Verax Training Manual

Revision 1.2

*A guide for setting up and using **Verax SPC Software Suite***
with the optical measurement systems supplied by:

ASC International

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1.0 Overview

1.1. The Verax SPC Software Suite (VSS) is a powerful tool that, when used with ASC International's Measurement Systems, can help operators understand and control a production process. Data collected by the ASC Measurement System is instantly analyzed by VSS software. Calculations crucial to understanding manufacturing performance are reported including:

- X-bar and range
- X-bar and sigma
- X-bar and moving range
- Histogram with normal and non-normal (Johnson) curves
- P chart, np chart, c chart and u chart
- Pareto, weighted pareto for defects and corrective actions
- Variance and standard deviation
- Skewness, kurtosis and chi-squared for goodness of fit
- Min, max and median values
- Cr, Cp, Cpk and lower Z values

1.2 VSS is capable of recording and statistically analyzing both *quantitative* (variable) and *qualitative* (attribute) characteristics. A *characteristic* is defined as a dimension or quality of a product (or process) which can be measured (variables data) or counted (attributes data).

2.0. Organization

The Verax SPC Software Suite is organized into three individual applications:

VSS Administration – Before any data collection takes place, the administrative user(s) of the VSS software use the Administration application to configure the database for use in data collection.

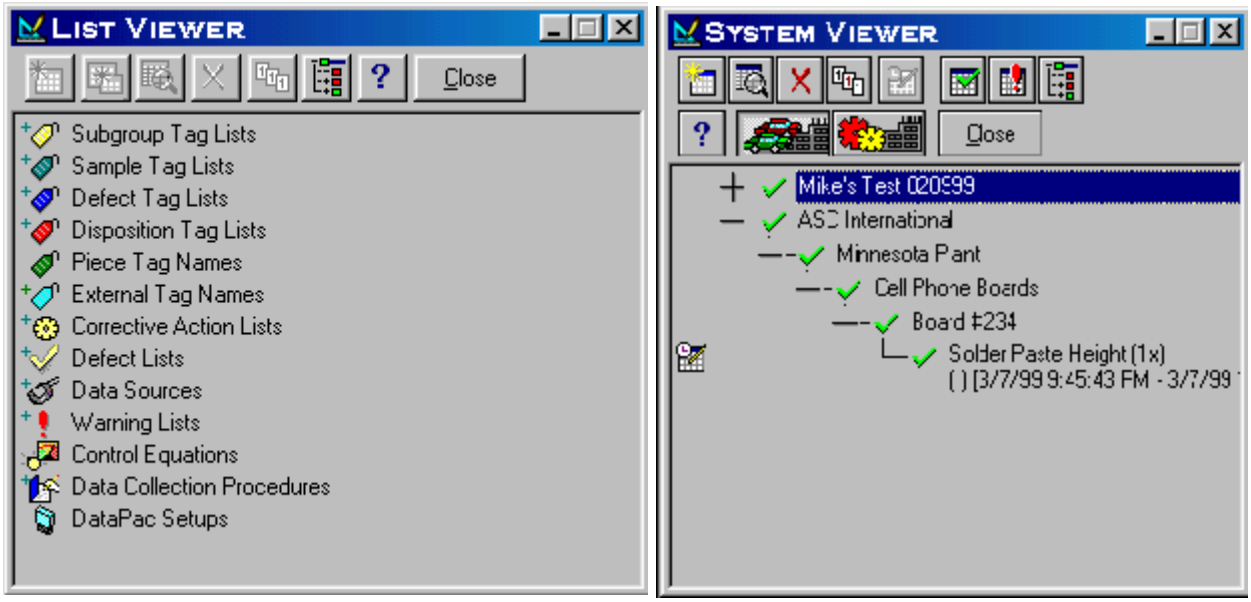
VSS Data Collection – On a regular basis, production workers collect data at workstations consisting of the VSS Data Collection application with attached gages or other metrology equipment. The data collection software contains trend-checking routines that are designed to immediately indicate out-of-control situations that may require process adjustments.

VSS Analysis – As the process data is collected, it is automatically deposited into the central database so that it may be accessed by engineers running the Analysis application. There, the data may be more carefully scrutinized in order to find areas of possible improvement.

NOTE: In networked environments, a single set of VSS database files can be located on a centrally located fileserver. If this configuration is desired, please contact ASC International for more information.

3.0 Contents of VSS Administration

VSS-Administration is divided into two main sections, the **List Viewer** and the **System Viewer.** These can be found under the <Setup> menu selection.



3.1. Operating Conventions - Note that by each item in both the List Viewer and the System Viewer, there is either a (+) or (-) sign. Click on the

(+) sign to reveal more information for the item selected. Conversely, click on a (-) sign to minimize the information contained under the item heading.

3.2. The List Viewer - can be used to create and edit various types of items, including tag lists, data sources, corrective action lists, and warning lists. The use of lists and categories such as these makes it easier to record accurate and detailed information about characteristics, data, and data collection methods. In addition, most of these lists and categories can be shared by more than one characteristic thus simplifying the process of defining information for multiple characteristics. The List Viewer can be opened or closed by selecting or deselecting it in the Setup menu.

Eight different types of lists can be created, edited and viewed with the List Viewer. They are:

3.2.1. Subgroup Tag Lists - Subgroup tags can be associated with subgroups of either *variables* or *attributes* data. Two types of subgroup tags are available: Manual and External. Manual tag values are entered or accepted by the operator during data collection.

3.2.2. Sample Tag Lists - Sample tags can also be associated with either *variables* or *attributes* data. As the name implies, sample tags are associated with individual data samples. Sample tags can be used with attributes data collected in sample or express mode. (However, sample tags cannot be used with attributes data which is collected in batch mode, because in batch mode, no information is saved regarding individual samples.)

3.2.3. Defect Tag Lists - Defect tags can be attached to individual defects collected for attributes data. In painting processes, for example, defect tags (e.g., indicating the location of the defect), could be associated with SPC data on specific painting defects (such as scratches or runs). Defect tags are used only for attributes data (any mode of collection). It is useful to note, however, that when attributes data is collected in batch mode, each defect record may stand for several occurrences of the same type of defect in the subgroup; therefore, defect tags in batch subgroups pertain to all occurrences of the same type of defect in the subgroup.

3.2.4. Disposition Tag Lists - Disposition tags are special tags which can be associated only with variables data samples. Disposition tags indicate the disposition (e.g., the acceptance or rejection) of the part (or piece) to which a sample belongs.

3.2.5. Corrective Action Lists **-** Manufacturing typically involves many complex processes which must be continually regulated and adjusted in order to ensure that production is as efficient and accurate as possible. All types of quality improvement methods, whether proactive or reactive, require some form of process manipulation to cope with problems or to aid in continuous improvement efforts. Verax software refers to this type of manipulation as corrective action. When a corrective action is made (e.g., a tool is sharpened or replaced), the action should be documented so that it may be correlated with trends in subsequent data.

Applications in the Verax SPC Suite have the ability to store corrective action information with each subgroup of data. In the VSS Data Collection application, the operator is automatically invited to enter information regarding a corrective action whenever a warning is generated for a subgroup. In addition, the operator can attach corrective action information to any subgroup, even when no warning has been generated, by selecting the appropriate menu item from the data collection screen. In either case, it is left to the operator to make the corrective action record clear enough to be understood by another person at a later date. The reporting of corrective actions can be made easier and more consistent by making use of Corrective Action Lists which present operators with codes for one or more valid corrective actions for a particular characteristic. The lists are used to group together corrective actions that are valid for a particular type of manufacturing process. *Therefore, a single Corrective Action List might be used by several different characteristics that are created by similar processes.*

Each individual corrective action on a Corrective Action List has a code, a description, and an assigned weight. Administrative users can create, modify, and delete corrective action lists from within the List Viewer.

3.2.6. Defect Lists **-** Recall from previous sections that attributes characteristics contain the results of visual observations or functional tests. *In other words, attributes SPC is based somewhat on counting the presence of different kinds of defects.* Obviously, then, before any data is collected for an attributes characteristic, it is necessary to define the defects which could possibly occur. Since, in any given installation of VSS, there may be many attributes characteristics which are inspected in the same fashion, defect definitions are stored in lists and referenced by the characteristics. Note that a defect list may be shared by more than one characteristic, but a characteristic may only be associated with one defect list.

A defect list consists of one or more individual defects, each with a code, a description, and a cost or severity rating. Administrative users can create, modify, and delete defect lists from within the List Viewer.

Tip: Special care must be taken when modifying a list that may be used by more than one existing characteristic. If the modification would not be appropriate for all characteristics which use the list, it may be better to make a separate list instead of modifying the existing list.

3.2.7. Warning Lists - Fields and controls on the Warnings tab are used to specify and customize sets of control warnings which are applied at the time of data collection. With the Warning List combo-box, a pre-defined set of warning criteria may be assigned to the characteristic. Several warning sets are provided. If it is not necessary to apply warning criteria to the characteristic, choose (None) from the list.
Once a warning set has been chosen, the individual warnings in the set are listed in the grid at the bottom of the window. Any warning may be turned off or turned on for the characteristic by double-clicking on the corresponding row in the grid. Additionally, an instruction file can be specified for any warning in the list by highlighting the warning and clicking the small builder button next to the Warning List field. In the Select Operator Instruction File window, specify the instruction file to be executed. Acceptable instruction files are those with .txt, .wav, .avi, .exe, .com, .pif, or .bat filename extensions. Once an instruction file is specified, the Test button may be used to execute the operator instruction as it will be presented upon generation of the warning during data collection.

3.2.8. DDE Unit Lists /DDE Link Options - The DDE Link instrument type may be used to configure an instrument to read data from or write data to other software applications. There are three link types which can be chosen: Automatic Read, Manual Read, and Write . In all three cases, the address of the variable to be read from or written to in the DDE source must be specified. The format for this requires the DDE source to be specified in the Topic box. The appropriate delimiter to separate a source designation from the specific variable designation in that application must be entered in the Delimiter box. The designation of the control to be read from or written to should be entered in the Item box. It should be noted that the Topic, Delimiter, and Item must be entered exactly as the DDE source application expects them (e.g., the format is generally case sensitive). If the Write link type is chosen, a string to send to the DDE source should be entered in the String to send box. If either the Automatic Read link type or Manual Read link type is chosen, the Wait for Signal Link option becomes enabled.

In addition, five other categories of items can be viewed with the List Viewer; they are:

3.2.9. External Tag Names - External tags are subgroup tags whose values can be automatically generated by an external program that runs along with a data collection procedure.

3.2.10. Data Sources - A data source (data source record) is used to define how to obtain measurements for variables data. Data sources can contain one or more instruments; each instrument represents a particular way of obtaining a specific data value (measurement).

There are countless types of metrology equipment available for measuring anything from coating thickness to tensile strength. As a result, there are also many different methods for interfacing such devices to a computer. Some connect via a serial RS-232 port, while others require special interfaces. Gage boards and multiplexers which provide several "ports" are also available. By creating a data source record, the administrative user may define which, where, and how instruments are interfaced to the VSS data collection workstation. Each variables characteristic points to a pre-established data source which defines how measurements will be acquired during data collection.

3.2.11. Control Equations - Often, when a statistical warning occurs on the shop floor, operators are unsure of what to do next. In some cases, the only option is to call an engineer who can fix the problem. This is typically the case with complex manufacturing systems which are fully understood only by the engineers. In many cases, however, manufacturing processes are governed by relatively simple mathematical functions. By solving such a function for a specific control variable (an adjustable process input), one can determine the magnitude and direction of adjustment which is required to re-center the process on the target. In VSS, mathematical functions which describe process behavior are referred to as Control Factor Equations. Control factor equations are used to set up closed-loop data collection sequences which can be run by an operator with minimal assistance by an engineer. During data collection, if a warning occurs on an operation with an associated control factor equation, the system will solve the equation and suggest a corrective action which is likely to bring the process average closer to the target. The user may then decide whether to use the suggestion or to enter a different type of corrective action.

The VSS Administration application represents control factor equations as linear polynomials. All polynomials consist of a sum of terms plus a constant. In a linear polynomial, each term consists of a coefficient and a named variable which has a specific real value. The named variable in each term corresponds to a specific process variable, which may or may not be controllable by the operator. Temperature, pressure, and line speed are all examples of such process variables. The coefficient in each term corresponds to the degree or magnitude with which changes in the variable

affect the final measured characteristic. In many cases, knowledgeable engineers can create linear polynomials which provide a model or estimate of the behavior of the process.

3.2.12. Data Collection Procedures - A VSS data collection procedure defines what data will be collected, who will collect it, and how it will be collected. The primary component of a data collection procedure or "job" record is an ordered list of characteristics. When an operator runs a job with the Data Collection application, data is requested for each of the characteristics listed in the job. A list of valid users or user groups, assigned to a job, grants access to the job. Operator instructions (like those for characteristic records) may also be assigned to the beginning and end of a job. When used effectively, the features listed above give administrators flexibility to configure a simple, efficient sequence for shop-floor operators to follow.

Job records may be designed to suit any manufacturing environment. In a production environment where the same tasks are repeated, a job record might be created for each workstation where data is collected. In this case, the job represents the task(s) performed at a workstation. However, in environments where production schemes change more often, a job record might be created for each purchase order.

There are two different ways of executing a job in the VSS Data Collection application: running a job and auditing a job. When an operator "runs" a job, the order of data collection is as specified in the job record. If an operator or supervisor "audits" a job, the job record simply provides a list of characteristics for collection. The order specified by the job record is ignored since the person collecting data specifies which characteristics in the list are collected.

Administrative users can create and modify jobs by using the Data Collection Procedure Setup window. To create a new job, a blank Data Collection Procedure Setup window should be opened. This can be done by selecting Data Collection Procedures in the List Viewer and then clicking on the Add Child button, or by selecting any existing data collection procedure and then clicking on the New button. To edit an existing data collection procedure, select the procedure to be edited and then click on the Edit button. This will open the Data Collection Procedure setup window with information on the selected job already displayed; any needed changes can be made right in this window.

3.2.13. DataPac Setups - used to set up the testing structure, allowing for organization of those products for which data will be collected.

4.0. Using VSS Administration

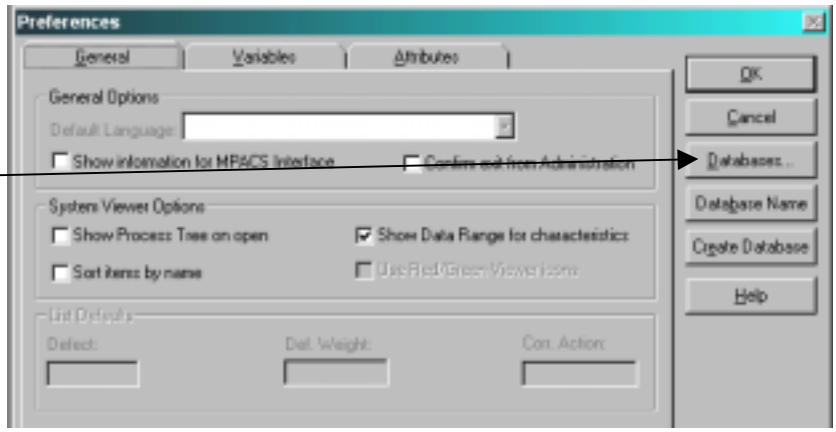
Administration is where all configuration of the Verax SPC Software will take place. It is used to set up the testing structure, allowing for organization of those products for which data will be collected.

Note: When working with Verax SPC software, do NOT have more than one application running at a given time. (i.e. do not have Administration and Data Collection open at the same time.)

4.1. Selecting the Correct Database

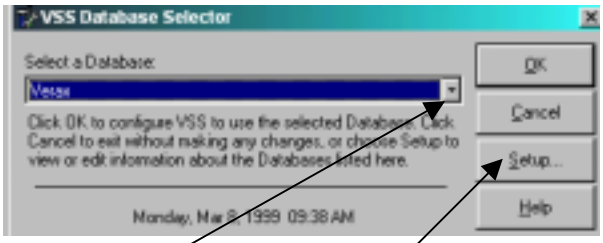
A. Open Administration and click on the <File> option in the file menu.
B. Click on <Preferences>. This will bring up the following window:

<Databases…> button



C. Click on the <Databases…> button and the following window will pop-up:

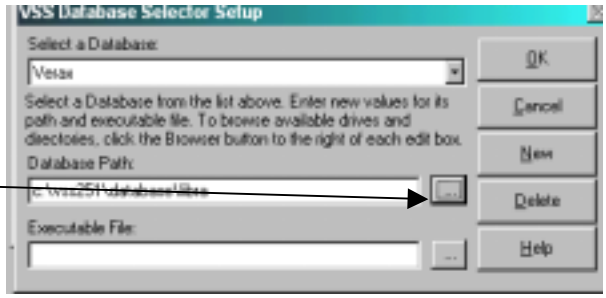
D. Click on the "combo button" and select a specific database, or click on the <Setup…> button.



combo button <Setup…> button

Now the following window will pop-up:

Ellipse <…> button



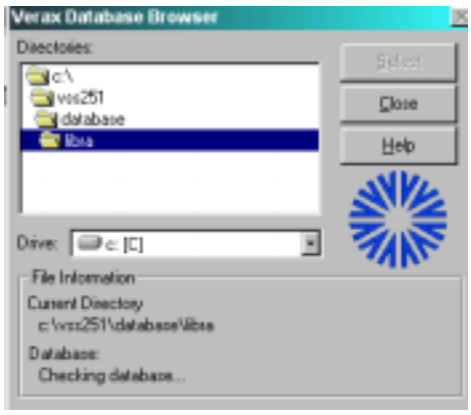
E. Click on the Ellipse <…> button and the VSS Database Browser window will pop-up:

F. Use this window to map a path to your new database. (If there is no valid database in the folder selected, the <Select> button will remain grayed out.)

G. Click on the <Select> button after you have mapped a path to the desired database.

H. Click <OK> on the previous windows, and you will be prompted that your database has changed.

I. You are now connected to you new database.



4.2. Setting Up Additional Users

If you have a large facility, or run multiple lines and shifts, you may want to limit the users' rights to collect data only for the products being produced during their shift. To do this you must set up individual user accounts and give them certain privileges.
(See **Setting up DCP's** for information about assigning users to individual DCP's)

A. In the Administration, click on <Users> in the file menu, then click on <User Accounts…>.

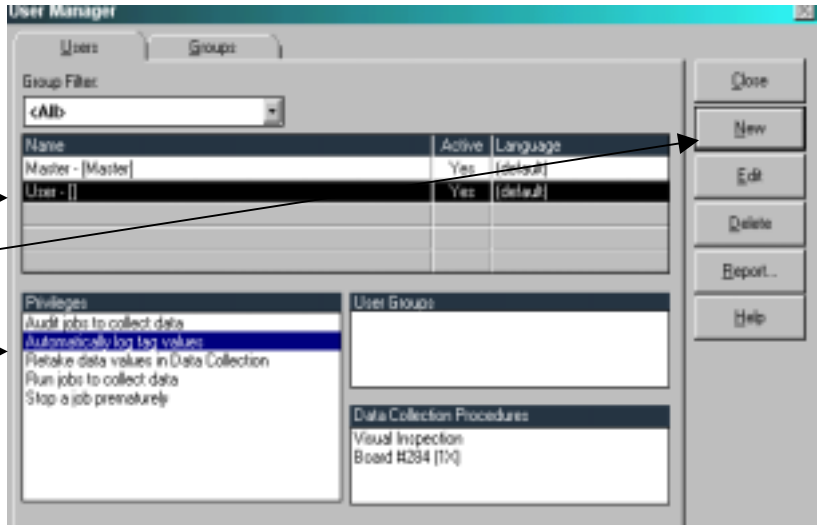
B. The following window will pop-up:

C. This window shows the setup for existing users. On the bottom half, it shows what privileges these users have.

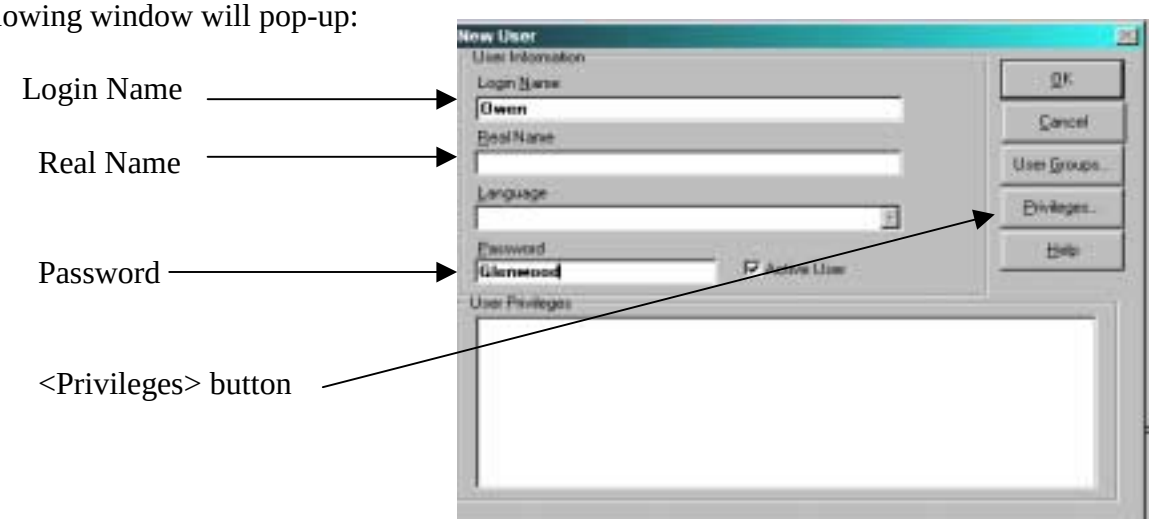
Existing Users

<New> User button

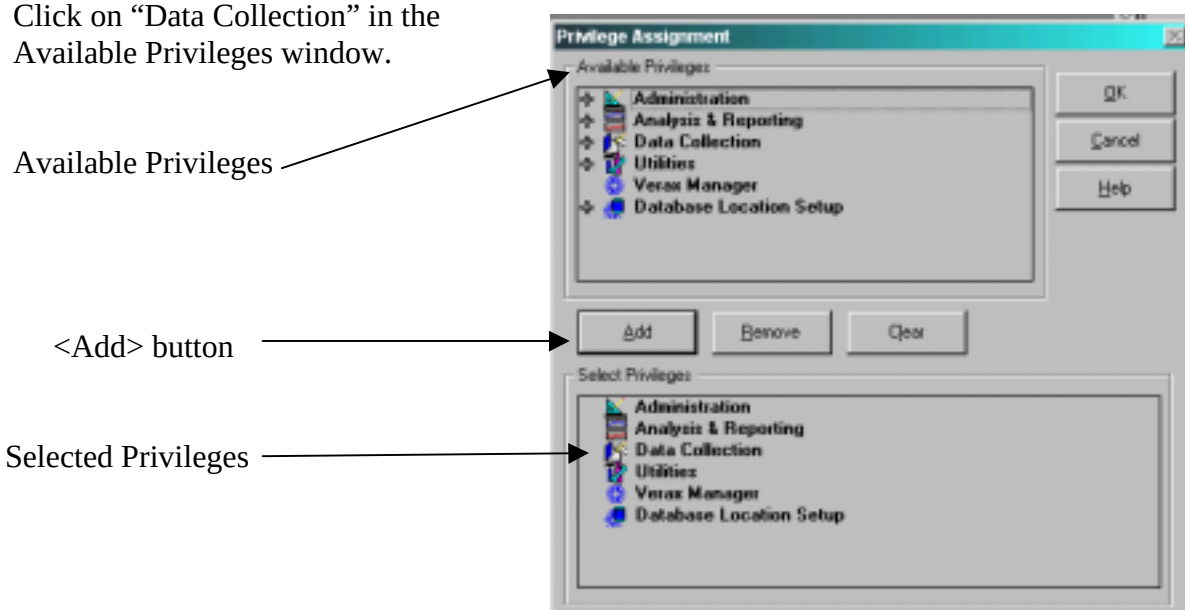
Privileges for selected user



D. To add additional users, click on the <New> button on the right side, and the following window will pop-up:



E. Enter a "Login Name"
F. Enter a "Real Name", if you want it to be different from the Login Name.
G. Enter a "Password" which is unique for that user.
H. Next, click on the <Privileges> button, and the following window will pop-up:
I. Click on "Data Collection" in the Available Privileges window.

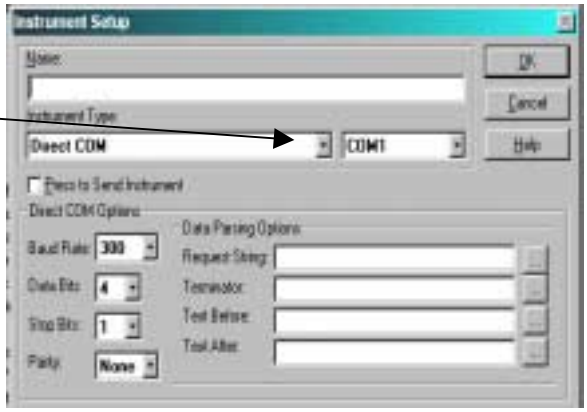


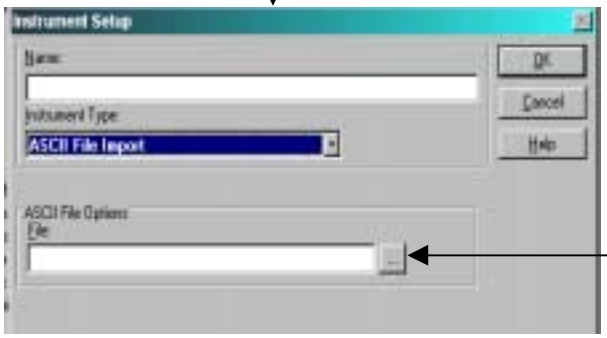
J. Click on the <Add> button. This will give the user privileges to collect data, but not to use Administration. If you want to set up a person who will be an Administrator, add ALL the privileges in the Available Privileges window using the <Add> button. You will see the privileges being added to the window on the bottom. A (+) sign will appear next to the category which has privileges added to it.
K. Click <OK>. Window will disappear.
L. Click <OK>. Window will disappear.
M. Click <New> to add another user, or click close, to complete this process.

4.3. Setting Up a Data Source

If you do not already have the appropriate data source set up, follow these step:

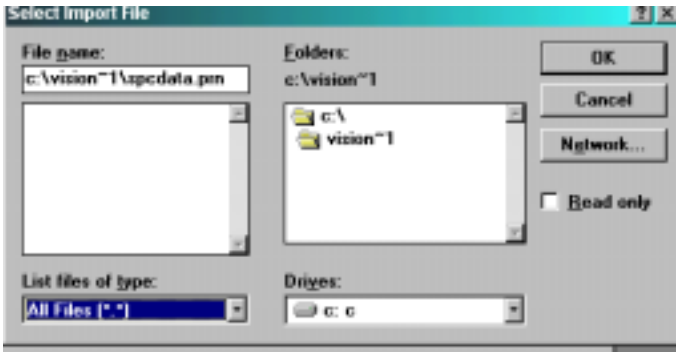
A. Go to the List Viewer in Administration under the <Setup> option in the file menu.
B. Click on “Data Source” in the List Viewer, it will now be highlighted in blue.
C. Click on the icon on the top of the list that says “New Data Source” when you hold your mouse over it. (It will be the second from the left.)
D. A window will pop up like this:
E. Enter a name for your data source.
F. Click on OK.
G. In the list viewer, there will now be a small (+) sign by “Data Source”. Double click on this sign. You will now see a list with your new data source name.
H. Click on the data source name, so it is highlighted in blue.
I. Now, click on the icon on top that says “New Instrument” when you put your mouse over it. (Second icon from the left)
J. The “Instrument Setup” window will pop up:
K. Enter the name again.
L. Now click on the combo box, and select “ASCII File Import”.
M. The window will change to look like this:





Ellipse button

N. Now click on the “Ellipse” button and a new window called “Select File Import” will appear:
O. Use this window to map a path to your data source.



Note: If you are using the SP2D system, the path will be:

C:\SP2D\Output\spc.dat

If you are using VisionMaster:

C:\VisionMaster\Spcdata.prn

Note: You will have to change the "List Files of type:" to "All Files (*.*) for the VisionMaster.

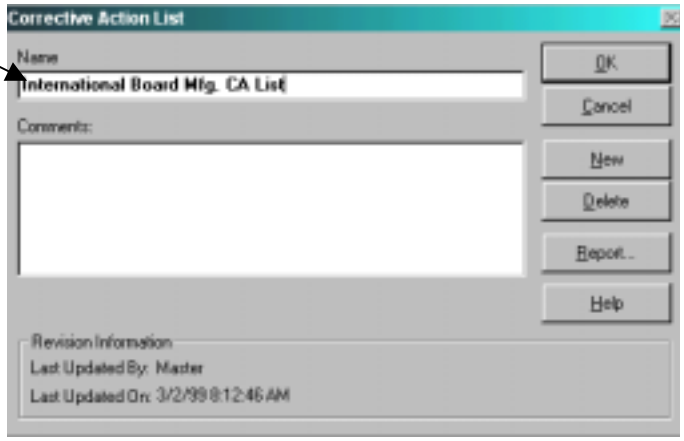
P. Click on OK in this window, then click on OK again on the Instrument Setup window, and your data source is now set up.

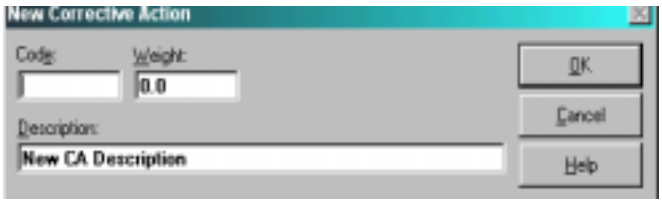
This data source will be used in setting up Characteristics, as well as in your Mathline.

4.4 Setting Up a CA (Corrective Action) List

CA lists are related to **WARNINGS**, which are selected in the "Characteristic" setup. When you receive a warning while collecting data, this list (CA) will give you a list of available options for recording how you responded to the warning.

A. On the List Viewer, click on <Corrective Action Lists>, to highlight it.
B. Click on the <New Corrective Action List> icon (2nd from left on top).
C. This window will appear:
D. Give your new CA list a name.
E. Click on <OK>.
F. Double click the (+) sign by Corrective Action List to expand your list, and then click on it to highlight it.
G. Click on the <New Corrective Action> icon on top (2nd from left)



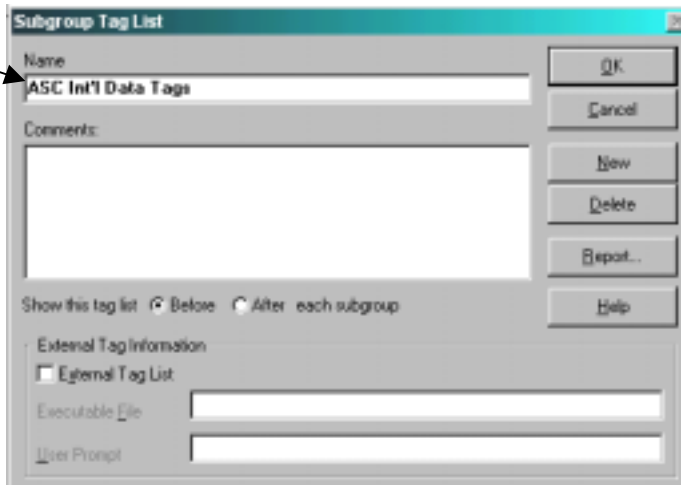


H. The following window will pop-up:
I. Enter a code for this Corrective Action. (Hint: use consistent codes for each list, i.e. A, B, C, etc.)
J. Enter a Weight. This value can correspond to the severity of the action taken, in relation to the warning.
K. Enter a description of this action. (i.e. Called Supervisor, Removed board, etc.)
L. When you are done, click on <OK>.
M. If you wish to create another Corrective Action, repeat steps 7-12.

4.5. Setting up a Tag List

These are used to "tag" data with specific information about the data collection. You can use these tags to sort data in the Verax Analysis Applicaton.

A. In the List Viewer, click on "Subgroup Tag Lists", so it is highlighted.
B. Click on the icon that says "New Subgroup Tag List" when you put your mouse over it. (2nd from the left.)
C. The following window will pop-up:
D. Enter a name for your tag list:
E. Then click on <OK>.
F. Double click the (+) sign by "Subgroup Tag List" in the List Viewer.
G. Click on the name of your new tag list, so it is highlighted.
H. Click on the icon that says "New Subgroup Tag" when you put your mouse over it. (2nd from the left.)



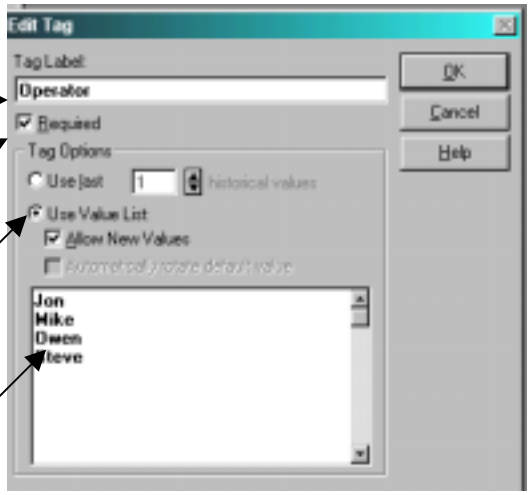
I. The following window will pop-up:

J. Enter a name for the data tag in the "Tag Label" line.

K. If you want this data tag to be mandatory, click in the "Required" box.

L. Click on the "Use Value List" box. This will allow you to enter tag names in the text box on the bottom.

M. Enter the desired data tag names in the text box. All these names will be an option when the user collects data, and will allow you to sort data by these tags in the Analysis section of Verax.

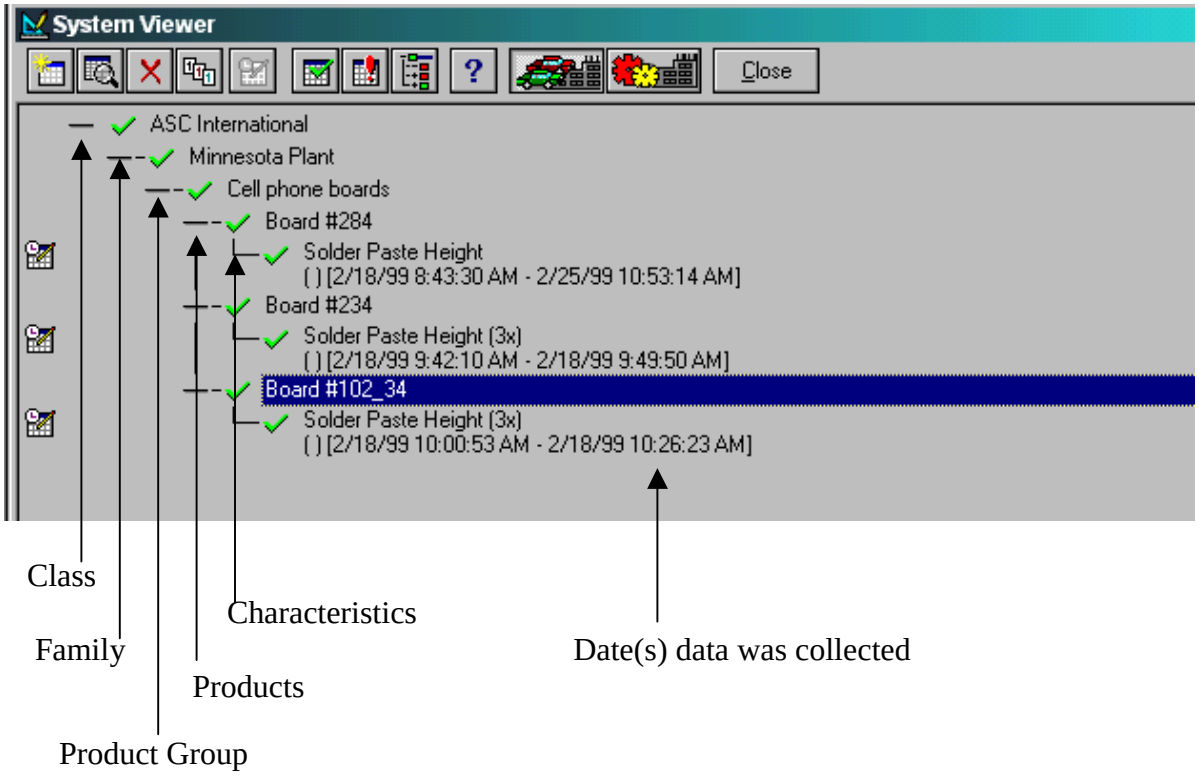


*Some suggested tag labels may be: Operator Name, Shift, Line, Product, Printer, etc.

4.6. Configuring Data Collection Using “Setup”

Under the “Setup” option of administration, there are two options, System Viewer and List Viewer.

4.6.1. Entering Product & Characteristic Information Using “System Viewer”



The System Viewer is used to create a hierarchy for data collection. It is used to organize individual products for which data will be collected, as well as for the specific characteristics of those products. Start at the highest level, “Class”, which can be a company name, and then list the “Family”. This can be different plants, or different departments within the company. Under “Family” is “Product Groups”. List the different products, (i.e., cell phone boards, PC boards, etc.) that you will be manufacturing. Under “Product Groups”, is “Products”. Here you list the specific product name, (i.e. Board #234.) From the Product Name window, click on <Characteristics>, and then select <Variables>. A “Variables Characteristic Setup” window will open. (See Figure 1.) Use this to configure the particular characteristics (i.e. height of solder paste, width of solder pad, etc.) for the individual products.

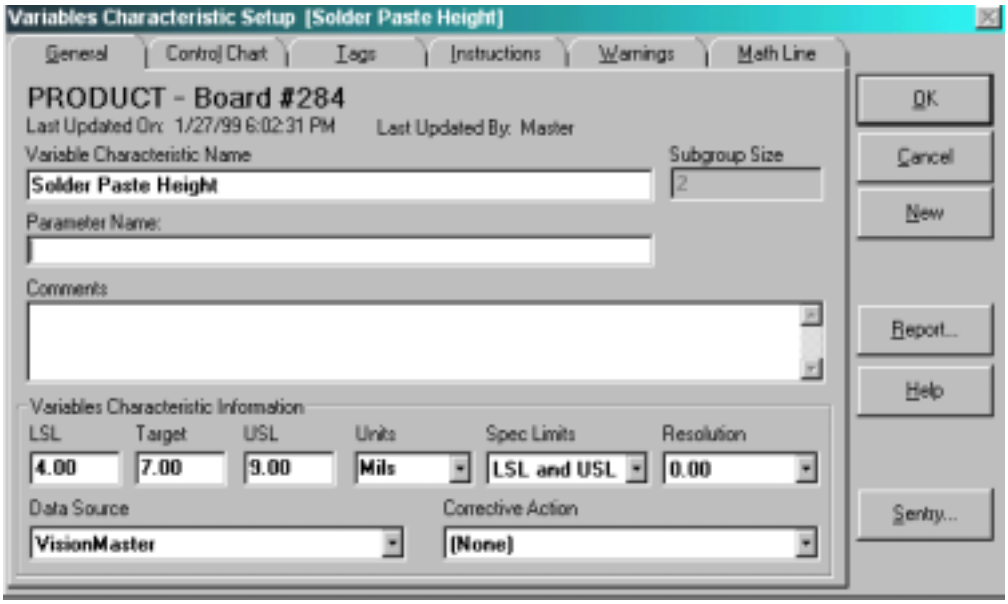


Figure 1.

In this window, there are six tabs, and we will go through them in order.

4.6.1.1. GENERAL

A. Enter a name for that Characteristic, (i.e. Solder Paste Height (1X).) The (1X) refers to the subgroup size you will be selecting in the next step.
B. Select the subgroup size. If you select "1", when you collect data, every individual datapoint you collect with VSS Data Collection will be plotted in the graph. If you select a number higher than 1, for example 4, VSS Data Collection will plot the four readings in a disposition chart, average those values, and then plot just the *average* of those readings in the graph**. Note: once this value is selected, and data is recorded for this characteristic, it cannot be changed.**
C. Enter the values for Lower Specification Limit (LSL), Target, and Upper Specification Limit (USL).
D. Set the Units. You need to type "mils" if you use mils. (It is not in the combo box.)
E. Select your data source. (See **Setting Up a Data Source** if you data source list is empty).
F. Select a Corrective Action List. (See **Setting Up A CA List** for more information).

4.6.1.2. CONTROL CHART

A. Select the desired Control chart for Warning Generation. This chart must correspond with your subgroup size. You can't have a subgroup size of 1, and try to select and X-bar chart. You will be prompted with a warning when closing the Characteristic window if you try to select an improper chart type.
B. Select the desired Control Chart Limits.
C. Select the Reasonable Limits (If Applicable)(See **Glossary** for more information)

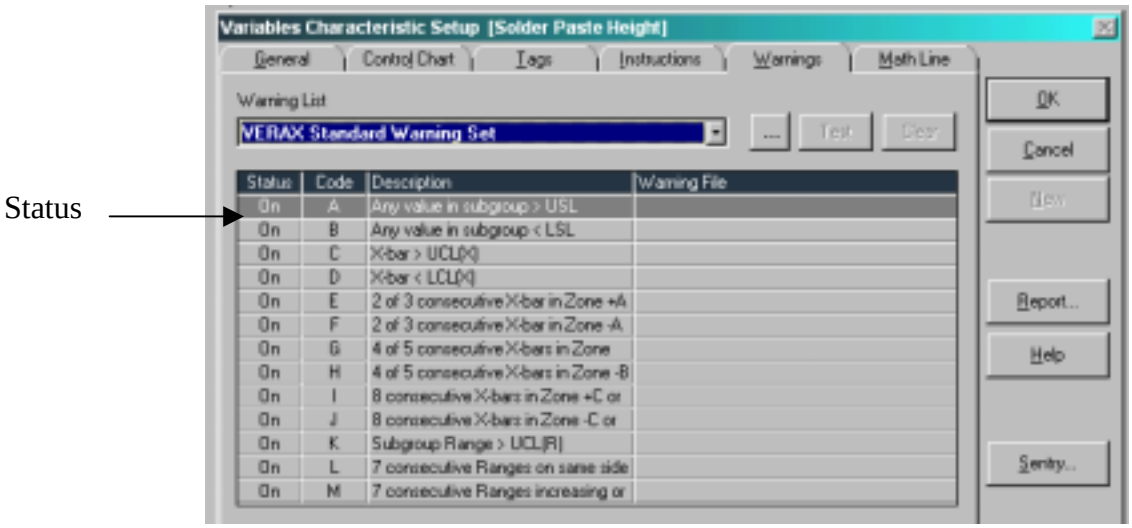
4.6.1.3. TAGS

Select the desired Tag List. Tag lists allow you to "tag" data, with specific information. (See **Setting up a Tag List** for more info.)

4.6.1.4. INSTRUCTIONS

Select the option to include/exclude specific characteristic instructions. These allow you to provide additional information/instructions to the user/operator. Create the file in either document format, or CAD format, and then use the ellipse button (…) to map the path to the specific file. The appropriate box on the left side of the window must be checked for this option to be turned on

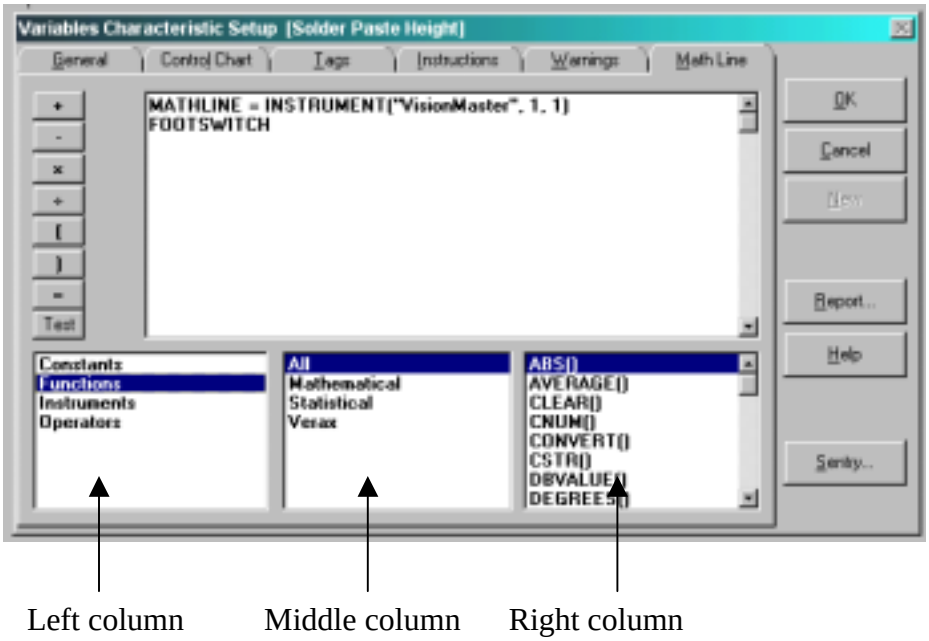
4.6.1.5. WARNINGS



A. Select the desired warning list from the available list. The Verax Standard Warning Set includes many of the recognized industry standard warnings.
B. You may turn specific warnings in the list on/off by double clicking on the specific line, and you will see the status change from ON/OFF.

4.6.1.6. MATHLINE

This should be preset when you receive your system, but if it is not, follow these steps.



A. At the bottom of the page, in the left column, click on the <Functions> option, then click on <All> in the middle column, then in the right column, scroll down to <MATHLINE>, and double click on it.
B. Next, in the left column click on <Instruments>, then in the right column, click on the appropriate Instrument you are using. (If there is nothing listed, you need to go to "Data Source" and set up a data source.)
C. Hit the right arrow key ONCE, and then hit <Enter>, to move the cursor to the second line.
D. Next, in the left column, click on <Functions>, then <All> in the middle column, then in the right column, scroll down to <FOOTSWITCH>, and double-click on it.

Now you may click on <OK>, and this completes the setup of a characteristic. As you will see later, it is much easier to make new characteristics after this point using the "Clone" function.

4.7. Configuring DCPs, Tag Lists and CA Lists with "List Viewer"

Under the <Setup> option, click on <List Viewer>. (See Figure 2.) This is where you set up Data Tag Lists, Data Collection Procedures, Corrective Action Lists, and other options.

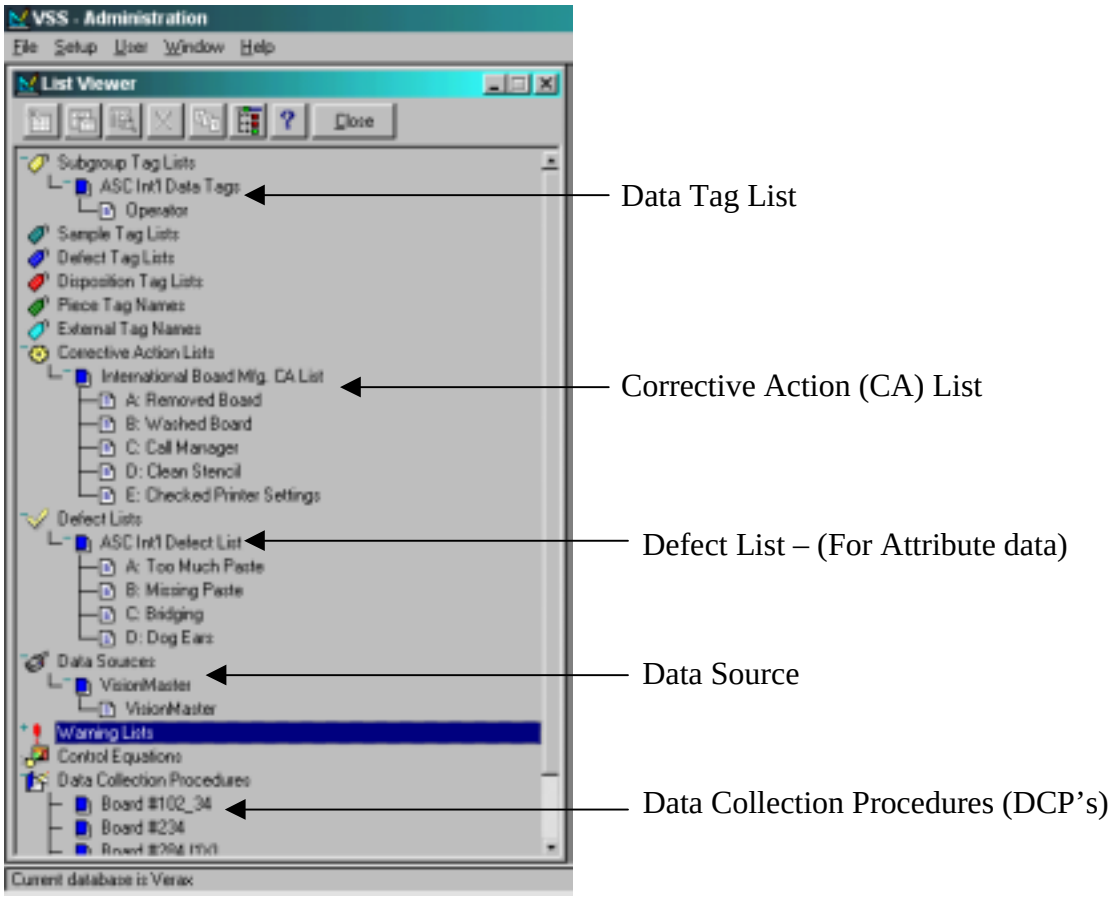
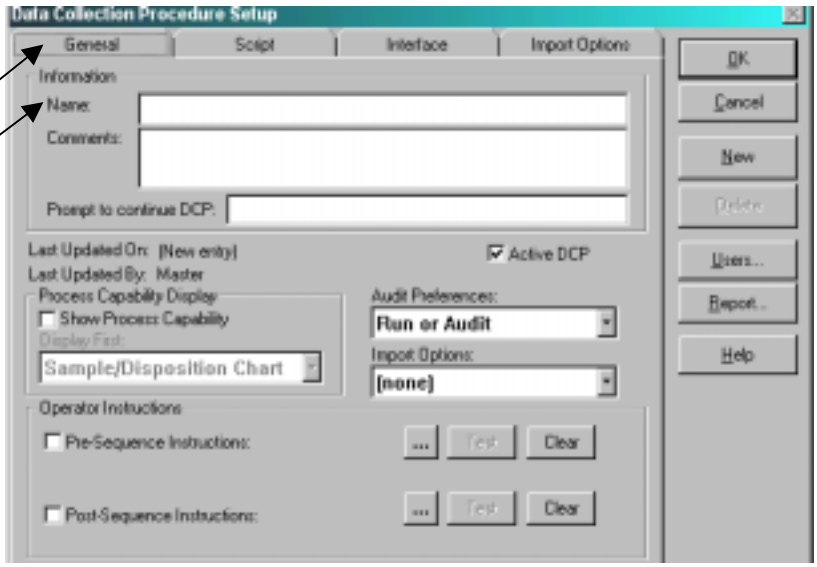


Figure 2.

4.8. Setting Up a DCP (Data Collection Procedure)

A Data Collection Procedure (DCP) is a macro that specifies the process to be used for collecting data on a particular feature or characteristic.

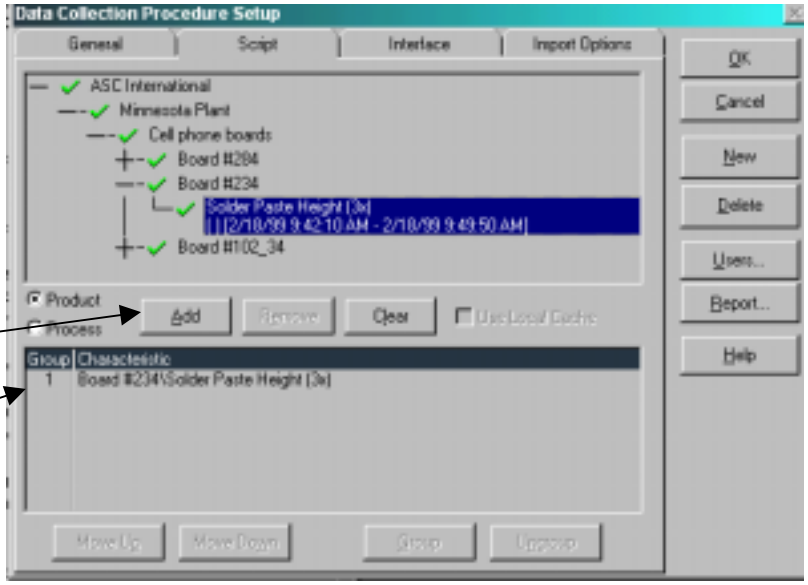
A. In the list viewer, click on "Data Collection Procedures", so it is highlighted in blue.
B. Click on the icon on the top of the window that says "New Data Collection Procedures" when you place the cursor over it. (Second from left)
C. This window will appear:
D. There are three tabs which we will use, and we will start with the GENERAL tab.
E. Enter a name for this DCP. You want the name to reflect the board name and characteristic(s) for which you are going to collect data. (i.e. Board 234 (3X.)



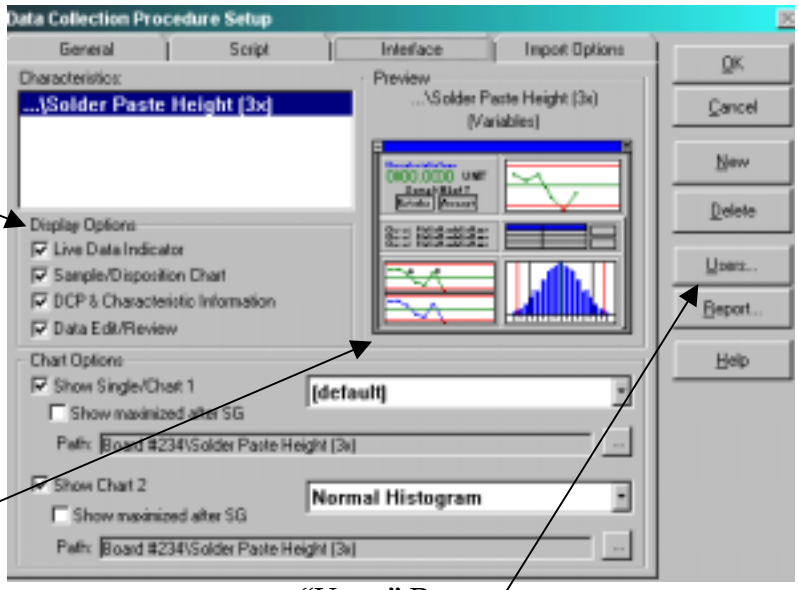
F. Next, click on the "Script" tab, and this window will appear:
G. If the list in the top half of the window is not expanded, click on the pluses to expand the list.
H. Highlight the characteristic you want this DCP to collect data for, and then click on the "Add" button. This will add it to the bottom window.

"Add" button

"Selected Characteristic"



I. Next click on the “Interface” tab, and this window will appear:
This allows you to configure how your Data Collection window will appear while collecting data.



J. In the “Display Options”, you can choose to select or remove particular segments of your Data Collection window. The “Preview” window shows you a small version of what your window will look like.

“Preview” window

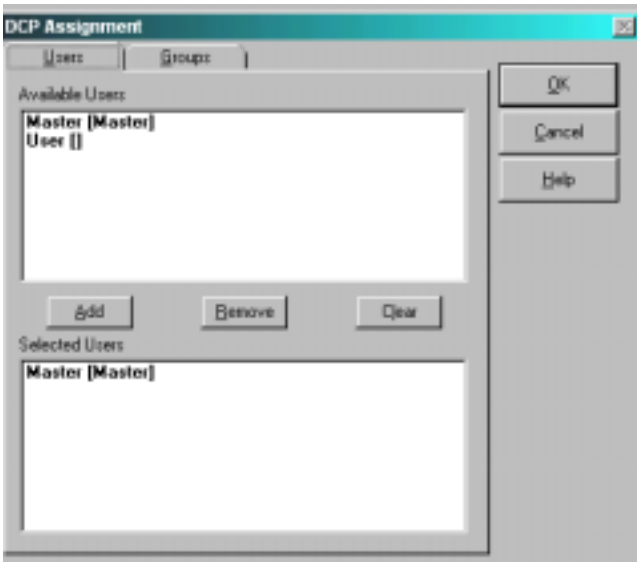
“Users” Button

K. Try clicking on these options to see how your Preview window changes.

L. Under the “Chart Options” heading, you can choose what type of graph will be present on the Data Collection Window. (You can choose to have one large graph, or, by checking the box by “Show Chart 2”, you can have two graphs, and both will be updated simultaneously while collecting data.)

M. Next, click on the <Users> button on the right side of the window, and the following frame will pop-up:

N. This is where you give individual users “rights” to collect data for a particular DCP. Highlight the user name under “Available Users”, and click on the <Add> button to add their name to the list of “Selected Users”. If a person is not listed here, when they log into the Data Collection of Verax SPC software, this specific DCP will not show on their list of available DCP’s, and they will not be able to collect data for it.



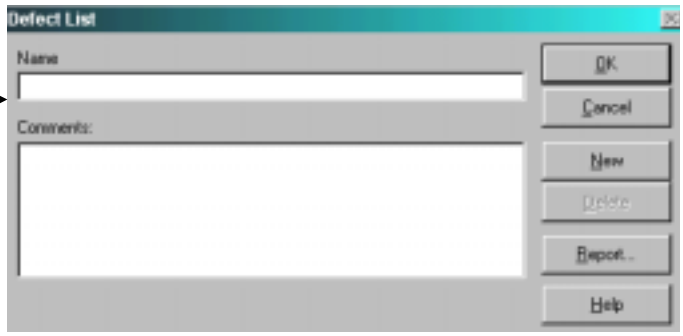
Now click on <OK> to close this window, then click on <OK> again, and now you have created a DCP, and will be able to collect data for a specific characteristic.

5.0. Attribute Characteristics

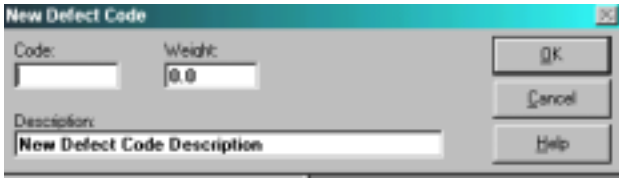
5.1. Setting up a Defect List

This list consists of physical attributes that may be detected during inspection. You can set up a Defect List in which you can record defects noted on specific boards. A Defect List is used in conjunction with an Attribute Characteristic. We will first make a Defect List, and then we will go through the steps to set up an Attribute Characteristic and it's accompanying DCP.

A. In the List Viewer, click on "Defect Lists" to highlight it.
B. Click on the icon at the top that says "New Defect List" when you place your mouse over it. (2nd from the left.)
C. The following window will pop-up:



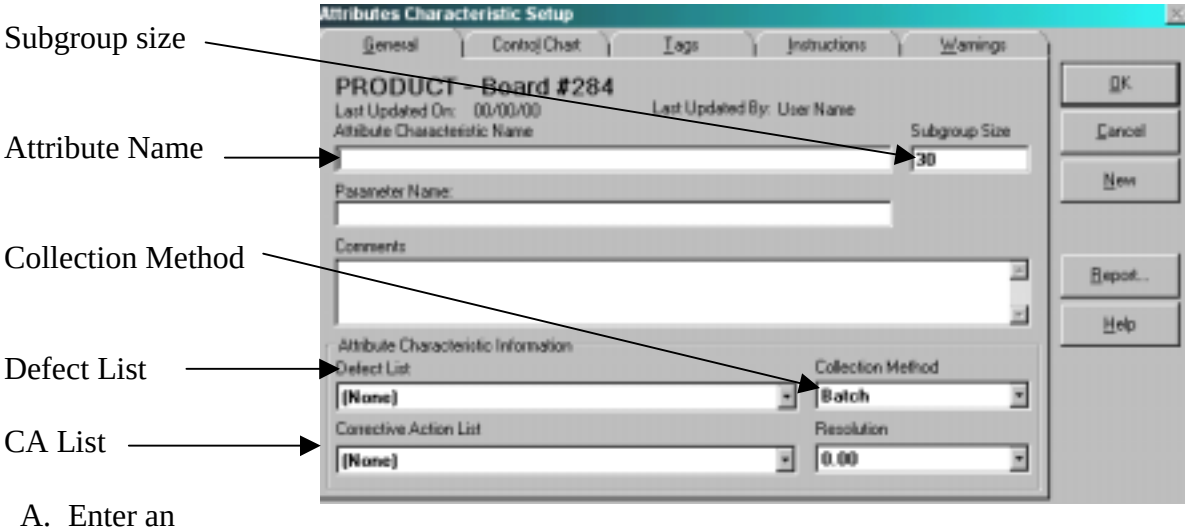
D. Enter a Name for your Defect List.
E. Click on <OK>.
F. Double click on the (+) sign by Defect List in the List Viewer to expand the list. Now click on the new Defect List name to highlight it.
G. Click on the icon at the top that says "New Defect" when you place your mouse over it. (2nd from the left.)
H. The following window will pop-up:



I. Enter a code for this defect. (Hint: use consistent codes for each list. I.e. A, B, C, etc.)
J. Enter a Weight. This value can correspond to the severity of the defect
K. Enter a defect description. (I.e. Too Much Paste, Missing paste, bridging, etc.)
L. When you are done, click on <OK>.
M. If you wish to create another Defect, repeat steps 7-12.

5.2. Setting Up an Attribute Characteristic to Track Defects

The setup for an Attribute Characteristic is almost the same as creating a Variable Characteristic. The only difference is that when you double click on the product name, and then click on the <Characteristic> button, you now select <Attributes>. When doing so, the following window will pop-up:



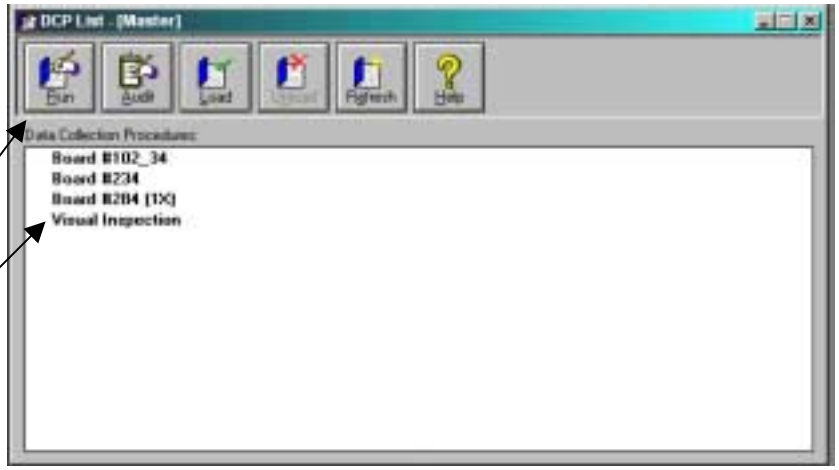
A. Enter an "Attribute Characteristic Name"
B. B.Enter the desired Subgroup size.
C. C.Select your Defect List from the combo-box.
D. Enter a Corrective Action List from the combo-box.
E. Select the Collection Method.
F. The remaining tabs: CONTROL CHART, TAGS, INSTRUCTIONS, AND WARNINGS, are configured in the same manner as are Variable Characteristics.

You now have to make a DCP for this Attribute Characteristic. This is done in the same manner as making a DCP for a Variable Characteristic. See **Setting Up a DCP** if you need to review this procedure.

6.0. VSS Data Collection

Data collection is the VSS application used to collect data for specific products. This is very easy to use, and we will go through the steps to use for data collection

A. Start Data Collection using the Shortcut, or start it through the programs startup menu.
B. The user will log in using their specific Login Name, and enter their password.
C. The following window will pop-up:
D. This is the default window for data collection. It shows you a list of available DCP's that you have rights to collect data for.

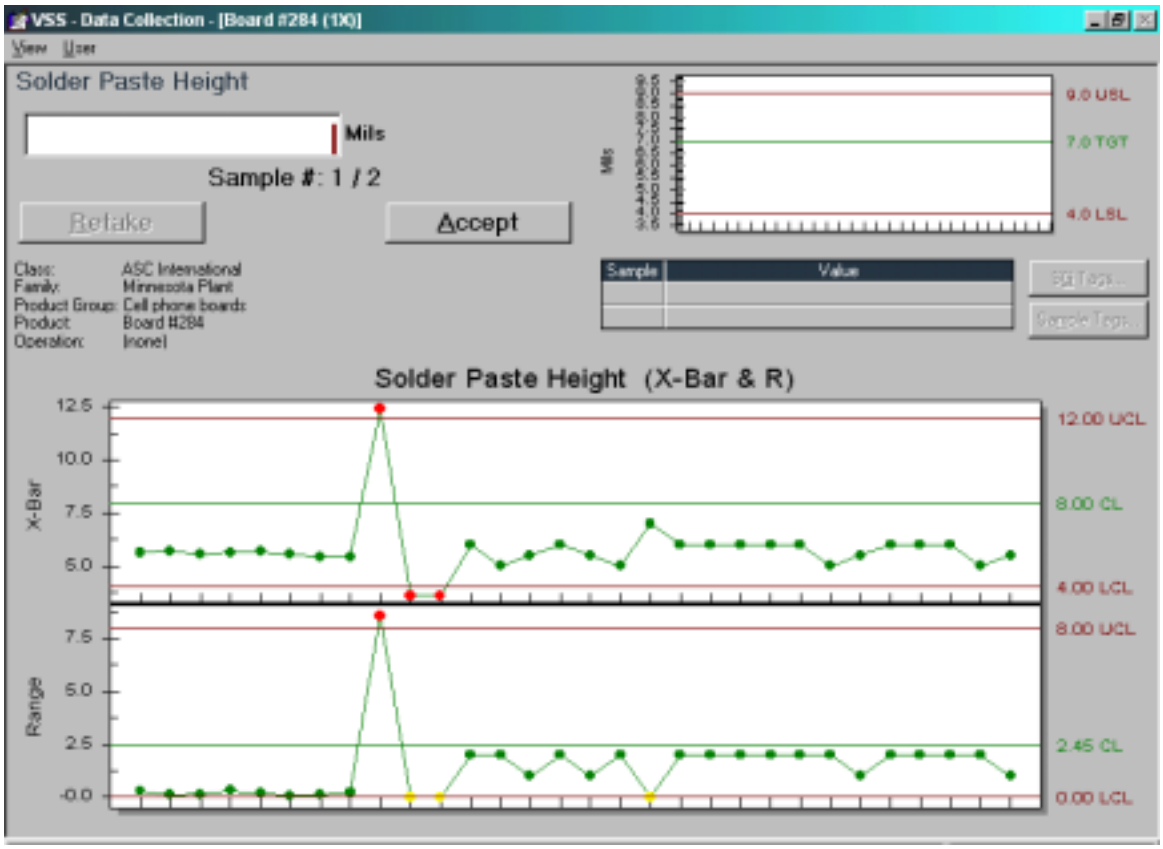


<Run> button

List of available DCP's

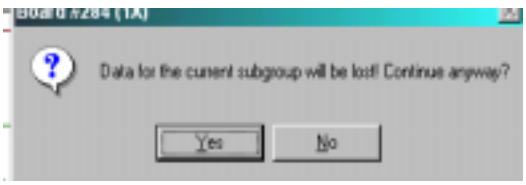
E. To start a DCP, double click on the name in the list, or click on it once to highlight it, and then click on <Run> .

F. After this, the data collection window will open, and you are ready to start collecting data. The data collection window will look similar to this:



NOTE: The first time you run a DCP for a product, there will be no chart until you have recorded 2 data points.

G. After you have collected the number of data points that was determined in the subgroup size in the administration setup, you will be prompted: "Do you want to continue this DCP?", select "NO" to end this DCP, or select "YES" to collect data for another subgroup.
H. You can also stop a DCP by clicking on <User> in the file menu, then click on <Stop DCP>.
I. If you select "NO", in Step 7, or stop a DCP using the procedure in Step 8, the following window will pop-up:
J. Select "Yes" to stop the DCP.



Note: The only time you will lose any data, is if you have a subgroup size greater than 1, and you have not taken all the readings. You will NOT lose data that has been plotted in the graph.

K. After this, you will return to the default window shown in Step 3 above.

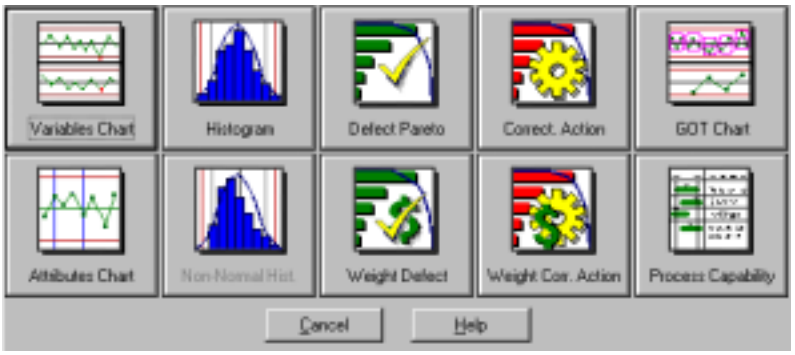
You may now do one of three things:

1. Leave Verax Data Collection in the default DCP window.
2. Close Verax Data Collection using <File>, then <Exit> in the file menu.
3. Click on <User>, then <Log User>. This will leave Verax Data Collection at the Login window, waiting for the next user to log in.

7.0. VSS Analysis

Verax Analysis is the VSS Application used to recall data for a specific product and time period, and analyze it. This reporting software is very powerful, and very configurable.

A. Login using your Login Name and password.
B. At the default screen, go to <File>, then <New>, and the following window will appear:



C. To make a "Variables Chart" click on the Image, and this window will pop-up:

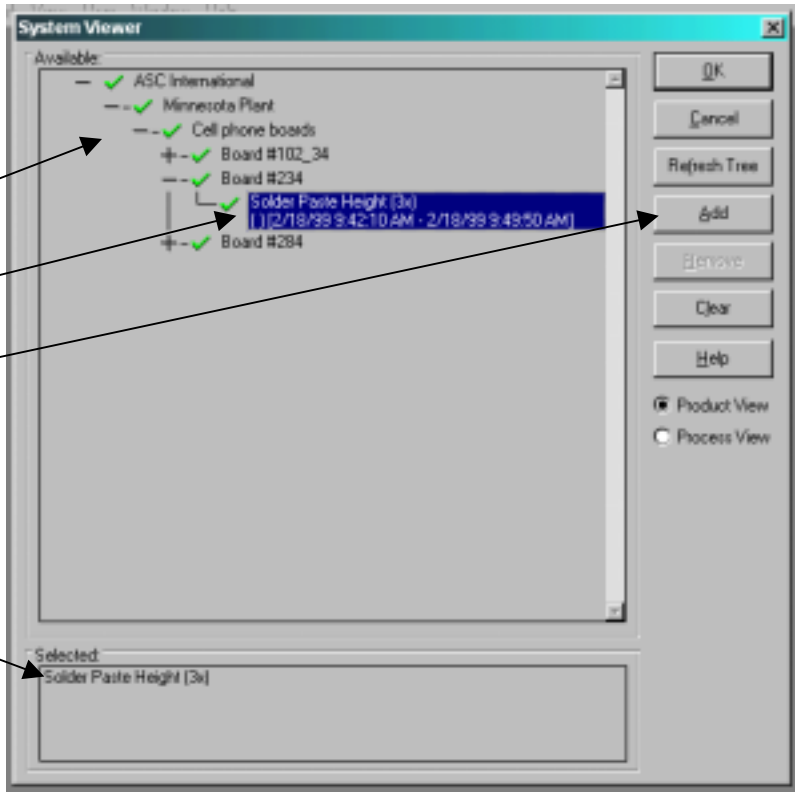
D. Using the System Viewer in the window, expand this list until you locate the characteristic you want to see data for.

System Viewer

Desired Characteristic

<Add> button

Selected Characteristic



B. Highlight the characteristic, and then click on the <Add> button, or just double click on the desired characteristic, to add it to the "Selected" window at the bottom of the page.

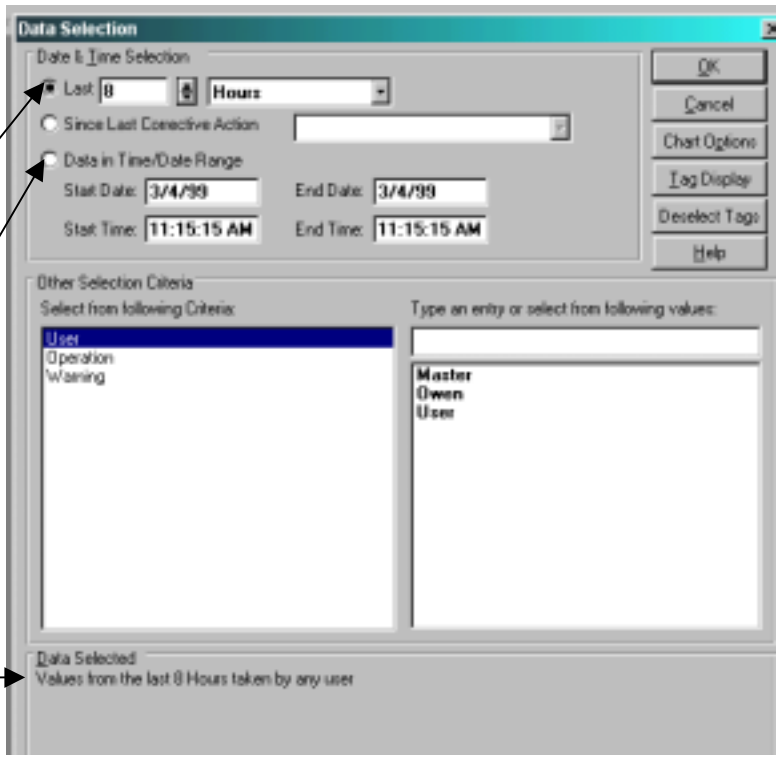
C. Click on <OK>. The following window will pop-up:

Here, you can select different criteria to sort data by. In this example, we have selected the data for the last 8 hours. You may instead choose data within a specific time frame.

Date & Time Selection

Specific Date/Time Range

Selected Criteria

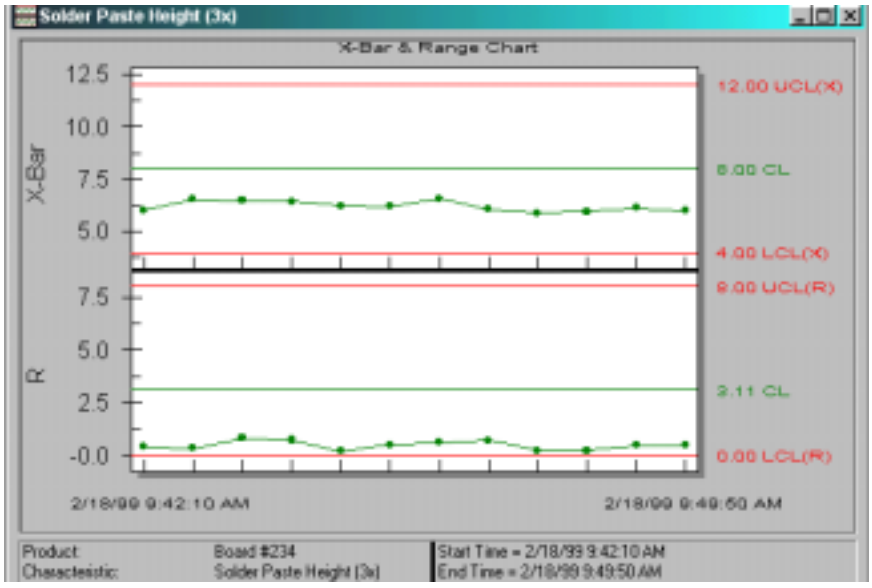


D. Click <OK>.

E. Now, the chart will appear, showing your selected data.

F. To edit the look of your chart, click on <Chart/Report>, then <Options>. In this window, you can configure the look of your chart to meet your needs.

G. To change this variables chart to a histogram, without



going through all the initial steps, click on <Chart/Report>, then click on <Change Report Type>, and you will be prompted to select your new chart type.

H. In the histogram chart window, follow the same steps as in Step 9, to configure the layout of your chart.

I. You can save these charts by clicking on <File>, then <Save As>.

J. To close out of Analysis, go to <File>, <Exit>.

8.0. Glossary

Arrow Keys - Keys which are labeled with arrows which point up, down, right, or left. These keys move the cursor, on the display, in the direction of the arrow.

Attributes Data - Data that is assessed qualitatively rather than with a measured value and can be counted for recording and analysis. Examples include characteristics such as the presence of scratches or blemishes, or the installation of all required fasteners. Other examples are characteristics which are measurable (could be treated as variables data), but are recorded in a simple yes/no fashion, such as the acceptability of a shaft diameter when measured on a fixture. Attributes data is what results from the counting of defects (nonconformities) and defectives (non-conforming units). Such data is analyzed using Pareto charts and p, np, c, and u control charts. (See also Variables Data.)

Average - The sum of values in a group divided by the number of values in that group; designated by a bar over the symbol for the values being averaged: X bar is the average of the X values within a subgroup; X double-bar is the average of subgroup averages.

c - For attributes data, the total number (count) of individual defects in a subgroup of fixed size.

c Chart - A control chart of the number of defects in a subgroup. C charts are typically used when each unit can have multiple defects.

Calibration - Adjustment of a gage or measuring instrument to a reference standard for the purpose of reducing measurement bias.

Capability - (Should be determined only after a process is in a state of statistical control.) A measure of the ability of a process to generate products that meet specifications. Represented as a proportion of specification (tolerance) spread to actual process spread. (See also Cp, Cpk, Cm, Cmk.)

Center Line - The line on a control chart that typically represents the average value of the items being plotted.

Characteristic - A dimension or quality of a product (process) which can be measured (variables data) or counted (attributes data); a qualitative or quantitative measurement of a unit.

Cm - A value similar to Cp, but using a value of s that is dependent on the average of subgroup ranges. (See also Cp)

Cmk - A value similar to Cpk, but using a value of s that is dependent on the average of subgroup ranges, as above. (See also Cpk.)

Configure - To connect and program a computer and its peripheral devices so that they operate smoothly as one system.

Control - **See Statistical Control.**

Control Chart - A graph of information about a characteristic which shows plotted values of a statistic calculated from data on the characteristic. The graph will also have a center line and one or two control limits. Control charts have two basic uses: as a judgment tool to determine if a process has been operating in statistical control, and as an aid in maintaining statistical control.

Control Limit - A line (or lines) on a control chart used as a basis for judging the significance of the variation between subgroups. Plotted points that are outside the control limits indicate lack of statistical control. Control limits are commonly located 3 standard deviations away from the centerline.

Cp - Process Potential - A capability index which is the ratio of the specification range to the range of the actual six-sigma spread of the process. Cp is a measure of process potential because it has no regard for the location of the data.

Cpk - Process Capability - A capability index which considers both the process spread and the proximity of the process spread to specification limits. Cpk is the ratio of the lesser of (USL - mean) and (mean - LSL) over the three-sigma spread of the process. A ratio of 1.33 or greater is usually desired.

CR - The inverse of Cp (1/Cp). This value ranges from 0 to infinity. A smaller value indicates greater process potential.

Cursor - The active position on a display (for example, indicating what part of the display has been selected or where new information will be entered). The cursor is indicated by a character or field which is highlighted, flashing, or underlined.

Cursor Keys - Keys which are labeled with arrows which point up, down, right, or left. These keys move the cursor, on the display, in the direction of the arrow.

Database - A structured set of related information stored in some format that allows for easy retrieval.

Defect - A specific occurrence of a condition which does not conform to specifications or other standards. Defects are sometimes called discrepancies or nonconformities. c and u control charts are used to analyze and control the occurrence of defects. Defects should not be confused with defective units.

Defective Units - Product units (or parts) which do not conform to specifications or other inspection standards; also called unacceptable or non-conforming units. p and np control charts are used to analyze and control the production of defective units. The presence of one or more defects in a unit causes it to be defective.

Distribution - A way of describing the output of a system containing variation. Specific individual values from a distribution are usually not predictable but, as a group often form a pattern that can be described in terms of its location, spread, and shape. Location, or central tendency, is commonly expressed by the mean or average; spread (or variation) is expressed in terms of standard deviation or the range of a sample. Shape involves many characteristics, such a symmetry and peakedness, but these are often summarized by using the name of a common empirical distribution such as the normal, binomial, or Poisson.

Export - The transfer of data and/or setups from the database to another storage medium.

Family - A set of related product groups.

Histogram - A graphical representation of the frequency distribution of sampled values or data points.

Individual - A single measurement. In variables data, a subgroup is usually constructed of several individuals.

Local Area Network (LAN) - A collection of inter-connected computers that allows users to share data and peripherals within a limited area.

LCL - Lower Control Limit - For control charts, the lowest plotted value at which a process is still considered in control. (See also **Control chart, UCL**.)

LSL - Lower Specification Limit - The lowest value of a product dimension or measurement which is acceptable. Specification limits are defined by physical constraints, and should be established by a design engineer - NOT a quality administrator. (See also **USL**.)

Mean - The average of the values in a group of measurements.

Median - The middle value when a group of measurements are arranged from lowest to highest; if the number of the values is even, the median is, by convention, the average of the middle two values.

Menu - A list of options displayed on a screen or window.

Moving Range Chart - A control chart that plots the range between adjacent subgroup averages. Often used in processes where individual samples (subgroups of size one) are analyzed.

Non-conforming Units - Units which do not conform to specifications or other inspection standards. (See also **Defective Units**.)

Nonconformity - A specific occurrence of a condition which does not conform to specifications or other standards. (See also **Defects**.)

Nominal Specification - The optimal value for a given measurement (used with variables data); usually the midpoint between LSL and USL. Also called target dimension.

Non-Normal Distribution - Any distribution which does not conform to the common normal distribution, or bell curve. (See also **Normal distribution**.)

Normal Distribution - A continuous, symmetrical, bell-shaped frequency distribution for variables data that underlies the control charts for variables. Any normal distribution is completely described by specifying its mean and standard deviation. When measurements are normally distributed, about 68.27% of all measurements lie within plus or minus one standard deviation unit of the mean. About 95.45% lie within plus and minus two standard deviation units of the mean, and about 99.73% lie within plus and minus three standard deviation units of the mean. These percentages are the basis for control limits and control chart analysis (since subgroup averages are normally distributed even if the output as a whole is not), and for many capability decisions (since the output of many industrial processes follows the normal distribution).

np - For attributes data, the total number of defective units in a subgroup. Given by n (number of units in subgroup) times p (proportion of defective units).

np Chart - For attributes data, a control chart of the number of defective units in each subgroup.

Operands - Values or symbols that are manipulated in a mathematical expression. For example, in the expression "a + 2" , "a" and '2" are operands. (See also **Operators**.)

Operators - Symbols that are used to combine operands in a mathematical expression. For example, in the expression "a + 2", "+" is the operator.

p - For attributes data, the proportion of defective units in a subgroup.

p Chart - For attributes data, a control chart of the proportion of defective units in each subgroup. (See also **p**.)

Pareto Analysis - An analysis of frequency of occurrence of various defects (or other data), using a Pareto Chart. The Pareto Principle holds that a small number of defects are responsible for the majority of problems. (See also **Pareto Chart**.)
Pareto Chart - A simple tool for problem-solving that involves ranking all types of problem causes or sources of variation according to their contribution to cost or to total variation. Typically a few causes account for most of the cost, so problem-solving efforts are best prioritized to concentrate on the "vital few" causes, temporarily ignoring the "trivial many."

Path - The location of a file within the hierarchy of directories of a computer's filing system.

Poisson Distribution - A discrete probability distribution for attributes data that applies to defects (non-conformities) and underlies the c and u control charts.

Pre-control - An initial period of development, before UCL and LCL are well defined; the "gearing-up" of a process for SPC.

Process - The combination of people, equipment, materials, methods and environment that produce a given product or service. A process can involve any aspect of business. Statistical Process Control is a key tool for managing the output of processes.

Process Average - The location (average value) of the distribution of measured values of a particular process characteristic, usually designated as an overall average.

Process Spread - The extent to which the distribution of individual values of the process characteristic varies; often shown as the process average plus or minus some number of standard deviations. For example, the six-sigma spread of a process characteristic is equal to the distance between the mean plus three standard deviations and the mean minus three standard deviations.

R - The range of values in a subgroup, i.e. the difference between the highest value and the lowest value in the subgroup.

R-bar - The average of subgroup ranges.

R Chart - A control chart which displays the range of data values recorded in each subgroup.

Range - The difference between the highest and lowest values in a subgroup. The expected range increases both with sample size and with the standard deviation.

Reasonable Limits - Reasonable limits are used to reduce entry of erroneous data by screening out values which cannot realistically be considered possible measurement results. Reasonable limits can be defined by entering the maximum and minimum numerical values to be accepted as measurements for this characteristic in the Upper RL and Lower RL boxes respectively. The Enforce Reasonable Limits box must be checked in order for the application to apply these limits at the time of data collection. When this box is checked, it specifies that measurements outside of these limits should not be accepted during data collection.

RS232 - Communications interface that is commonly used between electronic devices such as computers, modems and printers; requires a standard information protocol including baud rate, data bits, stop bits, termination characters, and parity checking methods prior to connection. (See also **Baud Rate, Stop Bits, Parity**.)

s - The sample standard deviation.

s Chart - A chart available in VSS which displays the standard deviation for each subgroup of data selected.

Sample - A collection of items to be measured for estimation purposes. Sometimes refers to a single measurement.

Shape - A general term for the overall pattern formed by a distribution of values.

Sigma - s - The Greek letter used to designate a standard deviation.

Sources of Variation - Any causes that act to create variation in the outcome of a process. Sources of variation tend to drive a process out of control or away from an ideal situation.

Specification - The engineering requirement for judging acceptability of a particular characteristic. Specifications and specification limits should never to be confused with control limits. (See also **LSL** and **USL**).

Spread - A general concept for the extent by which values in a distribution differ from one another; dispersion.

Stable Process - A process that is in a state of statistical control.

Standard Deviation - A specific measure of the spread of values of a (quality) characteristic of a process or the spread of a sampling statistic from the process; denoted by the Greek letter s (sigma).

Statistic - A value calculated from or based upon sample data (i.e.: a subgroup average or range), used to make inferences about the process or distribution that produced the output from which the sample came.

Statistical Control - A process is in control when the values of its quality characteristics only vary due to inherent natural randomness, and unpredicted sources of variation are not present. Statistical control is evidenced on a control chart by the absence of points beyond the control limits and by the absence of non-random patterns or trends within the control limits.

Statistical Process Control (SPC) - The use of statistical techniques such as control charts to analyze a process or its outputs so as to take appropriate actions to achieve and maintain a state of statistical control and to improve process capability.

Subgroup - One or more measurements taken together and used to analyze the performance of a process at a given time. Subgroups are typically made up of measurements from consecutive pieces, although random samples are sometimes used.

Target Dimension - For variables data, the optimal value for a given measurement; usually the midpoint between LSL and USL. (See **also LSL, USL**.)

Trend - An unusual or nonrandom pattern in the observed values of a characteristic (on a control chart) which suggest the presence of a previously unknown source of variation.

u - For attributes data, the average number of defects per unit in a subgroup. This number may exceed one, since each unit may have multiple defects.

u Chart - For attributes data, a control chart of the average number of defects per unit in a subgroup.

UCL - Upper Control Limit - For control charts, the highest value at which a process is still considered to be in control. (See also **Control Chart, LCL**.)

USL - Upper Specification Limit - The highest value of a product dimension or measurement which is acceptable. Specification limits are defined by physical constraints, and should be established by a design engineer - NOT a quality administrator. (See also **LSL**.)

Variance - The square of the standard deviation; (s2). (See also **Sigma(s)**.)

Variables Data - Quantitative data which consists of actual measurements of quality characteristics . This data is analyzed in terms of subgroups which contain one or more measurements. Examples include the diameter of a bearing journal in millimeters, the closing effort of a door in kilograms, the concentration of electrolyte in percent, or the torque of a fastener in Newton-meters. (See also **Attributes data**.)

Variation - The extent to which repeated measurements of the same process characteristic yield different values. Variation within a subgroup or sample is usually described in terms of range, variance, or standard deviation.

Warning Criteria - Conditions that signal an out-of-control process.

X-bar - For variables data, the average (mean) of values in a subgroup.

X double-bar - For variables data, the average of (X-bar) values of many subgroups. (See also **X-bar**.)

X-bar and R Chart - For variables data, control charts which plot the average value and range of the values in a series of consecutive subgroups. (See also **control chart, X-bar, R, subgroup**.)

X-bar and s Chart - For variables data, control charts which plot the average and standard deviation of the values in a series of consecutive subgroups. (See also **control chart, X-bar, standard deviation, subgroup**.)