:*          The allowed time using a password has expired.

*Action:*         Change your password.

**2339-   Your password will expire soon. Do you want to change your password?**

*Cause:*          The allowed time for using a password is about to expire.

*Action:*         Change your password.

**2340-   You must log in as a Windows OS user to change a password.**

*Cause:*          You attempted to change your password but you are not logged in as the Windows OS user.

*Action:*         You cannot change your password unless you are logged in as the Windows OS user. Close the application, then restart Windows and log in as the user.

**2341-   Error writing file or the user is not Windows OS user.**

*Cause:*              You attempted to log into the application but have been denied access. Your password file may have become corrupt.

*Action:*             Contact your Administrator.

**2342-   Please enter a valid password.**

*Cause:*              You entered an incorrect password.

*Action:*             Reenter your password in both fields. Ensure that **Caps Lock** is not enabled; entries are case-sensitive.

**2343-   This password is already in use. Please enter a valid password.**

*Cause:*              You attempted to change your password but entered one that has already been used.

*Action:*             Choose a different password.

**2344-   Application locked.**

*Cause:*              Your account has been disabled.

*Action:*             Contact your Administrator.

## 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 manual 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, click **Yes** to reset the instrument and download the proper software. Otherwise, click **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

**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.

*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-   Analyzer 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 limit**s.

*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.

## 6000 Series

**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**. 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 cal-
                    ibrated.

*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 Con-
                    figuration** 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:*         Contact your Administrator to 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 anal-
                    ysis.

*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:*          An error occurred during deconvolution of the model, probably due to a problem with the background calculation application.

*Action:*         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:*             Contact your Administrator and have the calibration files reinstalled.


**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 8 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 com-
                  plete. 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 com-
plete. 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.
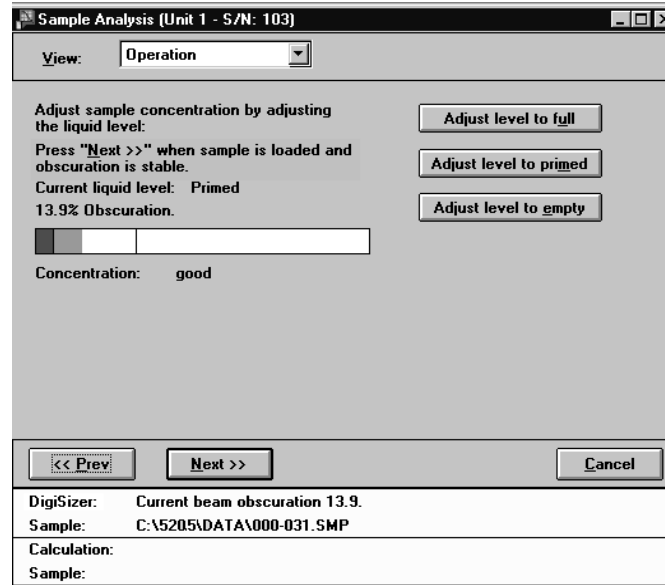


While observing the beam obscuration and concentration, gradually add your sample to the reservoir. Use the following guidelines for your sample concentration:

| 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/cm³) | Viscosity (mPas) |
|---|---|---|---|
| Ethanol (absolute) | 25 | 0.7851 | 1.096 |
|  | 30 | 0.7808 | 1.003 |
|  | 35 | 0.7764 | 0.914 |
| Ethylene Glycol | 25 | 1.1100 | 16.10 |
|  | 32 | 1.1051 | 12.18 |
|  | 40 | 1.0995 | 9.13 |
| Glycerol (10%) | 25 | 1.0206 | 1.1530 |
|  | 30 | 1.0192 | 1.0240 |
|  | 35 | 1.0178 | 0.9150 |
| Glycerol (20%) | 25 | 1.0452 | 1.5430 |
|  | 30 | 1.0436 | 1.3590 |
|  | 36 | 1.0400 | 1.1743 |
| Glycerol (40%) | 25 | 1.0970 | 3.1860 |
|  | 30 | 1.0948 | 2.7280 |
|  | 35 | 1.0926 | 2.3400 |
| Glycerol (50%) | 25 | 1.1238 | 5.041 |
|  | 30 | 1.1211 | 4.247 |
|  | 35 | 1.1182 | 3.540 |
| Hexane (n) | 25 | 0.6550 | 0.3046 |
|  | 30 | 0.6504 | 0.2900 |
|  | 35 | 0.6459 | 0.2828 |
| Isopropanol | 30 | 0.7769 | 1.7800 |
|  | 32 | 0.7752 | 1.6800 |
|  | 35 | 0.7728 | 1.5400 |
| Sucrose (20%) | 20 | 1.0810 | 1.945 |
|  | 30 | 1.0777 | 1.493 |
|  | 40 | 1.0737 | 1.184 |
| Sucrose (30%) | 20 | 1.1270 | 3.187 |
|  | 30 | 1.1232 | 2.373 |
|  | 40 | 1.1189 | 1.833 |
| Sucrose (40%) | 20 | 1.1765 | 6.167 |
|  | 30 | 1.1721 | 4.375 |
|  | 40 | 1.1676 | 3.241 |
| Sucrose (50%) | 20 | 1.2296 | 15.43 |
|  | 30 | 1.2250 | 10.11 |
|  | 40 | 1.2200 | 6.991 |

| Liquid or Solution | Temperature (ºC) | Density (g/cm³) | Viscosity (mPas) |
|---|---|---|---|
| Water | 26<br>32<br>38 | 0.9968<br>0.9951<br>0.9930 | 0.8737<br>0.7679<br>0.6814 |
| *n*-Butanol | 25<br>32<br>40 | 0.8058<br>0.8003<br>0.7940 | 2.59<br>2.18<br>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<br>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<br>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<br>Tween 20<br>Atlas  G-3300 | ICI Americas, Inc., Chemical Division, New Concord ville Pike, Wilmington, DE 19897 |
| Triton X-100<br>Tamol SN | Rohm and Haas Company, Independence Mall West, Philadelphia, PA 19105 |
| Sodium Silicate<br>"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

$$
\begin{array}{lll}
N & = & \text{refractive index of surrounding medium} \\
\lambda & = & \text{wavelength of light in a vacuum} \\
\theta & = & \text{scattering angle}
\end{array}
$$

# 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 $A_{k,-1} = A_{k,M} = 0$

$$G_k = RegParam \times \ln\frac{1}{F_k}$$

$A_{M+k,k-1} = G_k$ 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:

$$cutoff = DualThresh \times MaxModelIntensity \times \frac{100}{MaxIntensity}$$

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 172 elements:

AvgDiam[172] =   {0.075,0.079,0.084,0.089,0.094,0.100,...,1000.0,1059.3,
1122.0,1188.5,1258.9,1333.5,1412.5}

The diameter interval array has 173 elements:

IntvlDiam[152] = {0.073,0.077,0.082,0.087,0.092,...,1090.2,1154.8,1223.2,
1296.7,1372.5,1453.83}

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:

$HighDiam_i = IntvlDiam[i]$
$LowDiam_i = IntvlDiam[i-1]$

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.

$AvgDiam_i$ is the geometric mean of $HighDiam_i$ and $LowDiam_i$ =
$(HighDiam_i \times LowDiam_i)^{1/2}$

## Standard Sieve Sizes

ASTM E-11 standard sieve sizes and a few common sizes are used.

| Sieve Number (in.) | Aperture Size ($\mu$m) | Sieve Number (in.) | Aperture Size ($\mu$m) |
|---|---|---|---|
| 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:

$$AreaFreqFrac = \frac{VolFreqFrac_i / AvgDiam_i}{\sum VolFreqFrac_k / AvgDiam_k}$$

$$LenFreqFrac_i = \frac{VolFreqFrac_i / AvgDiam_i^2}{\sum VolFreqFrac_k / AvgDiam_k^2}$$

$$NumFreqFrac_i = \frac{VolFreqFrac_i / AvgDiam_i^3}{\sum VolFreqFrac_k / AvgDiam_k^3}$$

or to convert back to Volume percent based on the others,

$$VolFreqFrac_i = \frac{AreaFreqFrac_i / AvgDiam_i}{\sum AreaFreqFrac_k / AvgDiam_k}$$

$$VolFreqFrac_i = \frac{LenFreqFrac_i / AvgDiam_i^2}{\sum LenFreqFrac_k / AvgDiam_k^2}$$

$$VolFreqFrac_i = \frac{NumFreqFrac_i / AvgDiam_i^3}{\sum NumFreqFrac_k / AvgDiam_k^3}$$

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):

$$\mathrm{CumFracCoarser}_i = \sum \mathrm{FreqFrac}_k \text{ for all classes k such that } \mathrm{AvgDiam}_k > \mathrm{AvgDiam}_i$$

$$\mathrm{CumFracFiner}_i = \sum \mathrm{FreqFrac}_k \quad \text{for all classes k such that } \mathrm{AvgDiam}_k > \mathrm{AvgDiam}_i$$

$$\mathrm{CumFracRetain}_i = \sum \mathrm{FreqFrac}_k \quad \text{for all classes k such that } \mathrm{AvgDiam}_k > \mathrm{AvgDiam}_i$$

$$\mathrm{CumFracPass}_i = \sum \mathrm{FreqFrac}_k \quad \text{for all classes k such that } \mathrm{AvgDiam}_k > \mathrm{AvgDiam}_i$$

or, equivalently

$$\mathrm{CumFracFiner}_i = 1.0 - \mathrm{CumFracCoarser}_{i-1}$$

$$\mathrm{CumFracRetain}_i = \mathrm{CumFracCoarser}_{i-1}$$

$$\mathrm{CumFracPass}_i = 1.0 - \mathrm{CumFracCoarser}_{i-1}$$

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 = (CumFracCoarser$_m$ + 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:

$$\text{Skew} = \frac{\sum \text{FreqFrac}_i \, (\text{AvgDiam}_i - \text{MeanDiam})^3 \, / \, \sum \text{FreqFrac}_i}{\left(\sum \text{FreqFrac}_i \, (\text{AvgDiam}_i - \text{MeanDiam})^2 \, / \, \sum \text{FreqFrac}_i\right)^{3/2}}$$

Kurtosis:

$$\text{Kurt} = \frac{\sum \text{FreqFrac}_i \, (\text{AvgDiam}_i - \text{MeanDiam})^4 \, / \, \sum \text{FreqFrac}_i}{\left(\sum \text{FreqFrac}_i \, (\text{AvgDiam}_i - \text{MeanDiam})^2 \, / \, \sum \text{FreqFrac}_i\right)^2} - 3$$

$+x\ \sigma$

$$\text{PlusNSig} = \text{MeanDiam} + x \cdot \text{StdDevDiam}$$

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:

$$\text{GeoMeanDiam} = 10^{\dfrac{\sum \text{FreqFrac}_i \log(\text{AvgDiam}_i)}{\sum \text{FreqFrac}_i}}$$

Standard Deviation (of the distribution):

$$\text{GeoStdDevDiam} = 10^{\text{StdDevLogDiam}}$$

Standard Deviation of Log (size):

$$\text{StdDevLogDiam} = \sqrt{\dfrac{\sum \text{FreqFrac}_i (\log(\text{AvgDiam}_i) - \log(\text{GeoMeanDiam}))^2}{\sum \text{FreqFrac}_i}}$$

Skewness of Log (size):

$$\text{SkewLog} = \dfrac{\sum \text{FreqFrac}_i (\log(\text{AvgDiam}_i) - \log(\text{GeoMeanDiam}))^3 / \sum \text{FreqFrac}_i}{\left(\sum \text{FreqFrac}_i (\log(\text{AvgDiam}_i) - \log(\text{GeoMeanDiam}))^2 / \sum \text{FreqFrac}_i\right)^{3/2}}$$

Kurtosis of Log (size):

$$\text{KurtLog} = \dfrac{\sum \text{FreqFrac}_i (\log(\text{AvgDiam}_i) - \log(\text{GeoMeanDiam}))^4 / \sum \text{FreqFrac}_i}{\left(\sum \text{FreqFrac}_i (\log(\text{AvgDiam}_i) - \log(\text{GeoMeanDiam}))^2 / \sum \text{FreqFrac}_i\right)^2} - 3$$

$+x\sigma$:

$$\text{PlusNSigLog} = 10^{\log(\text{GeoMeanDiam}) + x \log(\text{GeoStdDevDiam})}$$

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:

$$RelRefIdx(Re) = \frac{ParticleRefIdx(Re)}{LiquidRefIdx}$$

$$RelRefIdx(Im) = \frac{ParticleRefIdx(Im)}{LiquidRefIdx}$$

### Sample Concentration

This is calculated exclusively for the collected and deconvoluted data.

BeamObscuration is obtained from collected data.

$BeamLength_m = 5000$
$ExtCoef_i$ = extinction coefficient for size class i, available from scattering model

$$ConcFrac = \frac{\log(BeamObscuration)}{-\frac{3}{2} BeamLength_{\mu m} \left[ \frac{\sum ExtCoef_i VolFreqFrac_i / AvgDiam_i}{\sum VolFreqFrac_i} \right]}$$

### Specific Surface Area

This is calculated exclusively for the collected and deconvoluted data.

ParticleDensity is obtained from the Material Properties.

$$SurfArea = \frac{6 \left[ \frac{\sum VolFreqFrac_i / AvgDiam_i}{\sum VolFreqFrac_i} \right]}{Particle\ Density}$$

# 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*.

$DiffRefCoarser_i = SampCumFrac_i - RefCumFrac_i$

---

1Always 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.

$$Xave = \frac{\sum x_i}{N}$$

$$Yave = \frac{\sum y_i}{N}$$

$$Slope = \frac{Sum(x_i - XAve)(y_i - YAve)}{\sum(x_i - XAve)^2}$$

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.

$$\sigma_x = \sqrt{\frac{\sum(x_i - XAve)^2}{N}}$$

$$\sigma_y = \sqrt{\frac{\sum(y_i - YAve)^2}{N}}$$

$$Cov(x, y) = \frac{\sum(x_i - XAve)(y_i - YAve)}{N}$$

$$CorrelationCoef = \frac{Cov(x, y)}{\sigma_x \sigma_y}$$

## 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<br>    1 = complete<br>    2 = analyzing<br>    4 = entered<br>    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<br>    0 = volume<br>    1 = area<br>    2 = number<br>    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<br>    0 = volume<br>    1 = area<br>    2 = number<br>    3 = mass | integer |
| 4 | Number of points | integer |
| 5 | Particle size, cumulative fraction/percent<br>(units as per the data presentation settings, repeated for each point) | floating point,<br>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<br>(repeated for each point) | floating point,<br>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 |
|:---:|:---|:---|
| | **<u>Background Data</u>** | |
| 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.  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.
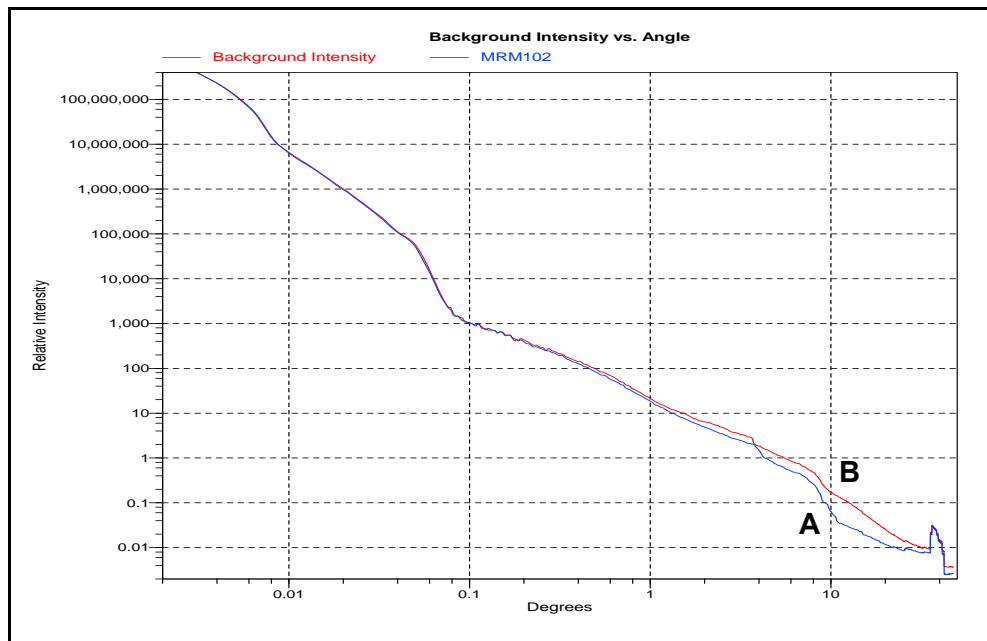
To aid in recognition of a dirty system, the previous background data are shown overlaid with each new set at the end of the background measurement. If the current background curve is higher than the previous, some contamination may exist. Note that some small fluctuations in intensity at large angles 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.

# I.  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.
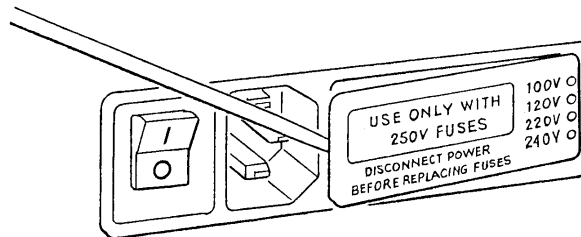


3. Pull the voltage selector card straight out of the power connector housing.



Voltage Selector Card
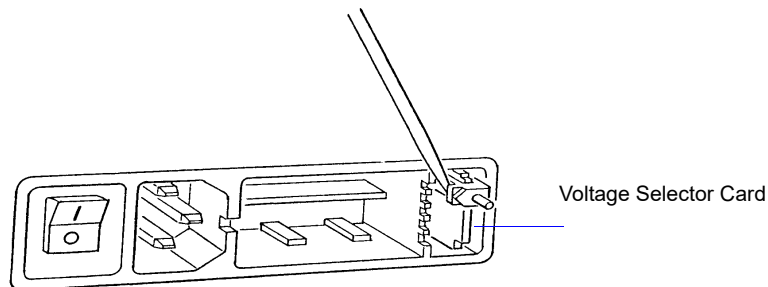
4.  Orient the voltage selector card so that the desired voltage is indicated at the bottom. Orient the indicator pin so that it points upward as shown in the following illustration.



Pin

Voltage

100V          120V          220V          240V
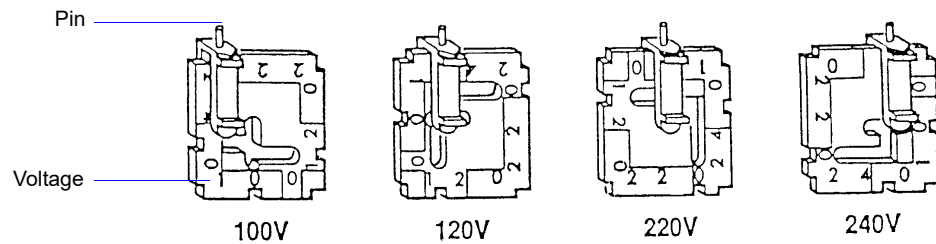
5.  Insert the voltage selector card into the power connector housing with the edge containing the desired voltage first and with the printed side facing the power ON/OFF switch.

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.



Fuse

Fuse Block

Retaining Screw

Fuses

Fuse Block

Cover

**Double-Fuse Arrangement**

Jumper Bar

Fuse Block

Fuse

Cover

**Single-Fuse Arrangement**
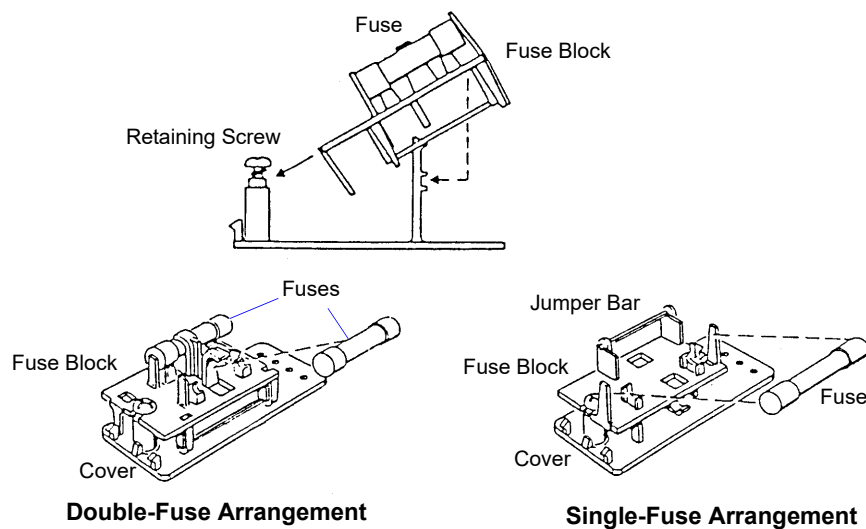
> ⚠ **The power cord should be disconnected from the MasterTech when installing or replacing fuses. Failure to do so could result in electrical shock.**

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.
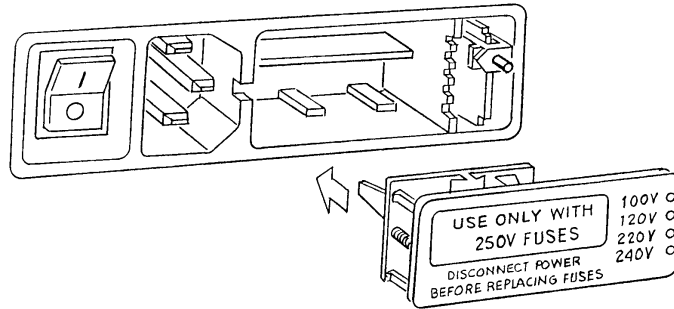
## Turning on the MasterTech

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.
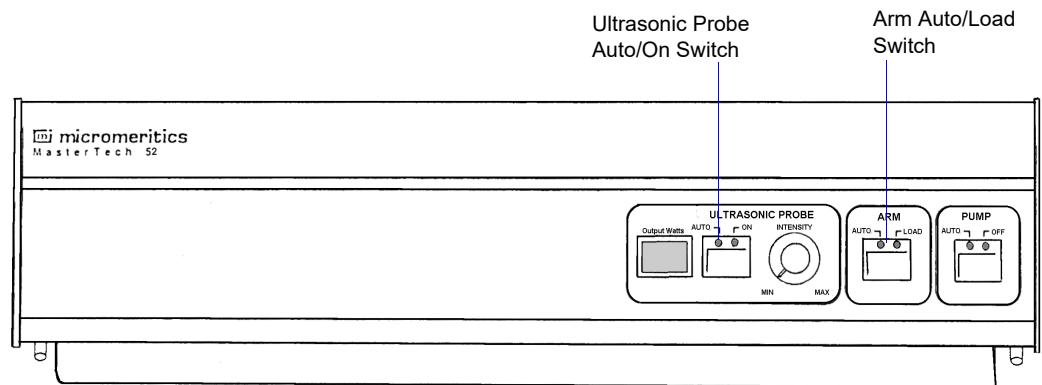
## Installing the Ultrasonic Probe

> ⚠️ **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**.
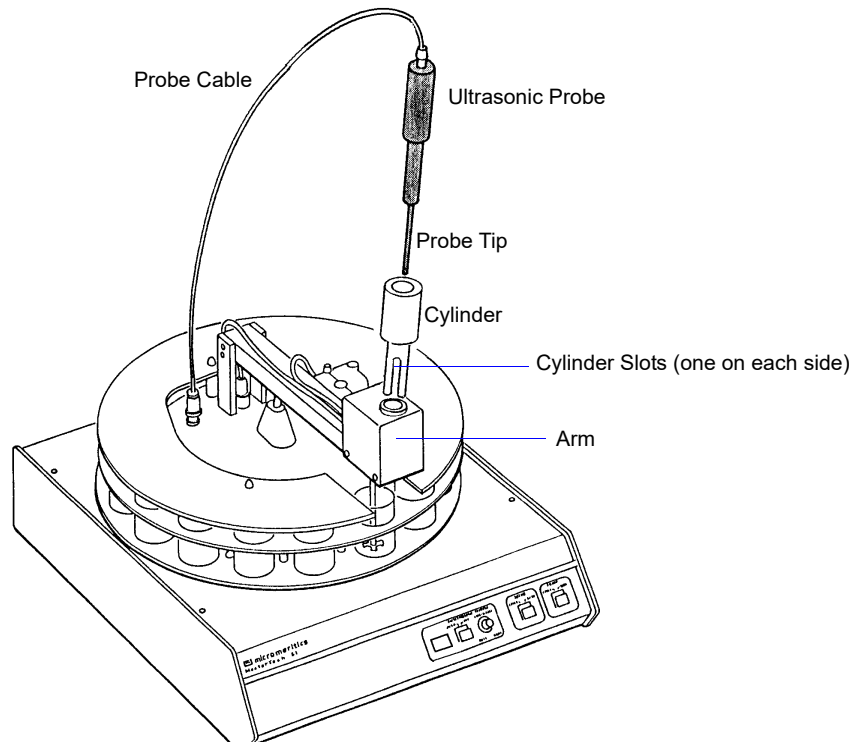


3.  Ensure that the probe tip is attached to the probe; if not, attach it before proceeding. A 1/4-in. probe tip is supplied with the MasterTech; a 1/8-in. tip is also available (refer to **Ordering Information**).

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.
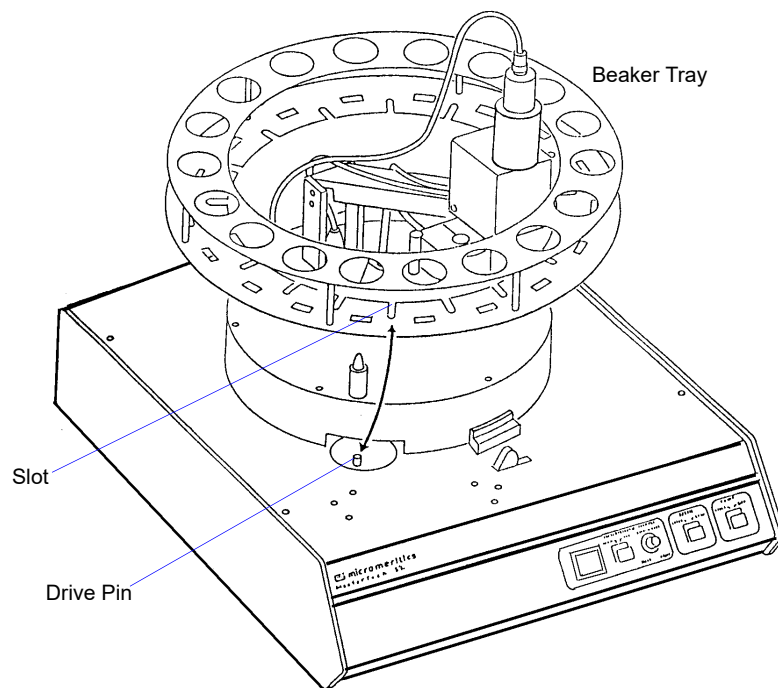
## Installing Sample Transfer Tubing

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.
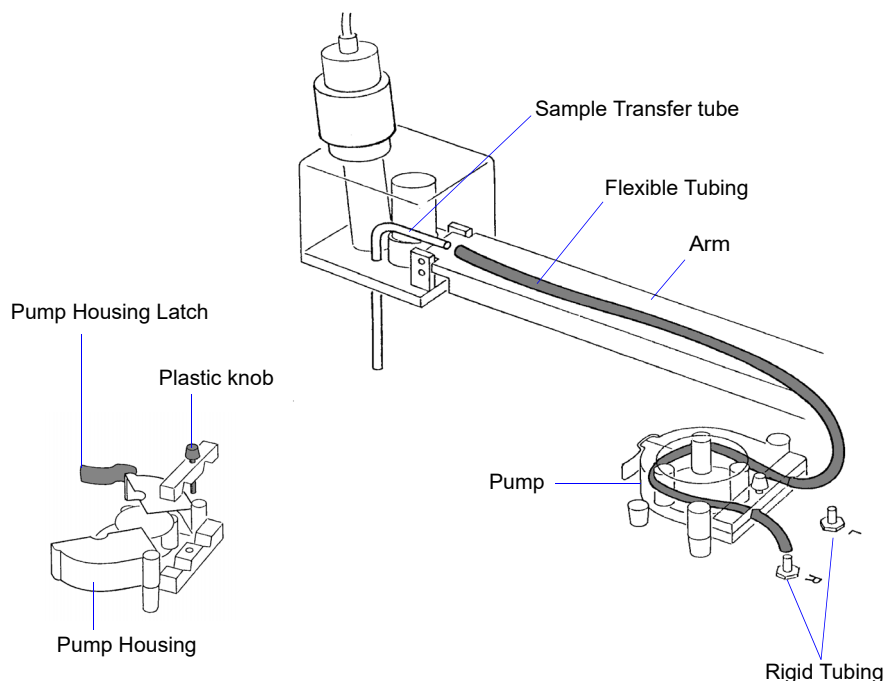


4. Unlatch the pump housing and unscrew the plastic knob on the rear of the pump.

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.



Load position

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.
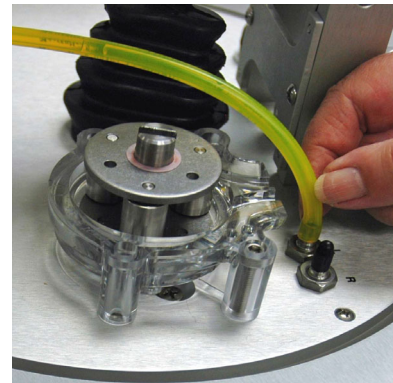


**A**                                **B**

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.
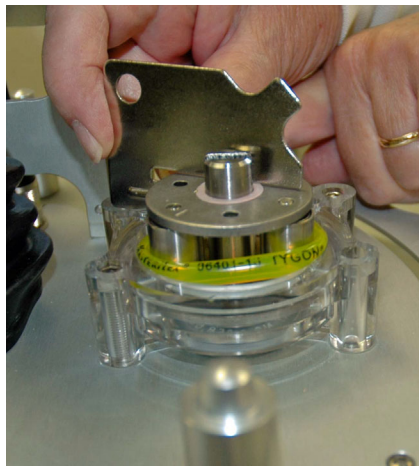
7. Slide the key out, then place the cover over the pump, wiggling it slightly to align it with the pump body and press it into place. Then insert and tighten the two thumbscrews only tight enough to secure the cover.



A                                               B
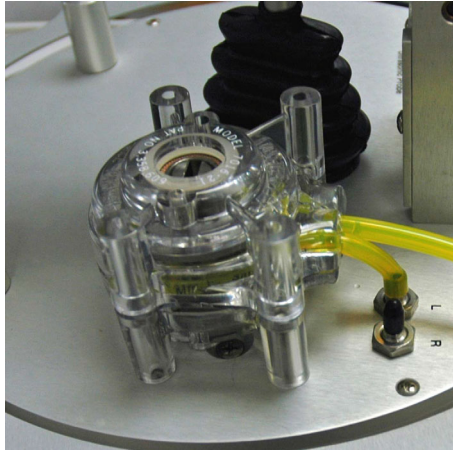
8. Attach the other end of the flexible tubing to the Sample Transfer tube on the front of the MasterTech as shown below.



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.
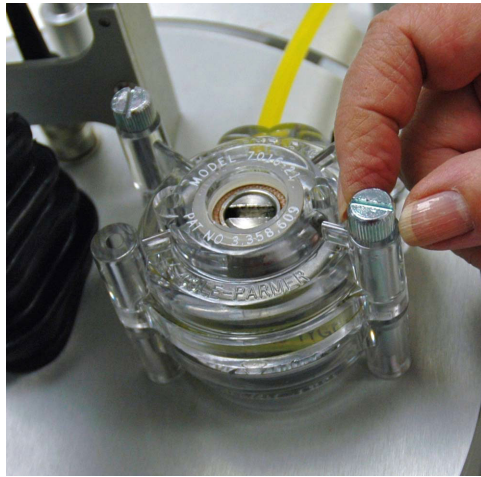


11. Press the ARM AUTO/LOAD switch to place the arm in the AUTO position.

## 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.



Analysis Liquid tubing

Remove this connector
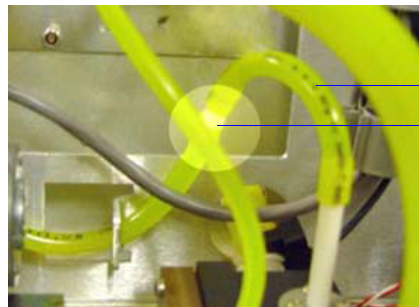
3. Using the T-connector supplied in the MasterTech accessories kit, reconnect the tubing using the two larger ends of the T-connector.



T-connector
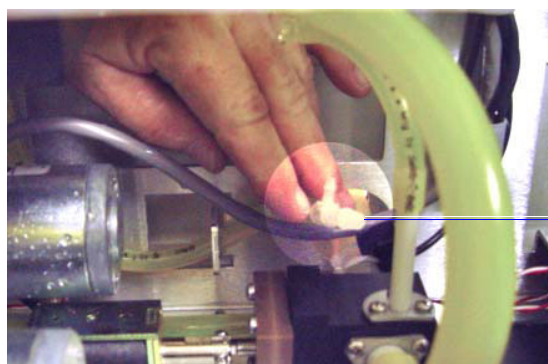
4. Insert the remaining piece of flexible tubing through the hole provided on the base of the sample handler.



MasterTech Flexible tubing
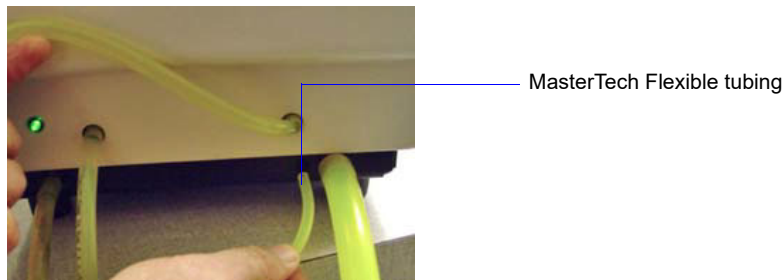
5. Guide the tubing through the hole in the front chassis (just below the rinse pump) and connect it to the remaining barbed fitting of the T-connector.

Barbed connector
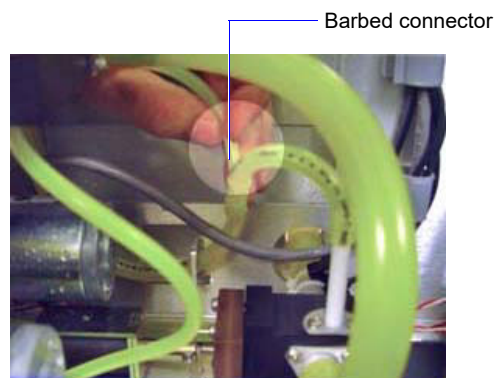


6. Install the other end of the flexible tubing onto the sample transfer tubing connector on the side chosen in **Step 5** of **Installing Sample Transfer Tubing**.



⚠ **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.
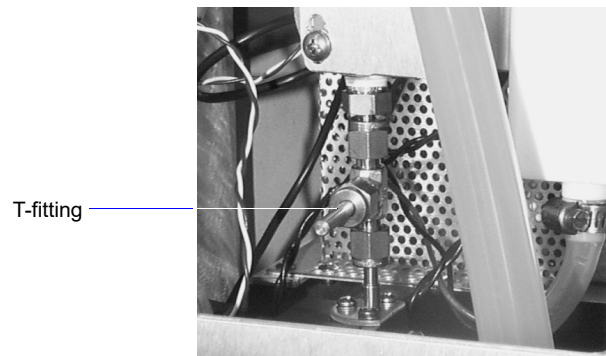


T-fitting

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.

Tubing connected to fitting ———



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**.
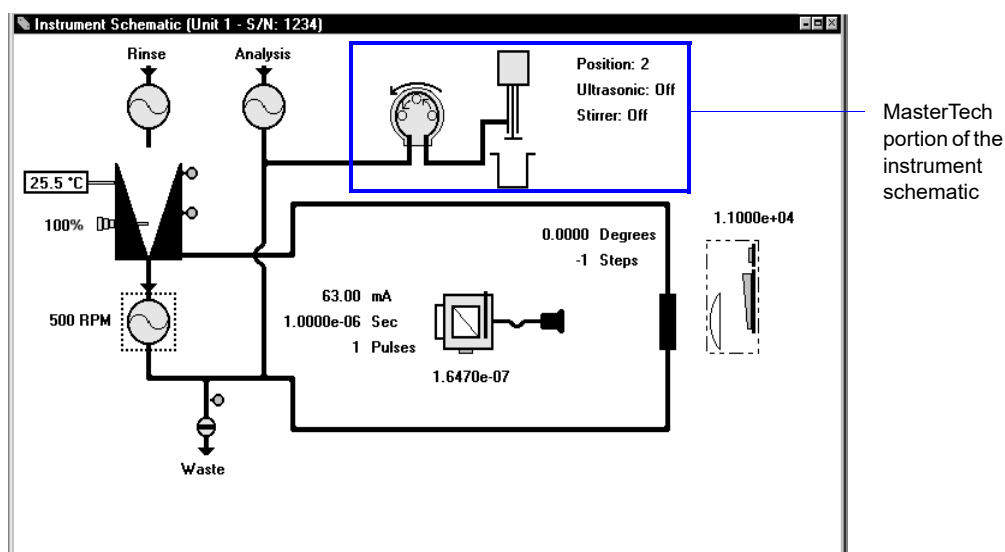


10. Ensure that the Arm AUTO/LOAD switch on the front panel of the MasterTech is in the AUTO position.

11. Select **Unit [n] > Initialize MasterTech**.

A message is displayed indicating that initialization is in progress. The tray on the Master-Tech 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.
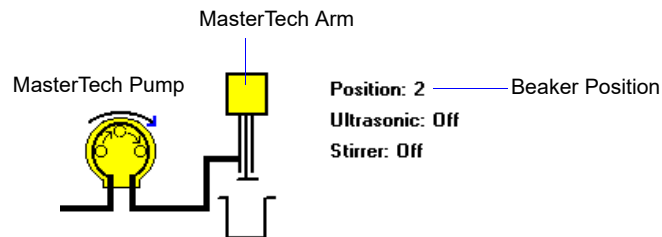


13. Place the MasterTech pump switch on the front panel in the **AUTO** position, then select the MasterTech pump on the schematic. In each instruction in this step, first access the shortcut menu:

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.

# J.   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.



Sample cell compartment
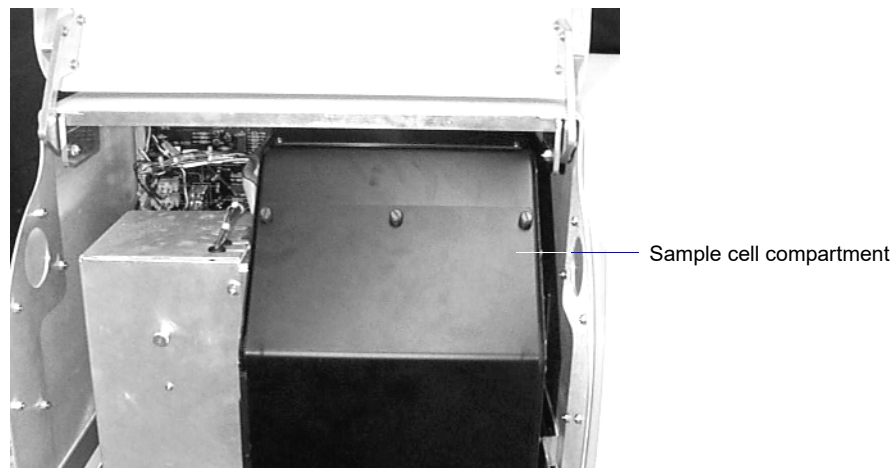
5.  Disconnect the sample transfer tubing from the upper and lower connectors of the sample cell holder.



Upper connector
Sample cell holder

Lower connector
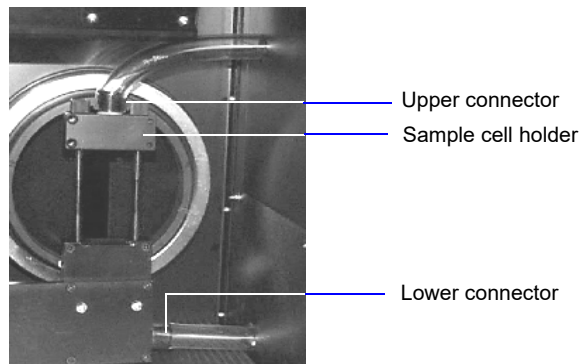
6. Grasp the liquid sample handler and slowly pull it away from the DigiSizer; store in an appropriate location.

## 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.



Longer piece on upper port.

This piece of tubing is already installed if you have the Low-volume unit.

Shorter piece on lower port.
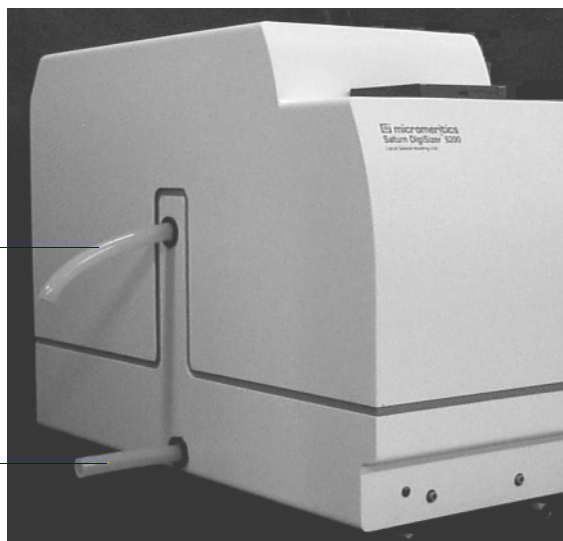
- If you are installing the Low-volume unit, the tubing on the upper port is installed; install the tubing supplied with the unit on the lower port.

4. Slide the liquid sample handler toward the analyzer, guiding the tubing through the ports on the right side of the analyzer.
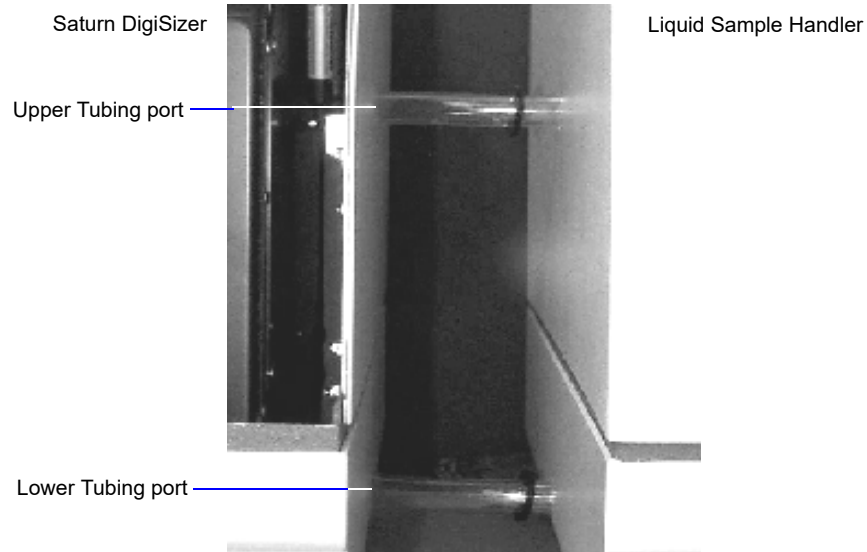


Do not allow the analyzer and liquid sample handler to touch; metal-to-metal contact may cause vibrations and, thus, inaccurate data.

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.
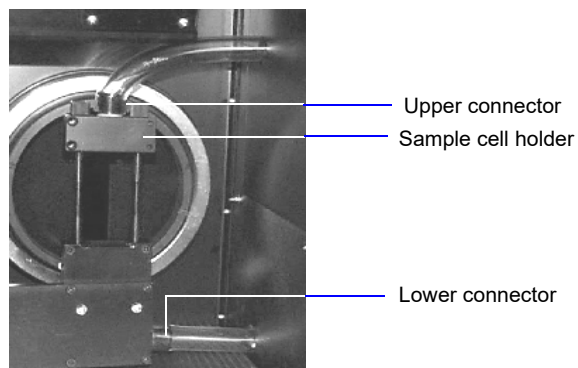


7. Attach the RS232 communications cable as follows:

   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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