Self-paced Tutorial for Microtrac FLEX Software

(Stepwise approach to learning and understanding how to use FLEX)

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Applications Note

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Provided By:
Microtrac, Inc.
Particle Size Measuring Instrumentation

Introduction

This portion of the Microtrac User's Course is devoted to developing a working knowledge of FLEX software. Since software is best learned by actual performance of various functions, hands-on operation is an integral part of this session. Portions will be explained, but the expectation is that each person will perform the various functions.

Each computer is provided space for two people since this type learning experience can be enhanced by the interaction and thoughts brought by the interaction of two people working together, much as is done in college laboratories. As such, it is a self-paced learning experience, but please be sure to ask questions if you should get "hung-up" in a particular area.

In some cases, a particular function will be "demoed" and then time will be allowed for you to perform a similar function.

Because of the high capability and number of feature of FLEX software, not all aspects of each feature can be attempted. Please see the User's Manual for more specific information and details than presented here or please ask us about specific features which we will cover on Friday on an individual basis.

Our staff welcomes your comments on this session.

General

The Microtrac FLEX software operates S3500 and Nanotrac. All features are available in both instruments, thus it is not necessary to be using the exact model instrument you own for this training.

This document contains basic procedures for using the following Microtrac FLEX Software features.

1. Tools and toolbars **(Part A)**
2. Explanation and diagram of information shown on the screen (display). **(Part B)**
3. Features and function of FLEX software
   a. Database and record retrieval **(Part C)**
   b. Plots (graphs) and comparison plots **(Part D)**
   c. Auto-recalculation of multiple records simultaneously. **(Part E)**
   d. Statistics set-up for averaging multiple records **(Part F)**
   e. Trend plot set-up to observe consistency of particle size values as a function of time **(Part G)**
   f. Data tolerance to set maximum and minimum values for automatic pass/fail examination of new measurements or those in a database. **(Part H)**
   g. Exporting and importing single or multiple records, either manually or automatically. Export to ASCII. FLEX, Excel or HTML format. **(Part I).**
   h. Preparing Adobe Acrobat pdf files**. (Part J)**

<< Tools and Toolbars (Part A) >>

Please click and open each of the following and note the function of each. The following items are those that we believe are common to all users and it is important that their purpose be understood.

On the "MENU BAR".

1. Go to Go to MEASURE and select an instrument. A file will open.
2. MEASURE allows for activating Save (all records), Save AVG records only, Auto Export of data, and auto-alignment with each setzero. When activated, a small lightly-colored blue bar will appear above the setzero indicator box. Activate each of these to show the three selections as blue bars.
3. Click VIEW, then CONFIGURE DATA VIEW: The information provided on the monitor or display is controlled here. The display items also can be controlled by the icons located in the Data Display Toolbar but any changes are NOT permanent. The changes will only remain if the check-box in CONFIGURE DATA VIEW labeled "Persistence" is checked. This dialog must be opened to make permanent changes to information shown on the display.
   - 3.1. CUSTOMIZE/ RESTORE. This tool actually only is used as "restoration" and not for customizing the tool bars.
4. TOOLS:
   - 4.1. SECURITY is a special function that we will discuss on an individual basis, since it is normally used in specialized industries. Security is designed to be compliant with FDA 21 CFR Part 11.
   - 4.2. HARDWARE CONFIGURATION (also titled S3000/S3500 in versions earlier than 10.2.12.) Allows setup and selection of sampling system, auto-sampling systems, optical bench types that are to be connected to the computer. Thus the software will search for these items when it is booted.
   - 4.3. SERVICE: Allows special functions to be performed such as alignment, bench status report (to check electronics), uniform calibration (tests and establishes balance among all detector segments). Uniform Calibration and alignment are only necessary with S3500.
   - 4.4. Auto-export, Load data tolerance File, and User Defined Edges will be discussed later.
   - 4.5. Other features include Auto-export, Manual Data Entry, Sediments Option and User Defined Calculations
5. REPORTS
   - 5.1. Click on Auto-print and Print Only Average. Little blue boxes will appear to show that they are activated.
   - 5.2. SELECT / DESIGN. Allows user to design own report that can be printed or exported.
     - 5.2.1. Click to open. Dialog boxes.
     - 5.2.2. Click any report on the left side. Click "Design". Images will be shown.
     - 5.2.3. Modify the image. (demonstration if in Microtrac User's Course)
6. HELP
   - 6.1. Click HELP, A list of all manuals will be shown. "User's Manual" provides detailed instructions for software features in Adobe, PDF, printable format.

On the "MAIN TOOL BAR"

Many of the items on the Main Tool Bar are operational icons and will not be covered including Set zero, Loading Screen, and Run. If you have questions regarding these operations, please consult one of the instructors. The other icons will be used later.

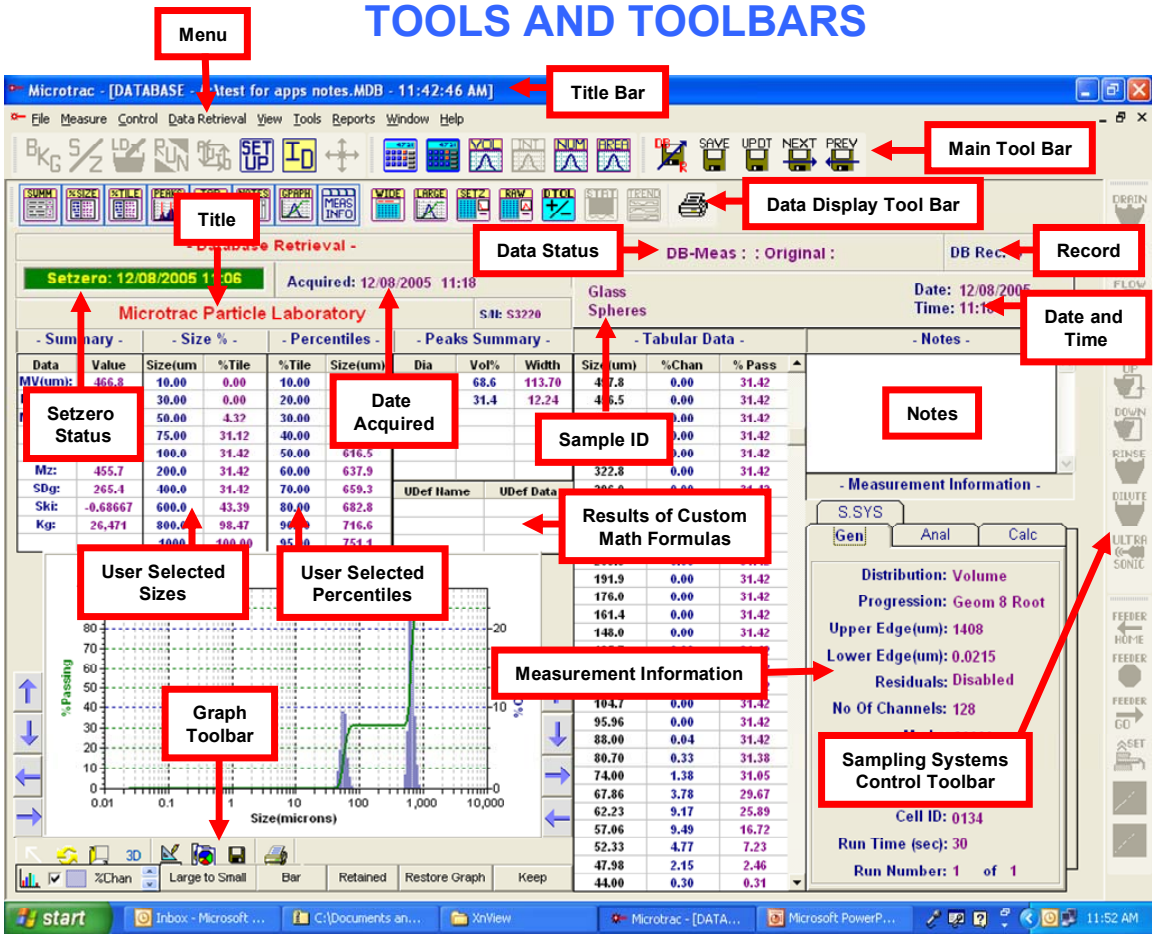
<< Microtrac FLEX Display Information (Part B) >>

Please see the example in the handout titled Microtrac FLEX Display Information (below) for a summary of each of the functions shown on the FLEX monitor display. This display is not changeable except from the standpoint of hiding or revealing information. Locations and sizes of the components cannot be changed; however, design of reports for printing and export is very flexible as shown earlier.

Microtrac Flex™ Display Information

Microtrac FLEX™ software provides for complete flexibility to modify the display, change colors, export/import data in commonly used formats, recall data records, and many other features. This assures that each customer can customize exported/printed reports as well as display only the information desired. A reproduction of the display is shown below containing the tool bars used to access features and operate the Microtrac instrument. Each item contains an explanation that is activated by placing the mouse cursor over the icon or button of interest. For more detailed information, please refer to the "User's Manual" in the HELP section of Microtrac FLEX software or contact the Microtrac, Inc at 727 – 507 – 9770 in Largo, FL.

TOOLS AND TOOLBARS



Menu – Provides access to various program operations and features. As a convenience, many items for Measurement, Control, and View are also shown and accessible as active buttons in other toolbars. “Reports” design permits customizing data reports that will be printed or exported. Reports design does not modify display items.

Title Bar – Provides the program version, path, location and file name being used.

Title – User entered title.

Main Toolbar – Allows for operator functions including making measurements (setzero, entering sample identification (ID), Loading screen, RUN activation and setup), database record retrieval, distribution type (volume, area, etc.), recalculation activation, updating a displayed record and accessing previous/next record from a database. Order of the functions displayed is customizable.

Data Display Toolbar – Allows selection of data items to be displayed by “Hide” and “Unhide” commands, printer activation, view trend plots, data tolerance, graphs of setzero, raw data, etc

Data Status - Indicates recalculation and security status of the record shown. Recalculated means that the record (Original) has or has not undergone a change. More details are available in the HELP tool under “User Manual”.

Data Acquired – Date that the measurement of the sample was performed.

Date and Time – Indicates the date and time the record was saved or recalculated.

Database Record Number – Data are stored as a sequence of record numbers in a specific file determined and named by the user. File name is shown in the Title Bar.

Graph Toolbar – Provides tools to customize the graphical image of the data and modify to show 3-D, modify axes, colors, and copy for use in presentations.

ID – Two levels of sample identifiers may be entered using the ID located on the Main Toolbar. ID will update when measurement is completed.

Sample System Controls – Provides access to all functions of fluid circulator, dry powder feeder, and ultrasonic probe. Shown is vertical arrangement but operator may select horizontally as desired with other toolbars.

Setzero Status- Green (setzero satisfactory), Red (Setzero warning that background is too high) and date/time of last setzero according to computer clock setting.

Measurement Information - Contains information regarding the sample measurement or record being displayed.

GEN provides user entered values applied parameters set during Measurement Setup (type of distribution, measuring time, filter status

Anal provides fluid and particle parameters (refractive index, viscosity, etc) used for calculating the displayed measurement.

Calc provides for miscellaneous calculated and measured values for the displayed record. Includes error of distribution calculation, loading index, transmission,

SSYS – provides information on sampling system (circulator, dry powder measurement) settings selected and to be used during the measurement.

Notes – An area that functions as a word processor for comments and experimental notes.

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<<Features and Functions of FLEX Software Part C, etc)>>

The following exercises use the database named **"Example".** Please note that the most commonly used features are reviewed in this document. Many other features are available in the software. Please be sure to ask us if a particular feature is desired or assistance is needed for other features.

Part C. Database Retrieval Function

1. Click "File", "Open Database for retrieval"
2. Select "Example" from the list of databases. The database is saved as a MS Access database file. The screen may seem to move – allow the display to settle down before proceeding.
3. Click "Retrieval" then click "Retrieve data".
4. Under database Query Filters click "bench type" and S3500. All tabs will become active (no longer grayed out)
5. In this tab, very selective recall of records may be set up according to day, date, time, and ID's. To properly activate, be sure to click "Enable Filters" box at the lower left.
6. Test: Click on the box next to Sample ID 1. In Sample ID 1, type "DMD Glass" exactly as shown here. Click the "Query Results" tab and only those records with that name will be shown even though other records are present in the database.
7. Click 1 or more of the records. Click on one record and it turns gray. To select non-sequential records, hold down the CTRL key and left click on the desired records. To select a number of records in sequence, hold down the shift key and click on the last record of the sequence. All records including the first and last records of the sequence will turn gray.
8. Select "Retrieve" at the lower left corner and the software will select only those records grayed out. When complete, the display will show the first record of the sequence.
9. Test: Select records 4, 5 and 7. Activate the retrieval. When retrieval is complete record 4 will be shown. Click the "NEXT" icon on the "Main Toolbar" to view record 5. Click "Previous" to view record 4 again.

Part D. Plots and Comparison Plot Options

1. Perform the steps above (1-4 and 9) – except do not activate to retrieve the records. Three records will be "highlighted".
2. Test: Move the mouse pointer over any one of the selected records and **RIGHT CLICK**. A menu will appear.
3. Click "Compare Plot Selected Records". A plot of the records will appear. The records may appear as only one (they are over-laid nearly exactly). Move the pointer to 3D and click. The graph will expand showing all records clearly.
4. Click the box next to the 3D icon and use it to change the position of the graph by placing the cursor over the graph and moving it back and forth. Stop when you obtain a graph that is appealing to you.
5. Click the "circle arrows" and move the cursor to the graph. Move the arrow and the graph will change again. Stop when you have an appealing picture.
6. Click the arrow on the left of the "circle of arrows". This is a selection arrow. Note that the graph must in the line mode (not 3-D). Place the cursor over the graph, hold the left mouse key down and move the mouse. A block will form around the graph data having the size of the motion of the mouse. The graph will expand to those limits. Thus you can be very selective about what data you wish to show.

7. At this point, the graph may be copied to excel, PowerPoint, Word or other compatible document. **Clicking the copy command places the image on the clipboard for easy pasting**.
   7.1. Click the “Copy” command.
   7.2. Open PowerPoint or Word. Select a new slide (PowerPoint) or page (Word).
   7.3. Click “Paste”. The graph will be pasted onto the slide or page. From here, the image can be modified as normally done with the MS Office programs.
8. Click the triangle/ruler icon and total command of the picture can be achieved. Example: Change color of one of the graph lines.
   8.1. Double left click on darkened bar (DMD Glass). A dialog box will show all of the features of the line. Take a few moments to try a few changes.
   8.2. Changing scales: If the graph does not have desirable scales, click the arrows (<), (>).
   8.3. Changing Plot Type: At the lower right corner a choice of 3 graphs types is presented. Select one or more.
   8.4. Click the “X” in the upper right corner to close the plot.
9. From “Data Retrieval” reselect the same records as above and click on “Comparison Plot Options”. The choices are:
   9.1. “Include Average Records” – Only when this is activated will the FLEX calculated average of a series (e.g. 3 measurements and the average are automatically calculated) be included.
   9.2. “Plot Average of set” – All records selected will be averaged and graphed – useful when you want to compare one or more records to an average of many others when the average includes the record.
   9.3. “Plot standard Deviation” – The standard deviation of all records selected will be calculated and displayed. It is often easier to spread out the plot so that these can be seen easily. Edit the Bottom -axis scale (Triangle/ruler icon) so that the S.D. values become more easily read.

Part E. Auto-recalculation

1. Retrieve data records as before (First **Click “S3500” in Query Files**) and tabs will become evident. Click “Auto-Recalc Set up”. This allows **set-up** (only) of what you want to change in a number of database records all at one time. This saves performing the same function on one record at a time. Note: Some portions of the changes will not occur when a average of a series runs is selected
2. **NOTE: BE SURE THAT ALL ITEMS ARE AS YOU WANT THEM TO BE OR AS THEY WERE SET ORIGINALLY.**
3. **If you do not want to change, e.g. Transparency, then do not check the box at the top labeled “Use New”. The values in the “Transparency” box will not be used.**
4. **If you make one change and the other selections are not as you plan them to be, then those will also be changed when the auto-recalc is activated. The settings shown are default values and most likely are not the selections you have made and shown in your data records. Thus, you can change the value of one, but the others must be evaluated to assure that they are as you originally set them except for the change you want to make.**
5. Click “Update Records” (Upon activation the recalculation will occur and the records selected will automatically be recalculated and the records overwritten/updated.) Note: Some portions of the changes will not occur when a average of a series runs is selected
6. Click “Particle refractive index”, and “Particle Shape”.

6.1. Change the refractive index to 2.0 and the shape to irregular (or spherical if it is already set to irregular).

6.2. Assume that the other values and checks are as you originally set them for the measurement.

7. Click “Query Results”. Right click on any record selected, and click on “Recalculate Selected Records”. The software will recall each record and recalculate the records according to the changes made in the set-up operation. At the same time it will update each record.

Part F. Statistics Set-Up

Multiple measurements can be viewed in spreadsheet format. Mean values, Standard Deviation and Coefficient of Variation can be shown. There are two ways to do this:

(1) From Data Retrieval, (2) during active measurements when more than 1 run is selected.

From Data Retrieval

1. Click “File”, “Open Database for retrieval”
2. Select “Example” from the list of databases. The database is saved as a MS Access database file. The screen may seem to move – allow the display to settle down before proceeding.
3. Click “Retrieval” then click “Retrieve data”.
4. Under database Query Files click “bench type” and S3500 (or Nanotrac). All tabs will become active (no longer grayed out).
5. Select parameters in the “Statistics Set Up” tab, and format for which you want to analyze and view
6. Click mean, standard deviation and coefficient of variation on the right side. This standard deviation shows variation about the mean of the values and is not the same as the Microtrac SD value (breadth of distribution).
7. Save these selections as a file (lower right corner) if you think you will use the same selections again. This saves time next time you want to use these specific values when doing statistical analysis using Microtrac.
8. Click “query results” tab and Right click on any of the selected records that are grayed out.
9. Click on “Retrieve to Statistics Display”. Click “OK” to perform data retrieval and statistics display.
10. NOTES:

    10.1. Any record can be included – even an average of multiple runs. It may not be desirable to have them included with single measurements. Also, it may not be desirable to have single measurements included if many “Microtrac average values” (those from multiple measurements of same sample in the circulator measured multiple times) are being shown.

    10.2. There is no limit to the number of records to be calculated or displayed.

    10.3. Only the individual measurements (records) can be exported to Excel. An equation must be set up in Excel to calculate the mean, std.dev and CV.

    10.4. The data are shown in the currently selected data view. Another data view (%Passing, %Channel, %Retained) may be selected from:

        10.4.1. Before Data retrieval, select View, Configure Data View.

        10.4.2. At the bottom of the dialog box select the desired view from “Statistics Display Presentation”

11. A trend of the values is shown at the bottom of the display

11.1. Highlight a row by clicking on any row in the Tabular Data in the top section. Click on "Plot Selected Tabular Row". The plot will be shown.

11.2. Highlight a row by clicking on any row in the Summary Data bottom section. Click on "Plot Selected Summary Row". The plot will be shown.

Part G. Trend Plot Set-Up

Up to 6 Data Items (MV, percentile, etc) may be selected and plotted simultaneously. Any number of records containing the data may be selected. Minimum/maximum limits are entered and will be shown as a green bar (passing spec). Graphical scales are adjustable. The plot can be printed, exported and displayed in 3-D.

1. Click “File”, “Open Database for retrieval”
2. Select “Example” from the list of databases. The database is saved as a MS Access database file. The screen may seem to move – allow the display to settle down before proceeding.
3. Click “Retrieval” then click “Retrieve Data”.
4. Under “Database Query Filters” click “bench type” and S3500 (or Nanotrac). All tabs will become active (no longer grayed out).
5. NOTE: A maximum of 6 data Items may be selected from all the channels sizes, summary data, etc.
6. Click Trend Plot Set Up. Enter the following “Min/Max Value Limits” as specifications.
   - 6.1. MV Limits: Min = 35 Max= 45:
   - 6.2. 10% Limits: Min=10 Max =30
   - 6.3. 50% Limits: Min=35 max= 45
   - 6.4. 90% Limits: Min=57 Max= 58
   - 6.5. In “ Standard Progression % in Channel…” enter Size= 37u (Select size by clicking and scrolling on the down-pointing arrow to the right of the open space).
   - 6.6. Also, Min =20 Max = 30
7. Plot Scale Minimum and Maximum. Enter the following values for purposes of plotting the data-points on the trend plot. These values should be lower than the min spec and larger than the max spec so that each data point will be shown.
   - 7.1. MV Min 30 max 50
   - 7.2. 10% Limits: Min=5 Max = 45
   - 7.3. 50% Limits: Min=25 max= 65
   - 7.4. 90% Limits: Min=55 Max= 65
   - 7.5. In channel Min=10 Max= 60
8. NOTE:
   - 8.1. Be sure to click next to “SEL” (Select), which will place check mark in the box. The check mark tells the computer to include those data items and their corresponding min/max values.
   - 8.2. These selections may be saved as file to save work next time you wish to use these selected values.
9. Click “Query Results” and select all records for DMD and Glass1. Right click on any of the selected records. I menu will be shown. Click “Retrieve to trend Plot” and answer “OK” to the next dialog. The software will find and plot the selected records according to the inputs made.
   - 9.1. Tests: (1) Click the scroll bar on “Points Per Page” to change the number shown. Note how the graph changes. (2) Click “Show Values” and the actual value for each point is shown
10. NOTES:
    - 10.1. Points within the green bar are those that are within the specified min and max values entered in the Trend Plot Set –up
    - 10.2. The “Save” icon (looks like a 31/2 inch floppy disk) will export the graph in picture format using a “Save As” dialog box.

10.3. The “Copy” icon will place the plots on the Windows clipboard ready for pasting into Word, PowerPoint, Excel or other compatible program.

Part H. Data Tolerance

Data tolerance display allows the user to establish pass/fail criteria by inserting minimum/maximum values. After a measurement, any values falling outside the min or max will display “FAIL” in the status column.

1. NOTES:
   1.1. Data must be saved in “Standard Progression”. Standard Progression may be obtained by going to SETUP, OPTIONS, and PERSPECTIVE. Then select Standard Progression and recalculate. If more than one record must be recalculated to achieve the “Standard”, then use the “auto-recalculation feature”. If there are any plans to use the Data Tolerance feature in the future, it may be easiest to make measurements and save data as STANDARD progression. All data in the Example Database are saved in the Standard progression.
   1.2. To set-up the tolerance display, data must first be displayed either as a measurement or database retrieval. This will act as a template to set up the Data Tolerance according to your needs.
   1.3. Two things must be done:
      1.3.1 Set up Data Tolerance limits
      1.3.2 Activate the display to allow the selected values to be shown
   1.4 Once set up, clicking “DAT TOL” will show for new measurements or those recalled from the database, whether the measurement values are within the tolerance specified.

2. **The general concept is as follows**:
   2.1. Retrieve a record from the database.
   2.2. Set the limits using one of two approaches.
      2.2.1. Set a range of minimum and maximum values for all of the particle size, percentile or summary data values.
      2.2.2. Set specific values one at a time or change some of the ranges set by the above approach.
   2.3. Put a check mark (left click on the box) beside the channels of specific interest. To allow them to be shown on the main screen, put a check under the **“SEL” column**. These will be shown on the main screen when this exercise is completed.
   2.4. Save the set-up to a file.
   2.5. Activate display (click on a box) so that the pass/fail will be shown on the main screen for each of the channels selected.
3. **Example of setting the tolerances.** Open the “Example” database. Retrieve record #1. This acts as a template (discussed above) to set up the tolerances you have previously decided upon. This exercise will provide a set of these tolerances as an example. (When all entries are completed, the file can be saved and recalled to see if a particular sample measurement passes or fails). It may be useful in your daily work to label the file according to a Product name so that it can be recalled and applied to the correct sample material being measured.
4. Click the “Data Tolerance” icon. Click Percent Channel under Data Format. (We are using Percent Channel for learning purposes only. For your specific needs at your place of business, there are other choices).

5. Since this is a new tolerance set-up, it is easiest to start with blank boxes under the SEL columns. Click “Reset” to start a new setup for tolerance testing. This will un-check all “SEL” boxes that are selected. This tool is easier than un-checking each size one-at-a-time. If its desirable to only change one, then “Reset” is not necessary. There is no harm in doing this if nothing is checked in the “SEL” column.
6. To use a broad approach where the same percent variation is applied to all data records, use “Set%” or “Set Fixed”. For example use the following values as limits:
   6.1. **“Set%” box.** In each case where you answer “Yes” the values will change to be **+/- 10%** of the value shown in the blue column (% Differ). Enter **10** in the “Set%” box. Click the “set%” button. A dialog box will be shown. If you want to apply that percent to “Percent Channel Pass or fail”, click “yes” – if not, then click “No”. The box pertaining to another table will be shown. Read each carefully and answer “Yes” or “No”. You must go through this process again if you wish to have different percents for any of the tables.
   6.2. **“Set Fixed” box.** Enter **20** in the Set Fixed box. Click the “Set Fixed” button. . A dialog box will be shown. If you want apply that percent to “Percent Channel Pass or fail”, click “yes” – if not, then click “No”. The box pertaining to another table will be shown. Read each carefully and answer “Yes” or “No”. In each case where you answer “Yes”, the values will change to be **+/- 20** of the value shown in the blue column. Note: Resulting values less than “0” are assigned a value of “0”. You must go through this process again if you wish to have different percents for any of the tables.
   6.3. If some of the values for max and min, are not desirable, then they may be edited by entering them manually.
      6.3.1. Place the cursor over the max or min value you want to replace.
      6.3.2. Type the value. Click “Refresh”. (“Refresh” acknowledges that changes have been made **manually**).
      6.3.3. **Save the file** with a new name or the one that you just changed. For the purposes of this exercise, please save the file with a new name.
7. **Showing and accessing the selected values.** NOTE: Showing selected values is particularly useful during measurements by allowing only those percentiles, etc of interest to be accessed rather all possible values. To allow these to be shown:

   Click “VIEW” on the Main Tool Bar

   Click “Configure Data View”

   Click “Data Tolerance” and click the box at “Show Selected Parameters”

   The previous steps above have allowed (1) the tolerances to be set up and (2) allow access to the selected parameters to be shown on the display.

   Be sure that the file has been saved as in Step 6.3.3. Click “OK” at the bottom of the dialog box and you will return to the main screen. Remember, you are using the latest Data Tolerance set-up/file that was just established.
8. **The “DAT TOL” tab**. Note that on the main screen in the Measurement Information area, a new (extra) tab now is shown. Clicking on it (DAT TOL) shows a box with a list entered above containing the sizes, %difference from the min/max values and whether the value PASSES or FAILS the tolerance values entered above.
9. Retrieve several records form the “Example” database. For each of the records, click the “Data Tolerance” icon. Any values not within the specification you entered for the present data tolerance file recalled, will show “FAIL” in red. “PASS” will be in green. If you would like to see all the values, including those not checked, click the “Data Tolerance” icon in the Data Display Tool Bar
10. If you need a different “Data Tolerance” file to decide pass/fail, click the icon and select the appropriate file containing the values needed for comparison to the record you are reviewing.

To do this, click ‘Recall” and select the first file saved. Note that the pass and fail criteria are changed and the sizes passing and failing have also changed. Click “OK” to return to the full display of the measurement data.

Part I. Exporting and Importing Data

The ability to export and import data is an important aspect of performing measurements. The following description provides descriptions of the various ways Microtrac FLEX data can be exported and imported.

Note: When exporting data, the location is usually at Programs, Microtrac FLEX 10.xx.xx, Databases, YOUR File name.

1. The diagram shows the procedure to **export a portion of the displayed data** and the method to **export a single measurement** (not a retrieved record form the database).

Export portions of data display (on-screen)

Exports only one Portion (Summary Data, Tabular Data, Percentiles, etc.) of the data on the display

↓

Right Click on any portion of displayed information (Summary Data, Tabular Data, etc)

↓

Click “Export”, Click on choice (ascii, Excel, HTML)

↓

Select a path at the top and type a File name at the bottom under which the file will be saved. Make a note of the path and any folders used..

↓

Click OK. Data will be exported in one of three file formats.

1.ASCII (can be used by many software programs)
2.Excel (Spreadsheet)
3.HTML (useful for email-ready image of the data)

File is found by accessing the file path used for export. If the path is not changed, the file may be located at:
C:Program Files→Microtrac Software Version→ Databases→ file name you typed

Manual Export and Import of a single data *measurement*.

No need to setup file in Windows Explorer before this activity as in necessary with auto-export
Produces ASCII file that can be imported to FLEX

Export *data record* – one at a time

1. Click “Measure”
2. Click “Export Meas to file”
3. Type file name
4. **Note: Remember location and name**
5. Click OK
6. File is now an ascii file that can imported into FLEX or other software.

IMPORT *data record* – one at a time

1. Set-up a file name in FLEX for data to be imported to.
2. Open database where the data will be imported **TO**
3. Click “Measure”
4. Click “Import Meas from file”
5. Find File that was made in Step 6 in the “Export Data Record” box to the left of this box.
6. Click “OPEN”. Imported data will be displayed
7. Click “SAVE” to add the record to the opened database. It will be last record in the list accessed by Data Retrieval

2. Auto-Export <u>MULTIPLE NEW MEASUREMENTS</u> to a file as they occur.

2.1. Need existing file **to send records to**

2.2. Before proceeding use Windows Explorer to set up a folder and file name where the data will be sent. The first several steps below are for setting up the transfer to the new file. The final steps activate the transfer.

2.3. Procedure

2.3.1. Go to “Tools”

2.3.2. Click “Auto export Set up”.

2.3.3. Select folder (Left Side of box)

2.3.4. Select the file name where the data will go. (This is the ***Base File Name*** set up in Explorer).

2.3.5. Select a Unique File Name (Each record will be given an extension according to date/time or numerical sequence. This is your choice)

2.3.6. Select file format. (Your choice. Do you want to import the data records into another FLEX file? Send them to Excel? Make an ASCII file that can later be imported into Word, Excel or other ASCII compatible program?).

2.3.7. Click OK.

2.3.8. Click “Measure”

2.3.9. Click” Auto-export to file”. **This activates auto-export.** This command is NOT persistent and will turn off when the software is exited.

3. Auto-Export <u>SAVED RECORDS IN A FLEX DATABASE TO A FILE.</u>

3.1. Allows **export** of multiple records. All records in a database or selected records can be exported. Note that the records exported will have “DAT” extensions.

3.2. Records can then be **imported** into another FLEX file or other database (Excel, Word, etc.). This can be useful when sending files to a colleague by email. When records are imported, their original record numbers will be changed to adapt to the new database. They will be added to the end of the database if a FLEX file is used.

3.3. Need an existing file to which records will be sent. This is called the **Base File Name.**

3.4. Before proceeding you may use Windows Explorer to set up a folder name (remember folder name!) where the data will be sent.

3.5. Procedure

3.5.1. Using FLEX software, open the database where the data resides. -

3.5.2. Click “Data Retrieval”.

3.5.3. Select any or all records that will be exported to the Base File name made in explorer.

3.5.4. Right click on any of the selected records. A menu will appear. Select “Auto-Export Selected Records”

3.5.5. **Auto-Export Set-Up** appears.

3.5.6. Select Folder (Left Side) of box.

3.5.7. Select or type the base file name (Base File Name) where records will go. The records will be exported as file names that start with the Base Name you have selected. For instance, if you use your personal name, the file for an individual record would be YOUR NAME_1.DAT if sequential numbering is used. See next step. If a new Base File Name is not entered, the Base File Name will be MTDATA_1.DAT for the first record exported. For the second record exported to as a file, the name will be MTDATA_2.DAT. Date and time may be selected rather than sequential numbering.

3.5.8. Select a Unique file name (Each record will be changed into a file and be given an extension according to date/time or numerical sequence. The extension will be shown after the Base File Name.

3.5.9. Select file format. (Your choice. Do you want to import the data records into another FLEX file? Send them to Excel? Make an ASCII file that can later be imported into another FLEX file, Word, Excel or other ASCII compatible program?).

3.5.10. Click OK. Auto-export will be activated and the selected files will show on the display.

4. Auto-IMPORT RECORDS FROM AN ASCII file.

4.1. Allows import of multiple records into another FLEX file. Useful when combining data from different files into one file. Imports all records saved in Base File Name.

4.2. Files for importing must first be exported to a Base File Name using the FLEX software as described above.

4.3. Records can then be imported into another FLEX file or other database (Excel, Word, FLEX, etc). This can be useful when receiving files or selected records from a colleague by email. When records are imported their original record numbers will be changed since they will be added to the end of the existing records.

4.4. Procedure

4.4.1. Open an existing database file in FLEX where the data will go. Alternatively, create a new database file using the FILE tool in FLEX. The records will be added on to the end of previous records if the file already has records in it. The new (added-on) records will take on new record numbers.

4.4.2. Click “Data retrieval” and click “**Auto Import Files to db”.**

4.4.3. **Auto-import ASCII** will be shown. From the left side, select the location and folder name where the exported data records were sent. The exported records (shown as file names) will be shown.

4.4.4. On the right side select records (files) to be imported. To select all files, highlight the first file and move the mouse cursor to the last file and click again. To only select certain files, click the first file of interest and then click the next file while holding down the **Ctrl** key. Perform this for each desired record or file.

4.4.5. Click “Import to DB”. Auto-importing will activate. After completion, check the folder where the records were imported. Note that the record numbers have changed if imported to an existing database. If a newly created database without records is used the record numbers will start with the number “1”

Part J. Saving records as Adobe PDF files

1.1. Go to FILE and open the “EXAMPLE” database for retrieval. Click “Data Retrieval”, “Retrieve Data” and then “Query Results”. Click on a record that will be used to prepare a “pdf” file. Click the “Retrieve” box in the lower left corner of the Dialog.

1.2. Click “Reports” and “Export”. A list of reports will be shown. Select “pdf Landscape Full”.

1.3. Click “OPEN”. The “Print Options” dialog box will be show. Click the “Change” box. The “Printer Choice” box will be shown. Warning: Do not change printer to Adobe pdf format since it will cause the pdf file to be very, very large.

1.4. Click “Select” and the “Print Set-Up” box will be shown. Next to “Name” the printer being used for normal hard copies will be shown. Use the scroll to select “Adobe pdf”.

1.5. Click “OK” (returns to Printer Choice”. Click “OK” in the box (returns to Printer Options box). Click “Start”. (If it is desirable to save all measurements as PDF files, then click “Save Options Permanently”

1.6. A box will be shown “Save PDF File As”. Select a folder (use C: by scrolling) and type the name of the file. Click on “SAVE”. The PDF file will be created and a bar will be shown in the lower right or left lower corner signifying that it is complete. The pdf will be shown on the display.

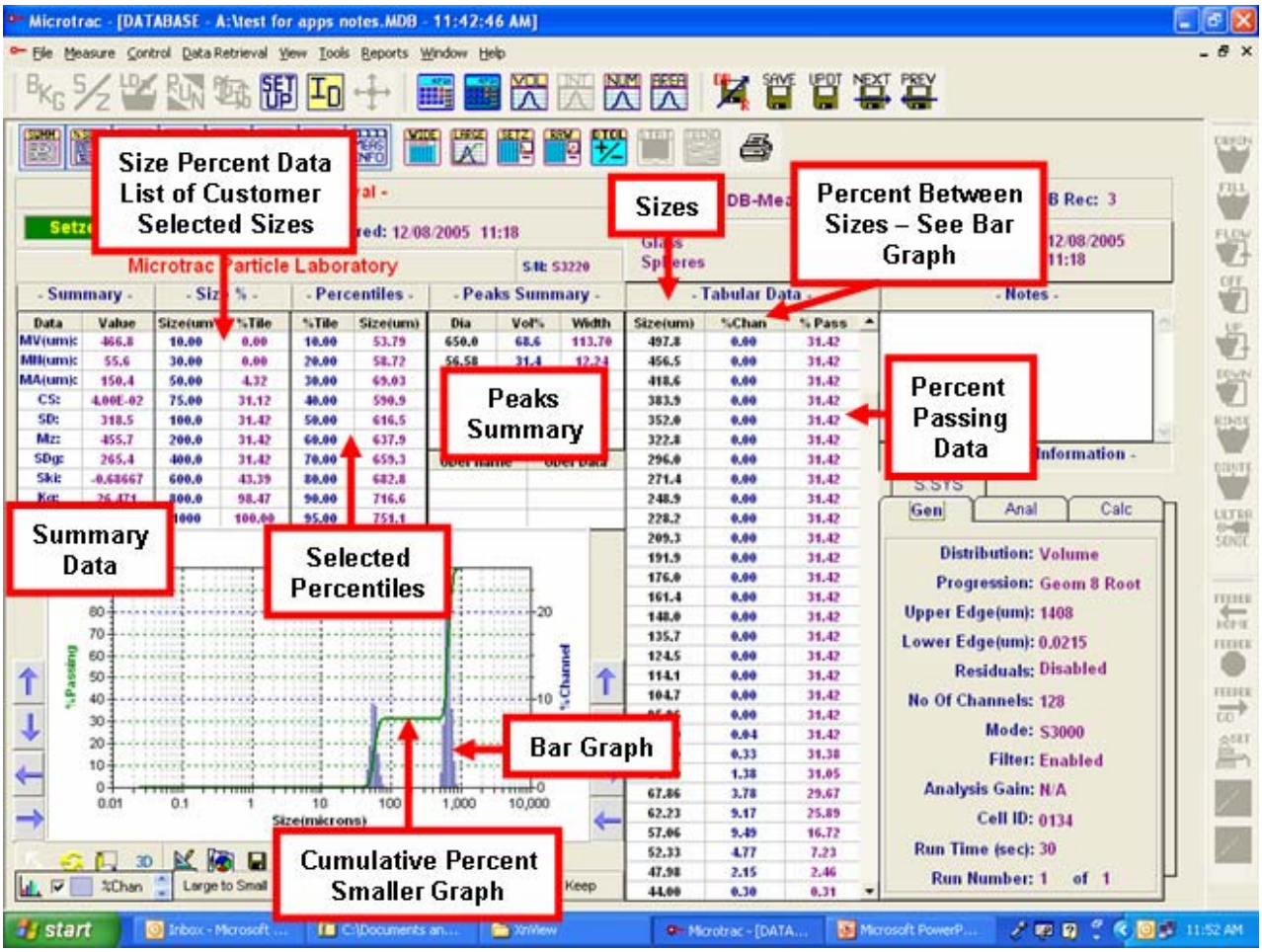
Endnotes:

As a final exercise, retrieve a record and activate any button not described, e.g., Wide, Large, Raw, Num, Area, etc. A copy of the Data explanation is below.

Microtrac Flex™ Data And Graphs Explanation

Microtrac data include many values that are essential to developing particle size distribution specifications and evaluating data. Each of these items is explained as well as changes to be expected. The display provides a quick look at values while actual printed reports and exported data are developed in the “Reports” section. For more detailed information, please refer to the “User’s Manual” in the HELP section of Microtrac FLEX software or contact the Microtrac, Inc at 727 – 507 – 9770 in Largo, FL.

PARTICLE SIZE DATA and INFORMATION



Sizes – The default unit for size is micrometers (microns). The sizes in this table are not customizable and are determined by the optical of the instrument. Customized sizes are selectable in the SETUP portion of the software and are displayed in Size Percent Data

Percentiles – Software selectable Percentile Points in microns, show the percentage of the volume (or weight if the density for all the particles is the same) that is smaller than the size indicated. Percentiles can be shown as percent larger and indicates the volume percent larger than the size shown. The “50 percent point” is the “median diameter” or D50 and represents one type of average particle size.

Summary Data –

MV – Mean diameter in microns of the "volume distribution" represents the center of gravity of the distribution. Mie or modified Mie calculations are used to calculate the distribution. Implementation of the equation used to calculate MV will show it to be weighted (strongly influenced) by a change in the volume amount of large particles in the distribution. It is one type of average particle size or central tendency.

MI – (Nanotrac only) Mean diameter of the intensity distribution. Intensity distribution is not calculated using Mie theory or Modified Mie theory.

Molecular Weight (MW) – A calculation to provide molecular weight (grams/mole). See equation below for details.

MN – Mean diameter, in microns, of the "number distribution" is calculated using the volume distribution data and is weighted to the smaller particles in the distribution. This type of average is related to population or counting of particles.

MA – Mean diameter, in microns, of the "area distribution" is calculated from the volume distribution. This area mean is a type average that is less weighted (also less sensitive) than the MV to changes in the amount of coarse particles in the distribution. It represents information on the distribution of surface area of the particles of the distribution.

CS - Calculated surface – Provided in units of M^2/cc, the value provides an indication of the specific surface area. The CS computation assumes smooth, solid, spherical particles. It may be converted to classical units for SSA of M^2/g by dividing thru value by the density of the particles. It should not be interchanged with BET or other adsorption methods of surface area measurement since CS does not take into effect porosity of particles, adsorption specificity or topographical characteristics of particles.

SD – Standard Deviation in microns, also known as the **Graphic Standard Deviation (σ_g)**, is one measure of the width of the distribution. It is not an indication of variability for multiple measurements. Equation to calculate is: (84% - 16%)/2.

SDg or **Ai – Often known as σ_i -** Inclusive Graphic Standard Deviation. Includes more than 90% of the distribution and includes tails of distributions. The SD includes only 67% of the distribution.

SD_g Value	Terminology
0.35	Very well sorted (Very narrow)
0.35 - 0.5	Well sorted
0.50 – 0.710	Moderately well sorted
0.71 – 1.0	Moderately sorted
1.0 – 2.0	Poorly sorted
2.0 – 4.0	Poorly sorted
> 4.0	Extremely poorly sorted (very broad)

K_G - Often known as SKg - Kurtosis (peakedness) of a distribution is taken from sedimentology and uses phi values for calculation. It measures the departure from normality of a curve. Peakedness refers to "how sharp" a peak is. Terms exist to describe the magnitude of kurtosis or how sharp the peak is. Platykurtic (from the Greek meaning "fat") describes a distribution having low kurtosis while leptokurtic (Greek meaning "slim") describes a distribution having high kurtosis. The following describes values for **K_G**

K_G Value	Terminology
< 0.67	Very Platykurtic
0.67 – 0.90	Platykurtic
0.90 – 1.11	Mesokurtic
1.11 – 1.50	Leptokurtic
1.50 – 3.00	Very leptokurtic
> 3.00	Extremely leptokurtic

Ski – Inclusive Graphic Skewness – Skewness is a measure of how asymmetrical a curve is and how it varies from a normal, bell-shaped curve. Ski includes 90% of the distribution and includes the "tails" of the distribution. A symmetrical curve has a Ski value of 0.00. Values of 1.00 to 0.30 show fines influencing the skew. Values of -0.30 to -1.00 show coarse particles as influencing the skew.

Mz – Graphic Mean provides a less coarse-particle weighted mean particle size than **MV.** While it includes the median value, it can provide a different and possibly better control value since both small particles and large particles are included in the calculation.

Peaks Summary– Microtrac software automatically provides information on multi-modal distributions. The "Dia", "vol%" and "width" identify individual modes.

Dia – The 50% (D50) of each mode is calculated after determining the minimum and maximum sizes contributing to the specific peak under consideration. For two modes, each will have a separate 50%. When only one mode is present, the **Dia** will equal the 50% of the particle distribution.

Width – Indicates the width of the peak under consideration. For two modes, each will have a calculated width given in microns. When only one mode is present in the distribution, the width = 2 (SD) = 84% - 16%.

Vol – The calculated contribution in percent of each peak to the total volume of the distribution.

RMS Residual – (Root mean square) Microtrac performs calculations to provide particle size distributions. The calculation is completed when software-decided least error is attained. The RMS is presented as percent.

UDEF Name and UDEF Data – Microtrac software allows the user to perform special calculations to suit a customized need. Each calculation is given a name (UDEF Name) by the user. The result is presented as the data (UDF Data).

Percent Passing, Percent Retained and Percent Channel Data

Percentiles - Values are selectable over the range 1% to 99% in 1% increments. They are calculated and then located in the table. Use SETUP command to access selections.

Tabular Data - The measuring range of the instrument is divided into fixed "channel" or particle sizes. Particles sizes are identified on the left column in units of microns or sieve sizes as selected by the operator. Cumulative data values are on the same line as the particle size and are read as "percent smaller (passing) than". The data may also be displayed as "percent larger (retained) than". For data presented as "percent smaller than", volume percent-in-channel (%-CHAN) values are read as volume percent between the particle size on the same line and the line below. For data presented as "percent larger than" or "%RETN", the volume percent between sizes is read as the amount between the size on the same line and the size above.

Example: In the data display shown (percent smaller than), 24.06% of the volume is smaller than 44 microns. The **percent between** adjacent sizes for percent passing format is shown beside the larger size, e.g., 5.19% lies between 44.00 microns and 40.35 microns. When data are presented in the PERCENT RETAINED format, as indicated at the top of the data column, the percent between sizes would be located beside 40.35 microns

Size Percent Data – Operator may enter up to 100 desired particle sizes. Microtrac will calculate the associated volume percentile.

Cumulative Graph – A cumulative graph, with "%PASSING (pass)" or "%RETAINED (Ret)" tabular data are presented as a line graph or in 3-D as selected by the 3D button part of the GRAPH TOOLBAR. Graph may be modified by using scrolling arrows and icons located in the graph area. The values used to produce the graph are those in the tabular data identified as "%Smaller" or "% Larger". The percent point for a specific size may be found by determining the point of intersection of the desired size and the cumulative curve for any size interest and then determining the volume percent from the vertical axis on the left. See above for information on percentile calculation and display.

Microtrac only presents data within the particle size range of a given model or instrument set-up. Particles larger than or smaller than the instrument measuring range are not included as part of the distribution or other data. For this reason, "percent smaller or larger than data begin with 100% at the largest or smallest size measured in a sample, even though some particles may exist outside the measuring range

Relative Graph (%CH) - When bar graphs are printed or displayed, midpoints of channel sizes are used. Line graphs are automatically developed by connecting the midpoints. Graphical data provide an opportunity to view the distribution at a glance. In the example data display, 5% (using the right axis) of the volume is indicated at approximately 90 microns. Best quantitative data are obtained from the numerical data in the tables. Volume percent in channel data are used to produce the graph.

Sediments Optional Feature – The optional feature is designed for those interested in soils and sediment particle size analysis. To compute the values it employs phi (Φ) values which are widely used in sediments scientists. Φ size value are calculated from Φ **= (-) log size/log 2.** The sediments feature uses all data including information included that may be out of the range of Microtrac. Note that the values for Mz, Ski, Kg, Sg on the main FLEX screen uses only Microtrac data and the percentile values, where units are in microns. The data values on the sediments feature screen are in phi values. The calculations for Mz, Sdg, Kg, and Ski are taken form "Petrology of Sedimentary Rocks", Robert L. Folk, Univ. Texas, Hemphill's, Austin Texas.

$$\mathbf{MV = \Sigma V_i d_i / \Sigma V_i} \qquad \mathbf{MN = \Sigma(V_i / d_i^2) / \Sigma(V_i / d_i^3)} \qquad \mathbf{MA = \Sigma V_i / \Sigma(V_i / d_i)}$$

$$\mathbf{MI = \Sigma I_i d_i / \Sigma I_i} \qquad \mathbf{MW = \rho N_A (\pi/6) d^3} \qquad \mathbf{SD = (84\%-16\%)/2}$$

$$\mathbf{CS = K / MA} \qquad \mathbf{Width = 84\% - 16\%}$$

Where:
V = Volume percent between sizes.
d = Size represented by the center (geometric progression) between any 2 sizes.
I = Intensity percent between sizes
P = Density of the particles
K = Ratio of Area to Volume of sphere

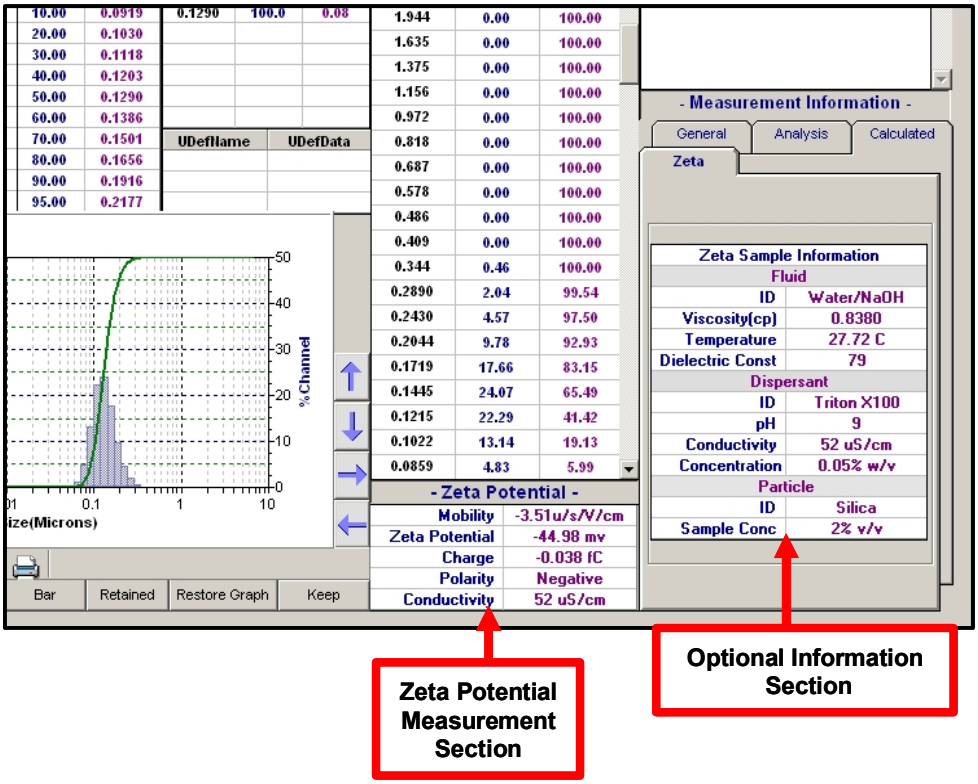
$$\mathbf{Mz = (16\% + 50\% + 84\%) / 3}$$

$$\mathbf{SDg = [(84\% - 16\%) / 4] + [(95\% - 5\%) / 6.6]}$$

$$\mathbf{Kg = (95\% - 5\%) / [2.44(75\% - 25\%)]}$$

$$\mathbf{Ski = \{[16\%+84\%- 2(50\%)] / 2(84\%-16\%)\} + \{[5\% +95\%- 2(50\%)] / 2(95\%-5\%)\}}$$

Lower Right Corner of Zetatrac Data Display



Optional Information Section – Zeta potential measurements are subject to many influences. The list provided shows several of the most important aspects of parameters that require control to achieve repeatable measurements. The values requested are voluntary and are not required for zeta potential measurements to be conducted successfully. The values become a permanent record with any saved data and allow easy record keeping of conditions imposed for the measurement.

Zeta Potential (millivolts)	Stability Behavior
0 - +/- 5	Coagulation
+/- 10 to +/- 30	Incipient instability
+/- 30 to +/- 40	Moderate stability
+/- 40 to +/- 60	Good stability
+/- 61 and greater	Excellent stability

Charge – Charge and polarity at the surface.

Polarity – Provides the identification of the positivity or negativity of zeta potential value.

Conductivity – Provided in units of microSiemans per cm

Zeta Potential Measurement Section - The values presented are measured by the Zetatrac.

Mobility – Provides the direction of travel of the particles when exposed to the Zetatrac imposed electric field. Negative sign indicates that the particle is moving towards the anode (+).

Zeta Potential – From Henry's Formula for mobility: The value represents the potential difference between the dispersion medium and the stationary layer of fluid attached to the particle. Zeta potential is related to colloidal dispersion stability. Zeta potential values greater than 25mvolts are an indication of stability. The chart above may be used as an approximate guide. The value can be either positive or negative.

Henry's formula: $\mu_D = \zeta 2\varepsilon f(\kappa a)/3\eta \longrightarrow \zeta = 3\eta\mu_D /2\varepsilon f(\kappa a) = q/2\pi\varepsilon d$

ε= dielectric constant; μ=mobility; η=viscosity; q=charge; d=diameter

$f(\kappa a)$ = Debye Huckel parameter (depends upon concentration and size. Where κ represents inverse distance of surface from the shear plane). For Microtrac zeta potential, assume Smoluchowski approximation where $f(\kappa a) = 3/2$ and zeta potential is calculated as: $\boldsymbol{\zeta = \eta\mu_D /\varepsilon}$

Charge – A calculated value equal to a sphere having a charge distribution which is the same as the mobility of the particles being measured $\boldsymbol{q = 3\pi\square\ \mu_D\ \eta\ d}$