EddyVISION32® v4.x

Technical Reference Manual for the

AutoVISION™ Program Module

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12. ERRATA

- EddyVISION 32 release 4.0 runs only on Windows 95/98 or Windows[1] NT 4.0.

NOTE: Windows NT 4.0 is the preferred platform.

- EddyVISION 32 release 4.x makes use of a three (3) button mouse; certain features are not available to users with a two (2) button mouse.
- EddyVISION 32 release 4.0 requires at least 64meg of ram, 1024x768 pixel display, a 200MHz Pentium-type processor, and a 1Gb hard drive with at least 100Mb free space. A screen resolution of 1280x1024 is recommended when using the Analysis software.
- Tube-sheet maps may print out very slowly under Windows 95 using the HP 5P laser printer while the *Vector Graphics* option is active. Enable the *Raster Graphics* option to speed up map printing.
- Under Windows 95 at 600 dpi, a laser printer with only 2Mb of RAM will not print in landscape mode. Either switch to 300dpi or portrait mode. Multiple smaller images work fine.

[1] All trademarks referred to herein are the property of their respective owners.

Contents:

Section 1: Introduction

AutoVISION is part of the EddyVision32 suite of eddy current related software products produced by CoreStar International Corporation, Irwin, Pennsylvania. Although these products are designed to operate under a Windows 95/98 or NT 4.0 environment, Windows NT 4.0 is strongly recommended since it is a much more stable environment. Some features of the AutoVISION software module are:

- Offers a tool by which the user can provide consistently and efficiently analyzed eddy current data.
- Decreases the time necessary for the analysis process.
- Allows the use of fewer personnel to staff an inspection.
- Increases the profitability of a service vendor.
- Allows auditors such as ANII, QA personnel and tertiary consultants to view fully documented signal analysis logic and methodology.
- Highly flexible system that accommodates all flaw morphologies.
- Runs on hardware that is much less expensive and more powerful than UNIX-based systems.

This manual is divided into the following key sections:

Section	**Title**	**Contents**
1	Introduction	General description of AutoVISION v4.x
2	Getting Started	System requirements, installation instructions, and installation notes
3	AutoVISION v4.x Basics	Preliminary steps for analyzing data
4	Sort Descriptions	Detailed information on measurement schemes, signal extraction and sort logic
5	Tutorial	A step-by-step tutorial for creating a typical set of sorts
Appendix A	Keyboard & Mouse Shortcuts	A listing of all the mouse & key combinations used to invoke specific functions
Appendix B	Glossary	Definitions of specialized terms you may see used in the software
Appendix C	Technical Support	Frequently Asked Questions (FAQ) list, troubleshooting tips, error messages and what they mean, and support contact information

Section 2: Getting Started

System Requirements

To install and use EddyVISION v4.x, the computer should meet the following minimum requirements:

? A PC with a 266 MHz Pentium-type microprocessor
? A 1.0 GB hard drive
? At least 64 MB of RAM (?128 MB recommended)
? VGA graphics adapter and monitor for at least 1024 x 768 resolution (1280 x 1024 resolution with a ?19-inch monitor are recommended)
? Microsoft Windows 95/98 or NT 4.0 (Windows NT 4.0 strongly recommended)
? 6X speed CD-ROM for software installation
? A 3-button mouse
? A Laser-type or color ink-jet is recommended
? A 10/100Base-T Ethernet network interface card (NIC) if networking is required
? A large capacity removable media device such as a ZIP (100Mb) or SuperDisk (120Mb) drive if data files are to be read from such media vs. a network link

Conventions Used in This Manual

Typographical Conventions

New terms that are defined in the glossary appear in *Italics*.

A command in text such as **Mode > Auto Mode** indicates a selection from a menu. This example means, "From the Mode menu, select Auto Mode."

Windows Conventions

CoreStar's software products and this manual use the same conventions as Microsoft Windows. If you are unfamiliar with Windows conventions such as menus, buttons, title bars, control buttons, or check boxes, see Windows documentation.

Other Conventions

This manual also uses the conventions described below to make this manual easy to read and understand.

Nomenclature

Throughout this document, AutoVISION will be referred to as "Auto".

Mouse Clicks

- **Click** means to click the left mouse button once on the desired function.
- **Middle-click** means to click the middle mouse button once on the desired function.
- **Right-click** means to click the right mouse button once on the desired function.
- **Double-click** means to quickly click the left mouse button twice on the desired function.

Control & Alternate Characters

Control and alternate characters are ASCII characters that have no representation that can be printed as a single character. CoreStar products use control and alternate characters as shortcuts for invoking certain functions. To type a control or alternate character, hold down the Control (Ctrl) or Alternate (Alt) key while typing the required character or clicking with the appropriate mouse button.

For example, on the main window of Auto, the Alt+click mouse combination will allow the user to employ a different signal measurement method than what is currently displayed on the screen. To use the Alt+click combination, first hold down the Alternate (Alt) key then click the left mouse button. This manual will indicate this keystroke as Alt+click. In the same respect, if a desired function is acquired by a control key combined with a mouse click, then it will be indicated as shown:

- **Ctrl+click**
  Hold down the **Ctrl** key first, then click the selection using the left mouse button.
- **Ctrl+middle-click**
  Hold down the **Ctrl** key first, then click the selection using the middle mouse button.
- **Ctrl +right-click**
  Hold down the **Ctrl** key first, then click the selection using the right mouse button.

Shift Key

CoreStar products use the Shift key in combination with other keys and/or mouse clicks to obtain certain functions. Shifted functions are activated the same as the control and alternate key combinations above. That is:

- **Shift+click**
  Hold down the Shift key first, then click the selection using the left mouse button.
- **Shift+middle-click**
  Hold down the Shift key first, then click the selection using the middle mouse button.
- **Shift +right-click**
  Hold down the Shift key first, then click the selection using the right mouse button.
- **Shift +right-arrow**
  Hold down the Shift key first, then press the right-arrow key on the keyboard.

Function Keys

Certain functions are activated by pressing one of the numbered function keys along the top of the keyboard. These keys are labeled **F1** through **F12**. In this manual, if a function key is specified, it will be shown in the format **F#** - keeping with the way in which these keys are labeled on the keyboard.

Windows^{TM} Conventions

Certain functions that are common to the *Windows*^{TM} operating environment will not be explained in this manual. It is assumed the user is already familiar with the standard commands and menu items such as **File > Save, Print Setup, Open, Save As, etc.** Where appropriate, explanations will be provided.

Installing EddyVISION v4.x

1. With Windows 95/98 or NT 4.0 already running, close all unnecessary applications.

2. Insert the CoreStar EddyVision32 v4.x CD-ROM disk in the CD-ROM drive.

3. If auto-insert notification is enabled for the CD-ROM on the PC, the installation program should start automatically. If the installation program doesn't automatically start after ?30 seconds, proceed to step 4, otherwise skip to step 5.

4. Click the **Start** menu, choose **Run**, click the **Browse** button, select the appropriate drive for the CD-ROM, select the file named *Setup.exe*, click **Open**, then click **OK** on the **Run** window. The installation window shown in Figure 2-1 will appear. Click the **Next** button.

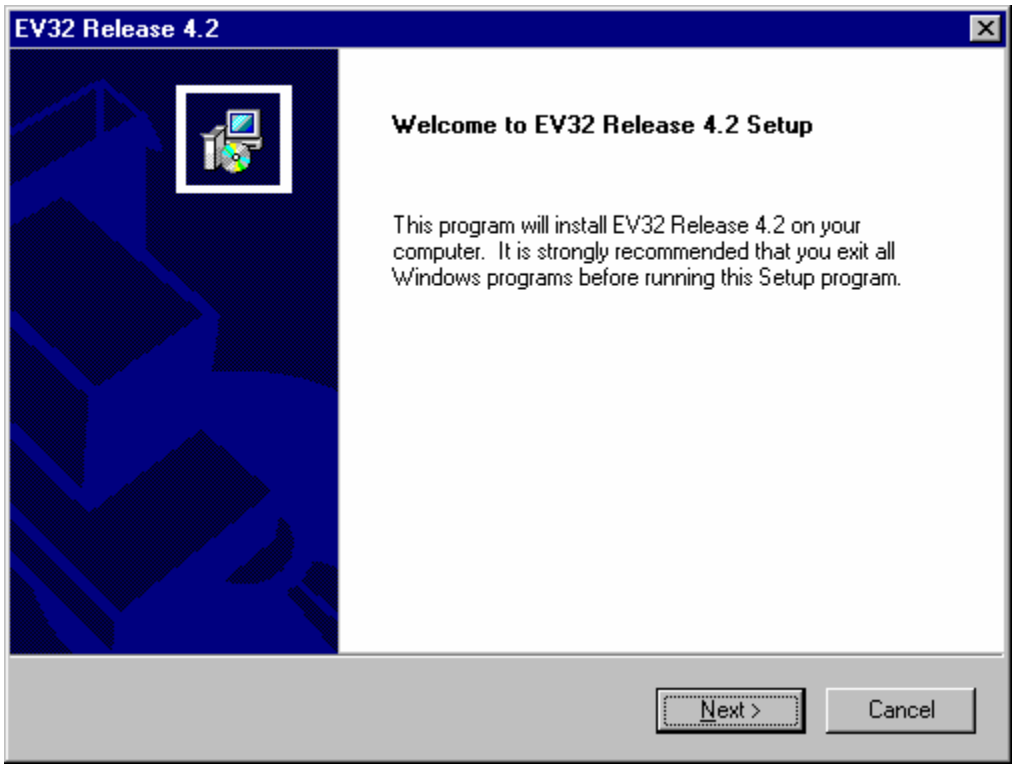

Figure 2-1. Installation Window

5. The window shown in Figure 2-2 appears. The installation program defaults to an installation directory of *c:\corestar*. Click the **Browse** button to select a different installation drive and/or directory. If the desired directory doesn't already exist, the installation program will create it. Click the **Next** button to continue.

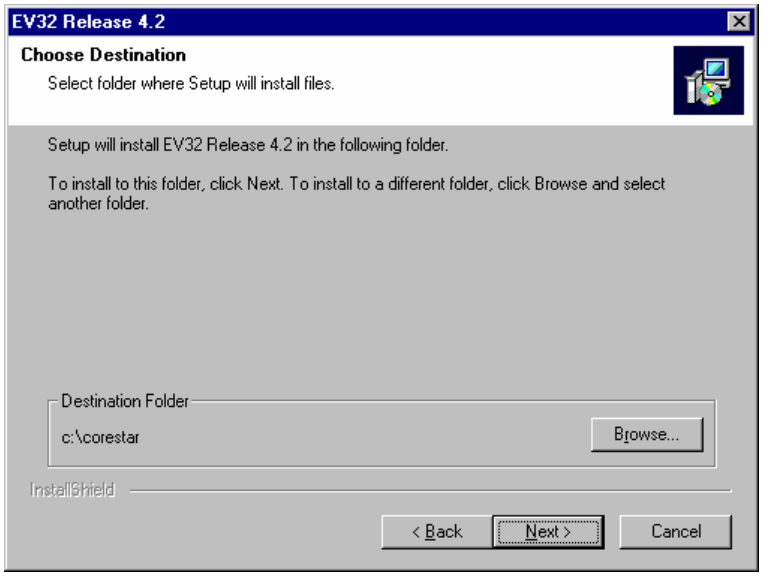

Figure 2-2. Installation Destination Window

6. The window shown in Figure 2-3 appears. Select, type the name of the desired program folder, or accept the default name where the program shortcuts will be stored on the Start Menu. The default name for the program folder is *EV32 Release 4.2* as shown.

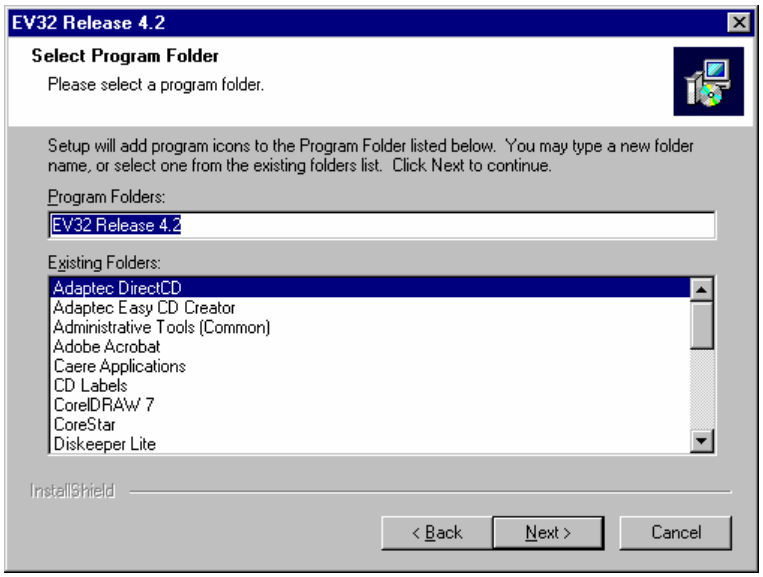

Figure 2-3. Program Folder Selection Window

7. Click the **Next** button on the window shown in Figure 2-3. The installation process begins. During the installation, the status window in Figure 2-4 will show the progress of the installation.

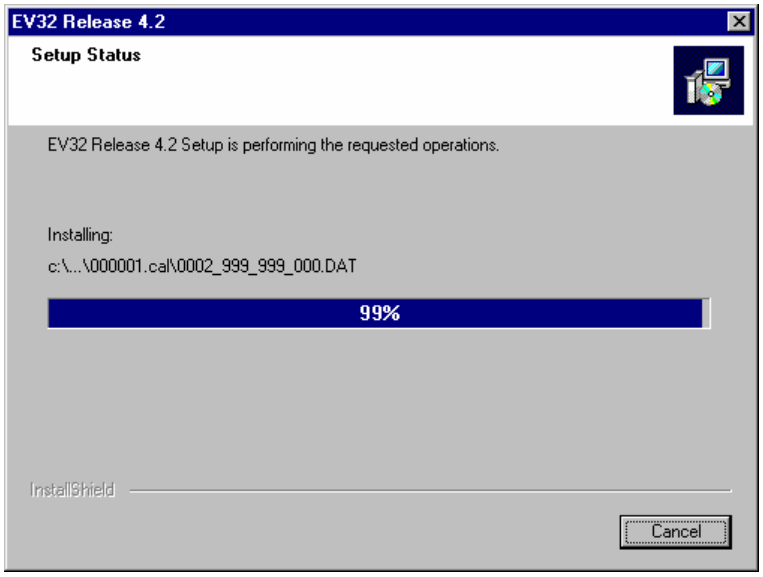

Figure 2-4. Installation Status Window

8. When the status bar shown in Figure 2-4 reaches its end, the message box shown in Figure 2-5 will appear. This message box simply notifies you that the driver for the HASP? security key is currently being installed. Once the driver is successfully installed, the message box shown in Figure 2-6 will appear. Simply click **OK** to continue. HASP is the brand name of the enable modules used with CoreStar software products that attach to the PC's parallel port.

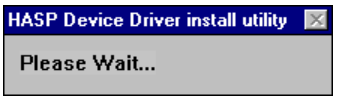

Figure 2-5. HASP Device Driver Installation In-progress Message

Figure 2-6. HASP Device Driver Installation Completed Message

9. Finally, the message box shown in Figure 2-7 appears indicating that the CoreStar EddyVISION32 software has been successfully installed. Click the **Finish** button to exit the installation program. You'll notice that a shortcut folder now appears on the Desktop entitled *EddyVISION32 Rel 4.x*. Double-clicking this folder reveals four (4) program shortcut icons. The installation program installs the complete CoreStar EddyVISION32 suite of eddy current related software products; however, only the programs you have security keys for will run. If desired, you may want to place copies of desired shortcuts directly on the Desktop. With the *EddyVISION32 Rel 4.x* folder open, right-click & drag desired shortcuts to the Desktop and release the right button, then select **Copy Here** on the popup menu.

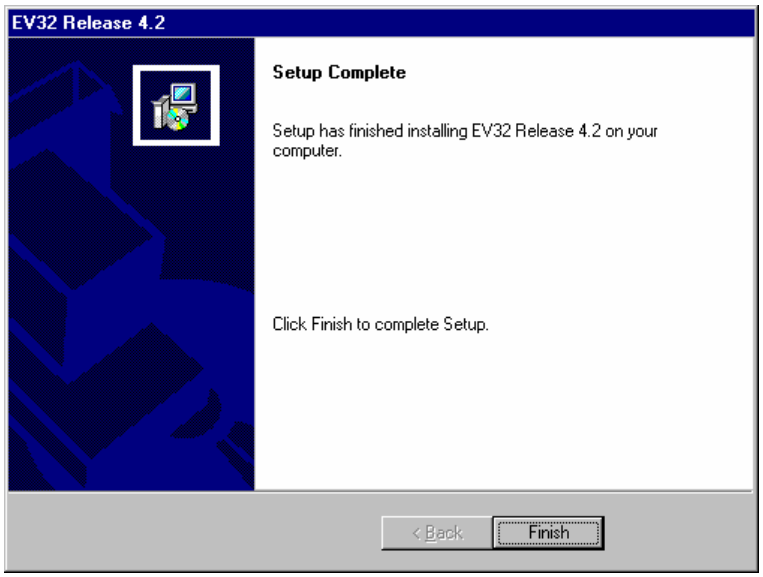

Figure 2-7. EddyVISION32 v4.x Installation Complete Message Window

10. As with any new software installation, it's a good idea to shutdown and restart the computer. Depending on the operating system you're working on, this may be necessary since some of the newly installed files may not be loaded into memory until the PC is restarted. As an alternative, the operating system your PC uses may display a message box suggesting that you restart the PC. If this message is displayed, select **Yes**.

11. Once Windows 95/98/NT has restarted, connect the Analysis program security key to the parallel (printer) port of the PC (See Figures 3-1 & 3-2 in Section 3). Right-click on the Analysis icon and select Properties. Click on the Shortcut tab. If the words **auto:rule_base** are not in the target string, insert the word string following the **.exe** suffix. (Make sure a space is between **.exe** and typed words.) The command line's word sequence determines which mode the software boots. If the words **auto:rule_base** and **analysis** were reversed, then the software would boot in the Manual Analysis mode. Click on Apply, then OK to exit the icon properties menu. Double-click the Analysis icon under the *EddyVISION32 Rel 4.x* folder on the desktop and Analysis should start.

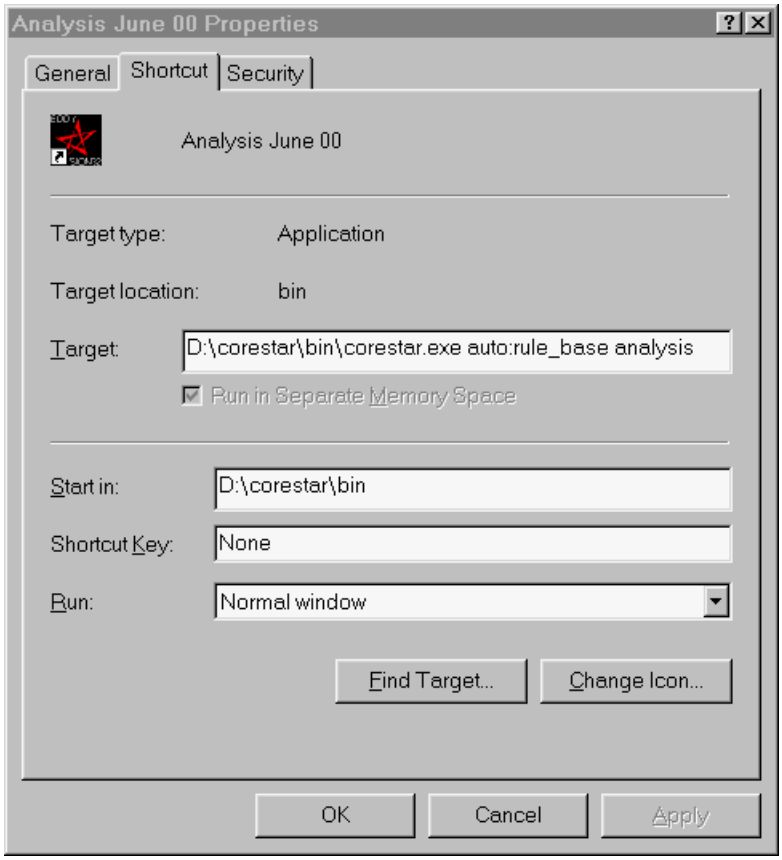

Figure 2-8 Shortcut Command Line String

If no security key is attached to the parallel port of the PC the analysis software will not boot. To run AutoVISION you must have an analysis key that have been specifically enabled for AutoVISION.

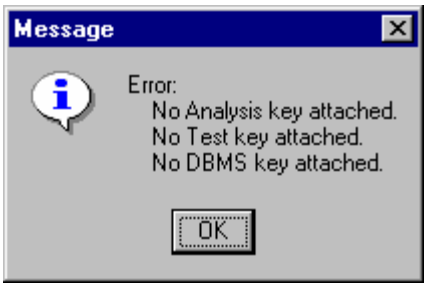

Figure 2-9. Security Key Message Box

Installation Note

If the computer system has the Adobe® Type Manager installed, uninstall it. This program overrides the font handling functions of Windows, and may cause problems when printing from CoreStar software products, especially products that use symbol fonts, i.e., tubesheet maps, symbols in headers or reports, etc.

Electronic Manual

This manual as well as manuals for all program modules are included in their entirety on the CoreStar EddyVISION32 Installation CD-ROM disk. They're provided in Microsoft® Word 97 format. If you do not have Word 97, you will need to install the free Microsoft Word 97 Viewer on your system. The Microsoft Word Viewer enables the user to open, view, and print Microsoft Word 97 document files; however, it doesn't allow any editing. One nice feature in viewing one of these manuals electronically is that the user can click a topic page reference on the Table of Contents, and that topic will immediately be displayed. The free Microsoft Word Viewer is included on the CD-ROM disk as well.

To install the free Microsoft Word Viewer:

1. Place the CoreStar EddyVISION32 Installation CD-ROM disk in the CD-ROM drive. If the install program automatically starts, wait for the installation window to appear, then cancel the install operation.

2. Click **Start > Run > Browse** and select the CD-ROM drive.

3. Open the directory on the CD-ROM called *X:\MSVIEWER*, where "X" is the letter of your CD-ROM drive.

Select the file named *WDVIEW97.EXE*, click **Open**, and then click **OK** on the **Run** window. Follow the instructions on the screen to install the free Microsoft Word Viewer.

Section 3: AutoVISION v4.x Basics

3.1 Connecting the Security Key

In order to start and use the Auto program, any valid HASP? security key must be connected to your computer's printer port. Figure 3-1 shows what the security key looks like. These keys are fabricated in such a way that more that one key can be connected in series if you wish to use other CoreStar software products concurrently.

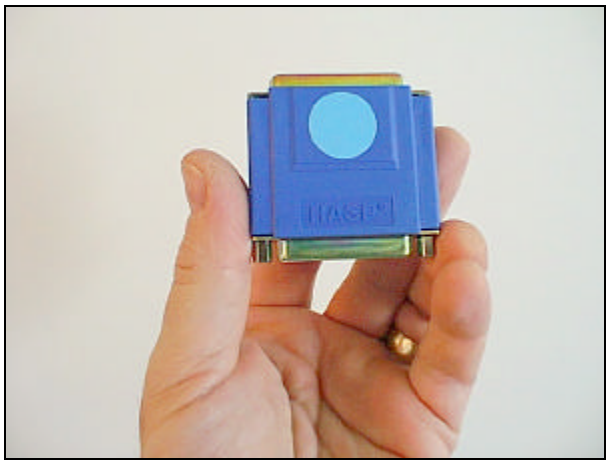

Figure 3-1. Security Key

Connect the key(s) to the parallel port as shown in Figure 3-2. If a printer is to be used, connect the printer cable to the back of the key.

Figure 3-2. Attaching the Security Key to the PC

3.2 Starting the AutoVISION Software

To start the AutoVISION software, double-click the Analysis icon located in the *EddyVISION32 Rel 4.x* folder on the desktop. After the program starts, you will see the screen shown in Figure 3-3. If you need to revert to Manual Analysis, you will need to select the Manual mode by selecting **Mode** > **Analysis** from the main menu.

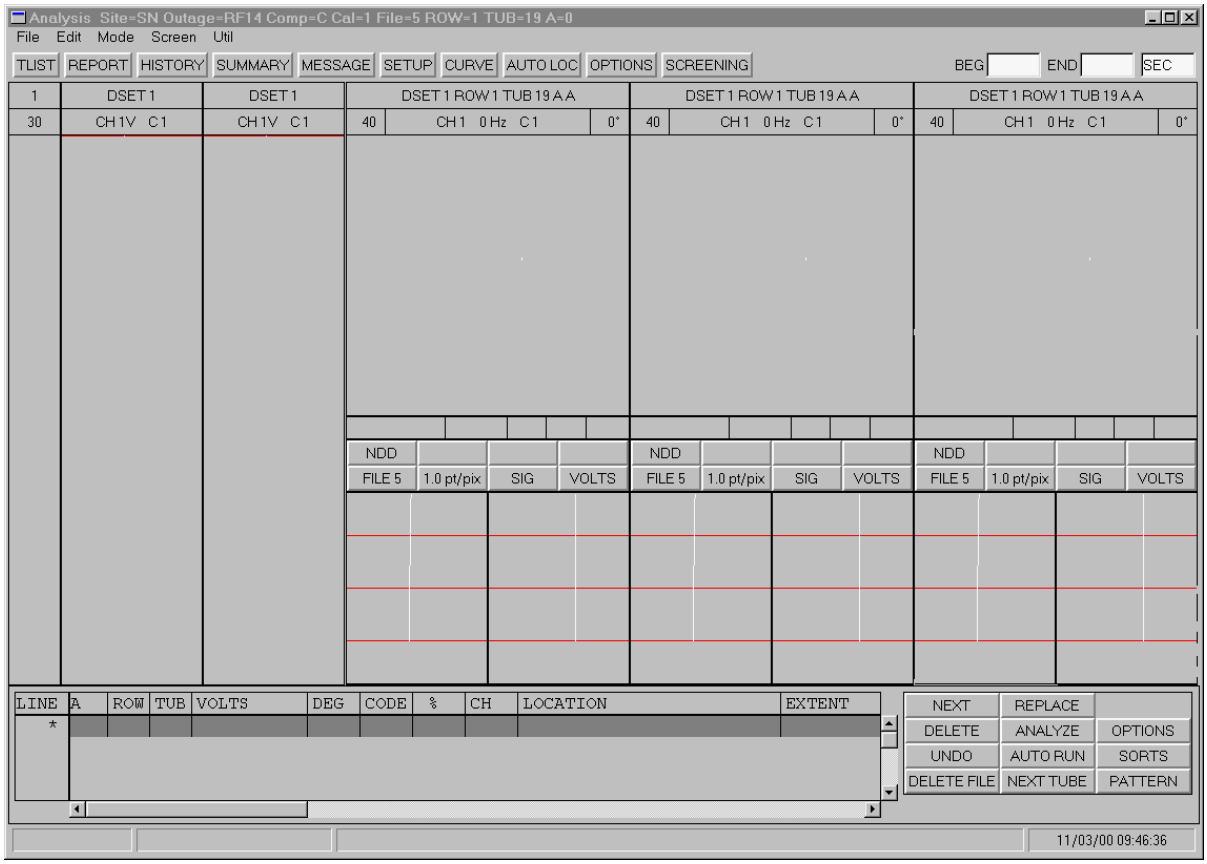

Figure 3-3. The Main AutoVISION Window

3.3 Description of the Main Window

All functions of AutoVISION are accessed from the main window shown in Figure 3-3. Various functions are accessed via pull-down menus along the top left of the window and specialized buttons just below the pull-down menus. Figure 3-4 points out the different areas of the main window and offers descriptions of each. Operations specific to the setting up of sorts, report editing, etc. are accessible through the lower half of the display.

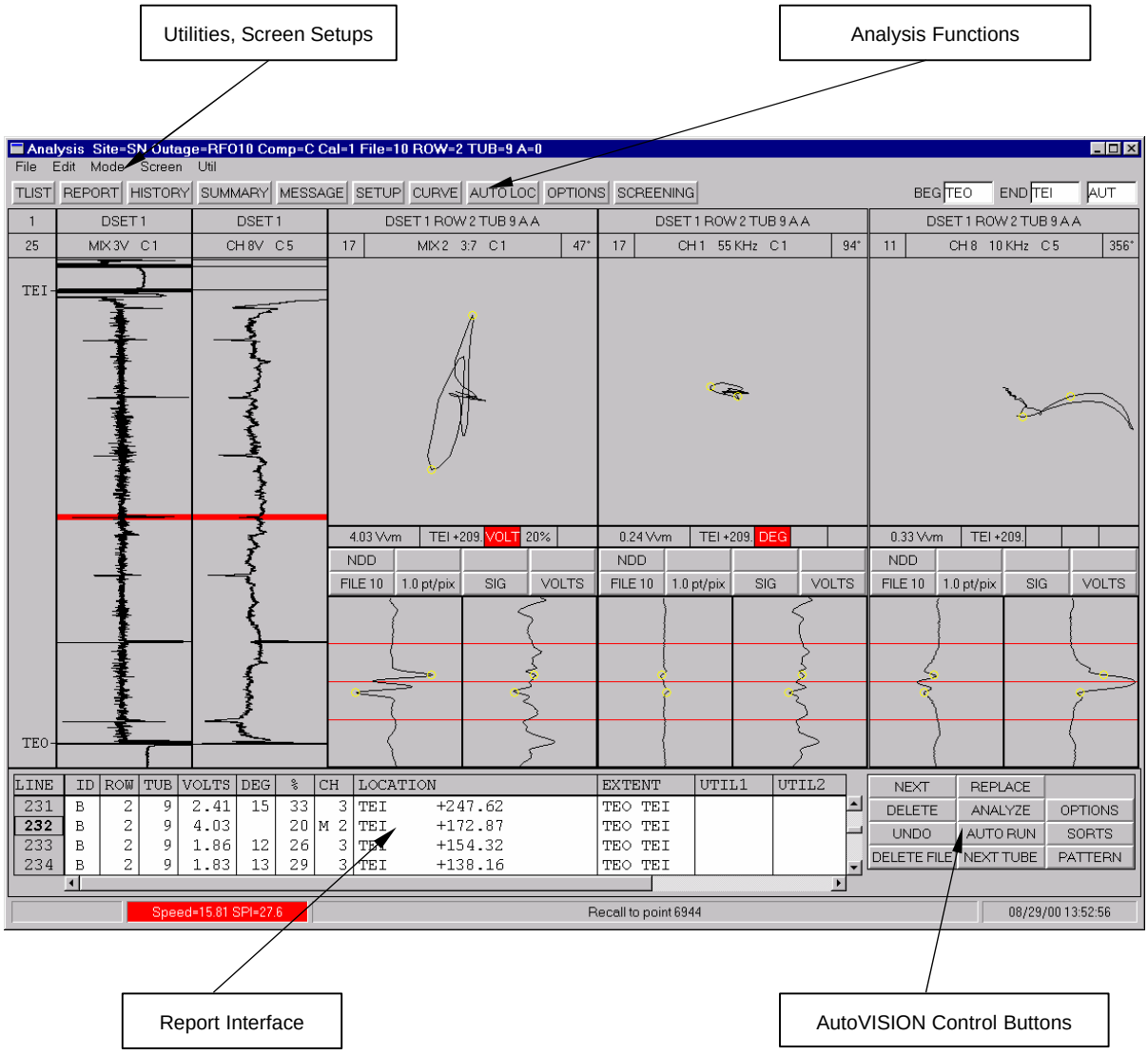

Figure 3-4. Parts of the Main AutoVISION Window

As the basic functions for the analysis window are addressed in another manual, the following section only addresses AutoVISION features.

3.4 AutoVISION Control Buttons

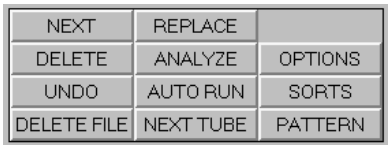

Figure 3.5 AutoVISION Control Buttons

The AutoVISION interface is comprised of the 11 buttons shown in figure 3.5.

3.4.1 Report Editing Functions

NEXT – Reads in the next tube on the TLIST
DELETE – Deletes the current entry in the report
DELETE FILE – Deletes all entries for a given file of data
REPLACE – Replaces the existing report call with the one in the lissajous screen
UNDO – Undoes the last delete operation

3.4.2 Action Functions

ANALYZE - processes the file that is currently displayed in the Analysis window
AUTO RUN – processes each file in the TLIST from the current position until an abort code is met
NEXT TUBE - loads the next tube in the TLIST
PATTERN – This feature is not active in the current release
OPTIONS – This button brings up the dialog in figure 3-6. From here, there are two categories of choices Options and Abort Codes.

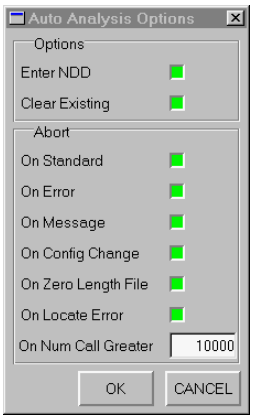

Figure 3-6 Auto Options

Options

- **Enter NDD –** When active, an NDD entry is made to the report when AutoVISION does not report a call for a given data file. If not active no entry will be made to the report.
- **Clear Existing –** When active, AutoVISION will clear the existing report entries for a given data file.

Abort

The following are events that will cause AutoVISION to stop processing when in AUTO RUN mode.

- **On Standard –** When a file encoded 999_999 is encountered
- **On Error –** When any error message is encountered
- **On Message –** When a message is encountered
- **On Config Change –** When the configuration changes
- **On Zero Length File –** When a file of zero length is read in
- **On Locate Error –** When any landmark in the component file is not located
- **On Num Call Greater –** When the total number of calls generated by AutoVISION for a given file exceed the value in this field

3.4.3 Setting up The Sorts

SORTS - The remaining button, labeled **SORTS,** is the first step in the process of setting up rules. Understanding this is the key to using AutoVISION. Sections 3.5 & 3.6 will describe this process.

3.5 Creating Sorts

Pressing the SORT button will bring up the dialog in figure 3-7. From this box, any number of individual CATEGORIES can be created. Each category corresponds to a defect mechanism. The set of defect mechanisms required to analyze the data for a given CAL is called a SORT.

3.5.1 The Sort Dialog

SORT – A set of categories required to analyze data for a given CAL. The SORT is stored as a unit; there is no way to extract a single category from the SORT. The SORT files are stored in a *.rul file by selecting **file > save** or **file > save as** from the menu.

CATEGORY – A new category is created by clicking the RULES button in the top left side of the dialog in figure 3-7. The next section will describe how the categories are created. This is truly the heart of AutoVISION.

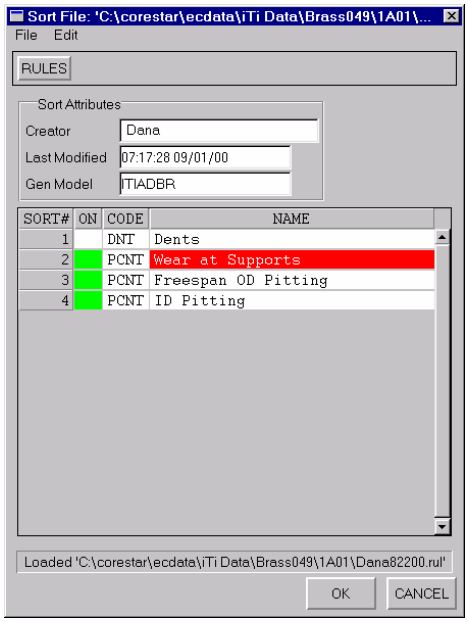

Figure 3-7. Sort Interface

- Once a category has been created it can be accessed by double clicking on it.
- A category can be enabled or disabled by clicking in the ON field. A green background indicates that the category is enabled.

MENU CHOICES - Clicking on **File** produces the following pull-down menu shown in figure 3-8.

File > New Sort - Clears the current sort and creates a new blank template. This step does not erase the sort file that is stored to the hard drive; it just clears the sort screen. Figure 3-9 shows the result of selecting the **New Sort** function. A **Creator** name can be assigned to the sort. The **Gen Model** will automatically be established when the sort is saved. The name of the current component file is used.

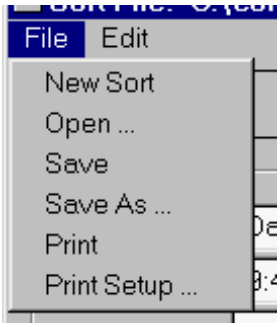

Figure 3-8 Sort Menu

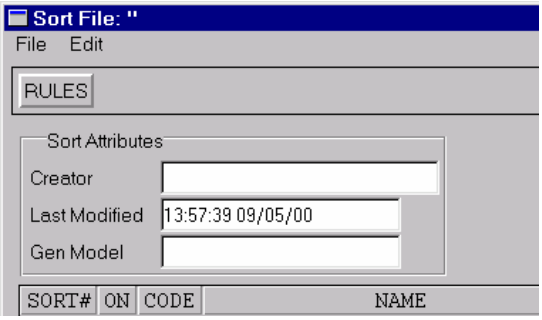

Figure 3-9 Result of New Sort Selection

If there is a mismatch between the current component file and the sorts that are being loaded, the software will generate the warning depicted in Figure 3-10.

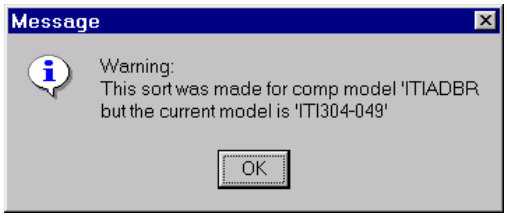

Figure 3-10. Component Mismatch Warning

Clicking OK allows the analyst to save the current sort parameters with the current component model. In this way, sorts that are created for a particular component can be saved for another type of unit. It is **very important** that the analyst keeps in mind the two components may differ and that the sort parameters would need to be modified to accommodate those physical differences, such as support locations, numbers, signal voltages, etc.

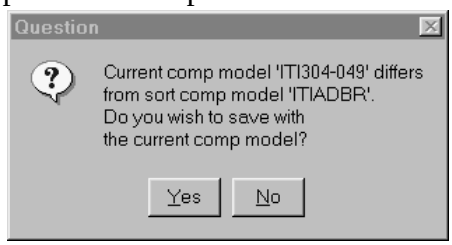

Figure 3-11. Linking sorts with a component

File > Open - This menu choice brings up the file open dialog and allows you to select one of the existing sort files.

File > Save - This menu choice brings up the file save dialog box if you have not previously saved the sort. If you have, it simply saves the sort to the existing file name and path.

File > Save As - This menu choice always brings up the file save dialog box and allows you to rename the sort file.

File > Print Setup – Allows you to configure the printer properties.

File > Print – Not Active.

3.6 Creating Categories

CATEGORIES are the core of AutoVISION. A new category is created for each defect mechanism that is to be detected. To create a new category, press the RULE button from the SORT dialog. There are five steps involved in setting up a category to detect and call flaw signals.

- ? Extract Signals
- ? Define region of tube to apply extraction
- ? Create rules
- ? Make Call
- ? Debug Rules Interactively

The following sections will be discussed in order of execution rather than in order of appearance.

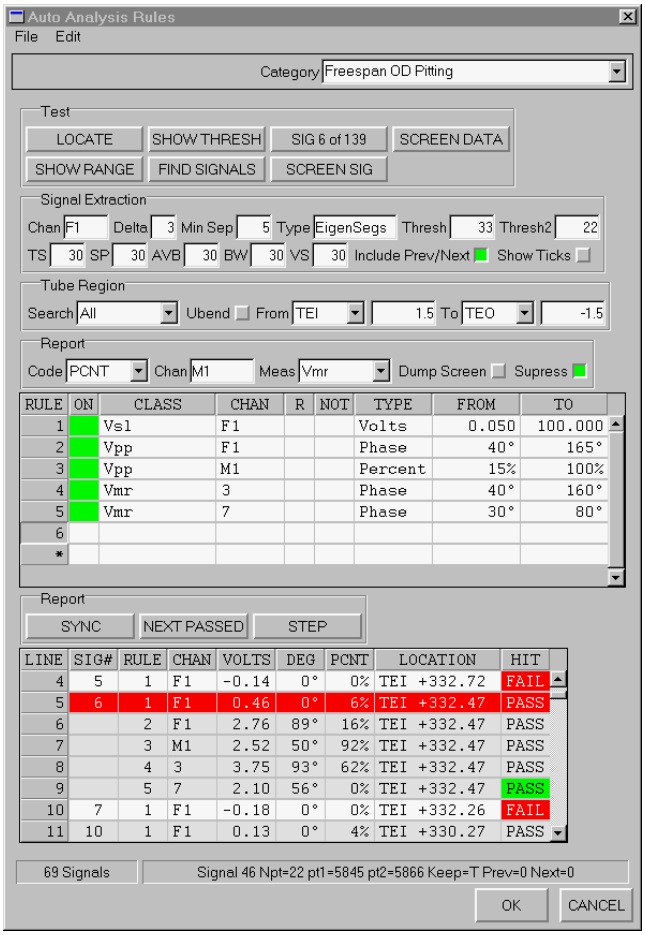

Figure 3-12 Category Setup

3.6.1 Extraction

This section of the software is considered the heart of the system. Unlike other automatic screening systems, Auto utilizes specialized algorithms to perform an initial screening of the data. It actually scans the data and selects significant signals from the background noise. Most other automated data screening systems rely moving a threshold based window through the data and keying on the areas that exceed the threshold value.

AutoVISION has several extraction methods that are designed for specific damage mechanisms.

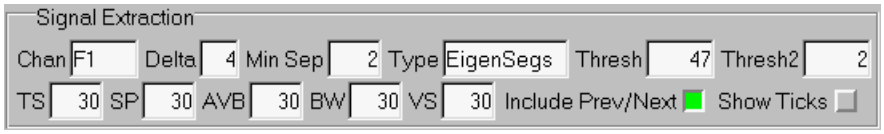

Figure 3-13 Extraction Setup

The extraction types are listed below. Please note that except for the CHAN field, the signal extraction parameters on the first line shown in figure 3-13 can have different meanings for different extraction types. The parameters on the second line are the same for all extractions types. CHAN and the second line of extraction parameters are defined below.

CHAN - The first step in setting up the extraction parameters is to select the **channel** on which the relevant signals will be extracted. Any raw or process channel can be used. The only criterion is that the selected channel is sensitive to the type of flaw signals the analyst is interested in extracting. For instance, it would not be wise to use a raw channel for extracting pit-like flaw responses underneath a Tube Support (TSP). Right or left click in this field to select the desired channel.

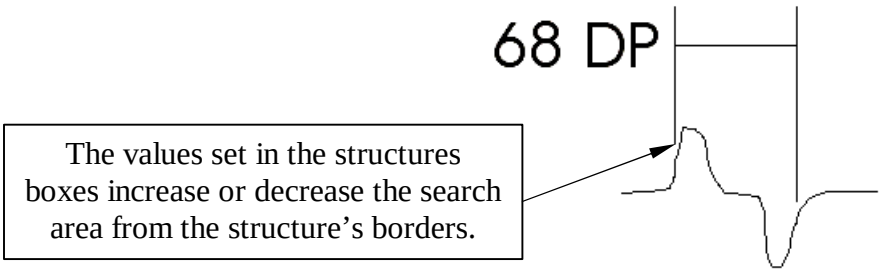

Figure 3-14 Landmark Window Size

TS – The value in this field defines the number of datapoints that comprise the tube-sheet signal. A value of 30 means that a region 15 data points above and below the tube-sheet's centerline is defined to be part of the tube-sheet signal. See figure 3-14 for an example. The same applies to the four following field descriptions.
SP – Same as above but referring to support plates.
AVB – Same as above but referring to anti-vibration bars
BW – Same as above but referring to bat-wings
VS – Same as above but referring to vertical straps

INCLUDE PREV/NEXT – When active, this feature always extracts the signal before and after each signal that meets the extraction criterion. This is useful when setting up rules to determine which signals to keep. There are rules that allow you to

examine the previous and next signal. This feature ensures that the previous and next signals are available for all extracted signals.

SHOW TICKS - When active, this feature puts a marker in the location window that corresponds to each signal that is extracted. It can be useful for debugging.

NOTE: You can change the signal extraction TYPE by right or left clicking in the TYPE field shown in figure 3-13.

EIGENSEGS TYPE - Eigensegs is the most commonly used and probably the most powerful extraction type. It should be used for all quickly moving defect mechanisms including pitting, cracking, denting, etc.

DELTA (under EigenSegs)

To the right of CHAN is another box labeled DELTA. A small value of DELTA will work better for quicker forming signals. A larger value of DELTA works best for slower forming signals. Typically when using EIGENSEGS, DELTA should be between 2 and 5.

MIN SEP (under EigenSegs)

Under Eigensegs MIN SEP is simply a flag. A value of zero tells it to ignore the value in the THRESH2 field.

THRESH (under EigenSegs)

THRESH is a threshold value based on the digital data value. No volts have been applied so it is independent of voltage settings. It can be set as low as necessary but setting it too low can increase extraction time unnecessarily. Depending upon the size of signals to be detected a value of 20 is a good place to start.

THRESH2 (under EigenSegs)

THRESH2 is only used with EigenSegs. It contains a value that refers to the angle between two adjacent signals. If the angle is greater than the value in THESH2 it will combine the adjacent signals into a single signal. A recommended value for THRESH2 is 50. You should never have to change it.

SEGMENT TYPE – SEGMENT extraction is used for quickly moving signals also. It is less discriminating and less often used than EIGENSEGS. SEGMENTS will extract every signal above its defined THRESH value. This can be useful in some instances. One example pertains to finding the top of a sludge pile.

DELTA (under Segments)

A small value of DELTA will work better for quicker forming signals. A larger value of DELTA works best for slower forming signals. Typically when using SEGMENTS, DELTA should be between 2 and 7.

MIN SEP (under Segments)

Does nothing under Segments.

THRESH (under Segments)

THRESH is a threshold value based on the digital data value. No volts have been applied so it is independent of voltage settings. It can be set as low as necessary but setting it too low can increase extraction time unnecessarily. Depending upon the size of signals to be detected a value of 20 is a good place to start.

THRESH2 (under Segments)

Does nothing under Segments.

VERTICAL TYPE – VERTICAL extraction is used for many slow forming vertical defect mechanisms. Most signals with an absolute drift signature should be extracted using this type. One exception is tube to tube contact which often is seen as an absolute signal with a constant slope. For this, we use WEARSEGS extraction. WEARSEGS will be discussed in the next section.

DELTA (under Vertical)

A small value of DELTA will work better for quicker forming signals. A larger value of DELTA works best for slower forming signals. Typically when using VERTICAL, DELTA should be between 5 and 15 or more.

MIN SEP (under Vertical)

MIN SEP establishes a minimum separation between discrete signals. For instance, if you have a very slow-forming indication with a dead spot of 10 data points between two sections of the same signal, a MIN SEP value of greater than 10 would join them into one signal.

THRESH (under Vertical)

THRESH is a threshold value based on the digital data value. No volts have been applied so it is independent of voltage settings. It can be set as low as necessary but setting it too low can increase extraction time unnecessarily. Depending upon the size of signals to be detected a value of 20 is a good place to start.

THRESH2 (under Vertical)

Does nothing under Vertical.

WEARSEGS TYPE – The WEARSEGS type was created for the detection of tube to tube wear. It is used for extracting long absolute signals of a constant slope. The extraction stops when the slope of the signal exceeds the predefined slope.

DELTA (under WearSegs)

DELTA defines the number of points over which the initial slope is calculated. A typical starting value is 10.

MIN SEP (under WearSegs)

Does nothing under WearSegs

THRESH (under WearSegs)

THRESH is the vertical rise over the number of points in DELTA.

THRESH2 (under WearSegs)

Does nothing under WearSegs.

NOTE: A slope value is calculated using the initial DELTA and THRESH value. It is the ratio of THRESH/DELTA. When the actual slope of the data exceeds the preset value, the extraction terminates and the end-point of the signal is defined. WEARSEGS is effective at extracting the entire freespan region between supports.

TYPE	Best used for
EigenSegs	Fast-forming, discrete flaws that have definitive edges. Pits, cracks, steam cutting, grooving, IGA, certain types of sharp-edged wear, dents, manufacturing burnish marks (MBMs). Works on both differential and absolute data channels.
WearSegs	WEARSEGS should be used to extract slow forming absolute signals that have a constant slope. It is quite useful for extracting the entire free-span area between supports. It was developed for tube to tube thinning.
Vertical	Useful for detecting expansions or lack of. It can be used for the detection of slow-forming, long axial length flaws such as erosion (ID & OD), thinning, large groups of "lake" pitting, wear indications at supports, etc.
Horizontal	Not often used
Vector	Not often used
Segments	Like EIGENSEGS, it is for the extraction of quickly forming signals. In most cases, EIGENSEGS should be used but there are exceptions. One example is to measure sludge height.

Table 3-1 Extraction Types and their usage

3.6.2 Tube Region

After an extraction type has be selected you must tell Auto what part of the tube to apply this extraction to. Unlike many other automated systems, you can specify what regions to apply the rules without using rule logic.

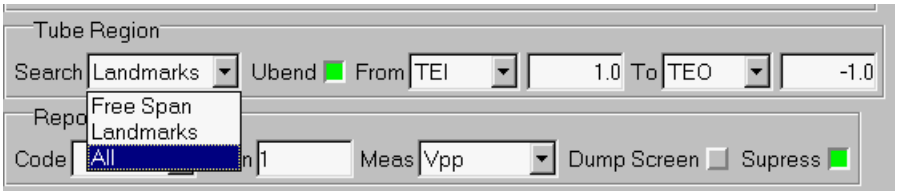

Figure 3-15 Tube Region

SEARCH – There are three selections:

FREE SPAN

FREE SPAN applies the extraction algorithm to all areas of the tube except landmark regions.

LANDMARKS

LANDMARKS applies the extraction algorithm only to landmarks (tube supports, tube sheets, etc).

ALL

ALL applies the extraction algorithm to all areas of the tube

UBEND – When active, the UBEND feature will consider landmarks and freespan in the UBEND region. When not active, no matter what has been selected as the SEARCH value there will be no extraction applied to the UBEND region.

RANGE – The last four fields in figure 3-15 define the RANGE. No matter what values are selected for SEARCH, extraction is never performed outside of the defined RANGE. The drop down value in the FROM and TO section are picked from the component file. The field to the right of the drop down value under FROM and TO contain the distance in units (as defined in your component file) from the defined landmark.

The TO/FROM part of Figure 3-15 illustrates the choices for "bracketing" a certain region of the tube where Auto will extract signals of interest. The nomenclature for the structures, such as TEI & TEO, is derived from the component file.

3.6.3 Test Functions

LOCATE – This function runs the auto-locate feature and displays the landmarks in the location window on the left side of the screen.

Figure 3-16 Test Functions

SHOW RANGE – This function uses the defined tube range to displaybars in the location window that correspond to the region in the tube that is being extracted.

SHOW THRESH – This function displays X, Y and Vector threshold values in the area under the upper left lissajous. This information can be used to set the THRESH value for extraction.

FIND SIGNALS – Pressing this button runs the current extraction algorithm on the defined tube region. Now right click on the NEXT SIGNAL button. It will display N1 of N signals, where N is the number of extracted signals. Right clicking will decrement through the signals and clicking will increment through the signals. As you step through the extracted

signals, they are displayed in the upper left lissajous. If you have defined rules, they will be displayed in the CATEGORY dialog box.

NEXT SIGNAL – Left or right click this button to view the signals that have been extracted. Either FIND SIGNALS or SCREEN DATA must have been already selected. They both run the current extraction algorithm on the data. SCREEN DATA runs also applies the RULES. These are discussed in section 3.5.4.

SCREEN SIG - Choose a signal by left or right clicking on NEXT SIGNAL. Press SCREEN SIG to apply the existing rules (see section 3.5.4) to that signal.

SCREEN DATA – This function runs the current extraction algorithm on the defined tube region. It then applies the existing rules (see section 3.5.4). It is used extensively during the sort debugging process. In practice, you change a rule or an extraction parameter then press screen data. The RESULTS table is filled in with all of the signals that have been extracted and pressing the PASS button will bring the next signal that passed the rules into the RESULTS table and display it in the lissajous. (see section 3.5.5)

NOTE: When SCREEN DATA or FIND SIGNALS are run, the data in the lissajous and in the strip charts will be colored alternately RED and GREEN. Data that remains white was not extracted. Either it was out of the defined TUBE REGION or it did not meet the extraction criteria. This banding graphically shows you the extracted signals. Each colored section corresponds to an extracted signal. You can change the extraction parameters and directly observe how this changes the extracted signals.

You may want to run a dark background with white data to be able to better observe the RED and GREEN signals.

3.6.4 Creating Rules

Clicking on the control button labeled RULES (FROM THE SORT DIALOG) presents the analyst with a clean rule-making slate. Initial values are assigned to the EXTRACTION, TUBE REGION and RULE sections. These values should **not** be used. You must fill in the appropriate values for your application. Clicking and swiping in the **Category 1** bar will allow the analyst to name the category. Names such as ID Pits,ID Erosion, Wear, OD Pits are typical examples. The names can be up to 29 characters long.

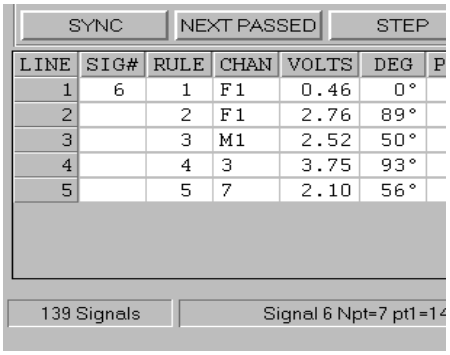

Figure 3-17 Rule Table

Before rules can be assigned you must do the following:

1. Choose extraction parameters appropriate for the defect mechanism to be detected. (See section 3.6.1 for information on extraction parameters)

2. In the section labeled **Tube Region**, establish the tube region for the signal extraction to take place. The choices are: FREE SPAN, LANDMARKS and ALL.

Now you are ready to create rules:

3. Click in the blank space on the right side of the TO field in the header of the RULE table to add a blank row.

4. You can add any number of rows. The logic in each row is ANDed with the others. This means that each condition or row must be met for the signal to pass (i.e. for the call to be made).

5. The complete set of rules is applied to each extracted signal.

GENERAL USAGE NOTES

- Right or left click in the CLASS field to choose the desired measurement class
- Right or left click in the CHAN field to choose the desired measurement channel
- Leave the R field blank. It was created to perform a second extraction pass and the value is the delta. In practice, the results can be unpredictable.
- Click in the NOT field to toggle the NOT logic on or off as desired. When NOT is displayed the rule is satisfied when the condition described is not met.
- Click through the TYPE field to choose measurement type. The choices are VOLTS, PHASE, PERCENT, POINTS, STRAIGHT

  VOLTS – for setting voltage range requirements
  PHASE – for setting phase rangerequirements
  PERCENT – for setting percent range requirements (must be an active curve on the channel used for this rule)
  POINTS – for setting point range (signal length) requirements
  STRAIGHT – for setting signal straightness requirements

  NOTE: The Vsl measurement class uses VOLTS as its measurement type.

The choice of signal measurement class depends on the type of signal being measured. Flaw signals form with respect to time in a variety of ways. Factors that influence flaw formation include the level of background noise, the flaw geometry, speed of the probe past the flaw, structures, changes in test material properties such as geometry, residual stresses, etc. Hence, specific methods for measuring the subtle differences in how a signal forms became necessary. Measurement classes Vpp, Vmr and Vvm are the same as those used in CoreStar's base analysis software.

The following table lists all of the current measurement and a brief description. While experience has shown us these methods work well with certain flaw types, it should be understood by the user that experimentation with alternative measurement class combinations may yield satisfactory results. Before experimenting, please aware that it is quite possible to create sorts that will not call the desired signal.

Description of Measurement Class – Each of these rules are applied to one signal at a time

Vpp	Measures a pair of data points that are farthest apart irrespective of their phase angles.
Vmr	Performs a Vpp style of measurement, then finds the maximum rate of change between the opposing peaks. (define Vpp first)
Vup	Measures a pair of data points that are farthest apart, but will only measure points whose phase lies between 0 & 180º. Useful for measuring signals that were extracted with the VERTICAL type. In most cases, it will pick the upside of the signal even if both sides of the desired signal were extracted.
Vut	Performs a Vup style of measurement, but then finds a pair of points that are between the original pair, have a minimum of three data points separation and has the largest voltage. Useful for isolating fast forming signals within slow ones such as a pit within general erosion. It is to Vup what Vmr is to Vpp.
Vma	Vma starts with a Vut measurement, then it moves the points around until it comes across a set closest to 40º. **Note:** Vma can generate unexpected results and should be used with care.
Vsl	Measures a signal's speed of formation. This is calculated by measuring the vertical component of the signal and dividing that value by the number of data points between the measurement vectors. Quicker forming signals with the same vertical amplitude will have a larger Vsl value. It is very useful in selecting a fast moving flaw in a group of slower forming deposits. Care must be taken on signals with a small vertical component such as very small amplitude signals or ID signals that have very little vertical voltage.
Vst	This measures the straightness of a signal. Its value is the ratio of the signals' end point to end point distance vs the end point to end point distance of the signal if it were pulled taught. Imagine the signal is a string and you measure the distance between the two endpoints and record it. You then pull the string taught and measure the distance between the two endpoints. The value is the first distance divided by the second distance. This gives a value between zero and one. One is a perfectly straight line and zero is a completely closed loop where the beginning and end points are on top of each other.

	It is used to select a signal with a straight transition from a group of more curved or loopy signals.
Vvm	Measures the amplitude of the vertical component of the signal. A phase value is not reported. Usually used for wear and compared against a voltage curve.
Vvs	Similar to Vvm, but the voltage signs are kept. Useful in combination with the prev/next functions described below. It is often nice to check that the overall motion of the signal before a flaw is downward. Just saying that Vvs is less than zero is often sufficient.
Same Points	This measurement type simply uses the same datapoints as the previous measurement type. Perhaps you performed a Vpp on chan3 and had a rule to check the voltage range on chan3. The next measurement type should be SAME POINTS, use it to check the phase range on the same channel. This saves unnecessary calculation time.
Point Range	This measurement type specifies a point range in data points. It essentially allows you to specify a range for the axial length of the signal. It is often used to eliminate noise spikes, which are usually less than four data points long.
Prev Sig	This measurement class isolates the signal that precedes the current signal. It is useful for looking at the entry lobe of flaw-like signals. A typical use is to check that the signal before a flaw has a negative Vvs value. **Note:** you must be careful in the use of this measurement type. Some true flaw like signals do not go down before they go up. You must be careful with compound flaw signals.
Next Sig	This measurement class isolates the signal that follows the current signal. It is useful for looking at the exit lobe of flaw-like signals. **Note:** you must be careful in the use of this measurement type. Some true flaw like signals do not go down after they go up. You must be careful with compound flaw signals.
Cluster	Clustering is not available in this release.

Table 3-2

NOTE: You must run the SORT with the same setup that was used to create the sort. If you choose a process channel that does not exist or have loaded an incorrect setup file the results will be unpredictable.

Once you have set the rules, press the SCREEN DATA button discussed in section 3.5.3. It will extract and apply the current rules to the data and present the results in the RESULTS table. In section 3.6.6 we will discuss some additional debugging features. For now you can change the rules or the extraction parameters and view the new results on the screen. The NEXT PASSED button will take you to each signal that successfully passed the rules.

3.6.5 Reporting

The top part of Figure 3-18 controls the reporting functions. Signals that have successfully passed all of the RULES are reported according to the settings in this section.

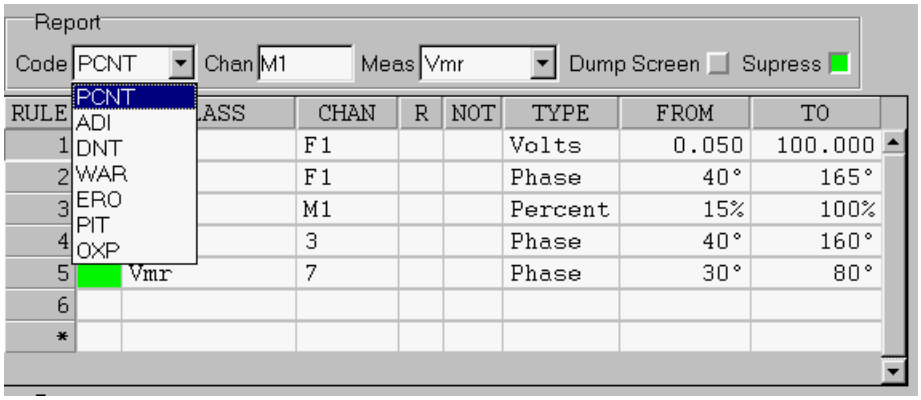

Figure 3-18 Reporting Calls

NOTE: During RULE development, the calls are not actually written to the report.

CODE – This field contains a list of the current defect codes as define in the defect list. This list is created and controlled from the standard analysis software. The defect list includes the defect code and the required fields. The reporting measurement type/channel must include the required information or an error will be generated.

> **NOTE:** If a Defect Code is selected that will also report a percentage for the flaw, an error might occur if certain rules are not created. The analyst needs to include a rule that requires a non-zero percentage value using the same channel and measurement class as those used while reporting the call. This also applies to percent calls.

CHAN – This field contains the calling channel. It can be any raw or process channel.

> **NOTE:** You must run the SORT with the same setup that was used to create the sort. If you choose a process channel that does not exist or have loaded an incorrect setup file the results will be unpredictable.

MEAS – This field allows you to choose any one of the measurement types available. See table 3-2 for a complete list and description.

DUMP SCREEN - Dump Screen generates a hard-copy screen dump to a printer when a signal passes all of the rules for a given category. The parameters for the screen presentation should be established by the analyst prior to initiating Auto. Until the sorts are finalized, prints should not be made. Otherwise, an inordinate amount of unwanted graphics could be produced. In most cases, you will want to turn this off.

SUPRESS - With the Suppress function deactivated, the lissajous is continuously updated to reflect the progress of the data analysis. As this requires more processing time to support the updating, the Suppress function is usually turned on. Engaging Suppress reduces the processing time for a given tube by a factor of eight to ten.

3.6.6 Debugging

Several Debugging features are available expedite the sort creation process.

Figure 3-19 Debug Keys

A typical sequence of events:

? Load a valid data file

? Click on LOCATE so that Auto finds the structures

? Click on the SCREEN DATA key to extract the signals and apply the rules

NEXT PASSED – Click on NEXT PASSED to display the first signal that satisfied the rules. Continue clicking to view all of the signals that met the criteria. Right clicking will move backward through the data. As the flaws are displayed the RESULTS table will be updated to point to the current passed signal and the lissajous will be updated as well.

STEP – Select a signal by either clicking on NEXT PASSED or NEXT SIGNAL or just clicking in the RESULTS table. Right or left clicking the STEP button will step through the existing rules. At each step, the rule will be applied and the lissajous is updated. The entry in the RESULTS table indicates a PASS or FAIL value for the rule in question.

SYNC – This is perhaps the most powerful debugging tool. After the SCREEN DATA function has been run on the current data file you can center any signal in the expanded strip chart and then press the SYNC button. The RESULTS window will be updated to display that signal. This is most commonly used to find out why a given signal was not called. You can now use the STEP function or just view the RESULTS table to determine what rule the signal failed to pass. You can adjust your rules accordingly and SCREEN DATA again. Simply click NEXT PASSED to see if your adjustment was satisfactory. The whole process takes only seconds.

> **NOTE:** In order for the SYNC function to work, the signal must be extracted. To determine this, click on FIND SIGNALS, NEXT SIGNAL until the signal in question is displayed.

SCREEN SIG - performs the same set of functions described above, but only on a single signal. The results of the application of the rules are displayed so that the analyst can step through them sequentially.

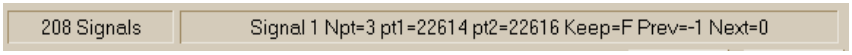

Figure 3-20 Status Window

STATUS WINDOW - There is a status window at the bottom the AUTO ANALYSIS RULES dialog box. It contains information about the current signal displayed in the RESULTS table. On the left side is the number of signals extracted in the current data file. On the right are various parameters including:

SIGNAL - The number of the current signal is displayed here.
NPT - The length of the current signal is displayed here. This is very useful when used in combination with the POINT RANGE measurement type.
PT1 - The data point number where the signal begins.
PT2 - The data point number where the signal ends.
KEEP - Indicates whether or not thesignal has passed the RULES. T equals Passed and F is Failed.

3.6.7 Overview of Category Creation

The entire process of creating a category from signal extraction and tube region selection to rule creation and debugging is done interactively. No calls aremade and nothing is stored. To store the sorts, press the OK button at the bottom the AUTO ANALYSIS RULES dialog box. Then the SORT must be saved from the SORT dialog box as described in section 3.4.1.

The interactive methodology makes it easier for theanalyst to develop and revise sort parameters. In all cases, no entry into the report is made. This only happens when the analyst sets Auto in motion using the keys in the main screen.

General Notes:

? It is a good practice to implement the most limitingrules first. This causes the majority of signals to be eliminated by the first few rules. This will reduce processing time.

? The sorts must be saved prior to processing data in a production mode.