1. Introduction

CADImage/SCAN is a program designed to interface your Scan-Plus III with a wide range of popular software for CAD, desktop publishing, FAX, and drawing archival/interchange. The system configuration is shown in Figure 1-1. CADImage/SCAN features include:

- Controlling the CalComp ScanPlus III scanner's advanced image enhancement features with a standard graphic user interface for ease of use.
- A point-and-click feature in the drawing overview for easy on-line setting of threshold, scan window, and alignment. This provides easy verification of quality during scanning.
- AutoScan ensures optimal ease and cleanness of scanning. Tiled, strip or global auto-thresholding is selectable as well as interactive grayscale histogram presentation.
- Supports more than forty industry standard image file formats including PICT, TIFF formats, CALS and ISO-ODA, CCITT Group 4 compressed format, Intergraph RLE and CIT, and Image Systems CADOverlay RLC format for AutoCAD.
- Converting between image file formats with easy point-and-click set up of horizontal alignment and a window feature for converting a portion of a drawing.
- Perfect electronic horizontal deskewing of drawings permits you to correct skew when scanning with point-and-click setable alignment points.
- Rotation of drawings (between 0 and 360 degrees)
- Electronic despeckling (removes speckles with setable size)
- Reversing and mirroring of drawings
- Browse and zoom to any level in scanned drawings. Measure angle and distance between any two points.
- Print or plot to laser printers and industry standard inkjet, electrostatic, and thermal plotters with a setable print

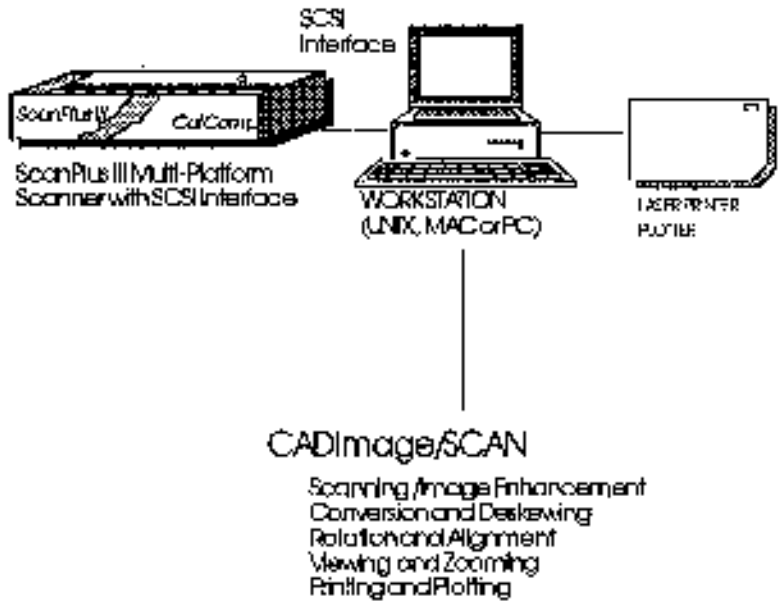

Figure 1-1 CADImage/SCAN System Overview

window feature for printing a portion of a drawing and setable scaling or autoscaling.

2. Installation

The CADImage/SCAN program is not copy protected, but requires the ScanPlus III to be installed correctly and powered on. Refer to the ScanPlus III Hardware User's Guide for information on installing the ScanPlus III scanner. The following sections describe how to install the various editions of CADImage/SCAN on:

- DOS
- Windows and Windows NT
- Mac
- UNIX workstations (Sun, HP, IBM-RISC, SGI, and DEC)

Always check the READ.ME file on the CADImage/SCAN distribution diskettes or tape for updates to the described installation procedures, or for installation on newly supported computers and operating systems.

2.1 Installing CADImage/SCAN for DOS

The system requirements are:

- IBM PC, PS/2 or compatible (386 or higher model processor)
- Minimum 4 Mb RAM, hard disk and floppy drive
- VGA or other supported graphic display
- DOS 5.0 or later version
- Mouse is recommended, but can be omitted

1. Make a backup copy of your CADImage/SCAN distribution diskette(s), and store the original diskette(s) in a safe place.
2. Edit your CONFIG.SYS file to include the line FILES=32 or greater. See the DOS manual for your PC for more information.
3. If you are using a mouse, ensure that the mouse driver is installed in accordance with the manual that came with the mouse.

4. Insert the backup CADImage/SCAN diskette into a floppy disk drive and type:

   `A:INSTALL` <Enter>

   Follow the instructions on the screen.

5. To start CADImage/SCAN for DOS (assuming that you are in the CIS directory containing CADImage/SCAN program files, or that the directory containing the CADImage/SCAN program files is in your DOS path), type:

   `CIS` <Enter>

   CADImage/SCAN automatically searches for the memory location of the SCSI interface board. If unsuccessful, you must properly resolve any conflict with other I/O boards. Please refer to the ScanPlus III Hardware User's Guide for SCSI interface board setup information.

2.1.1 DOS CADImage/SCAN Startup Switches

CADImage/SCAN has command line switches that can be set at startup time to modify the behavior of the program. The commands are:

```
CIS /x
```

where

x = set	To list the supported graphic display types and their command line override codes
x = X:d	To override the automatically detected graphic display of your computer, see above for values of X and d.

Example: `CIS /i:23`

2.1.2 DOS CADImage/SCAN Reinstallation

When installing CADImage/SCAN to a hard disk directory, where a previous version of CADImage/SCAN was installed, remember to delete the old version of the CIS.INI file. Otherwise, the new version of CADImage/SCAN will have unpredictable setup parameters.

2.2 Installing CADImage/SCAN for Windows

The system requirements are:

- IBM PC, PS/2, or compatible (386 or higher model processor, 486 recommended)
- Minimum 4 Mb RAM (8 Mb recommended), hard disk and floppy drive
- VGA or compatible graphic display
- DOS 5.0 or later version, Microsoft Windows 3.1 or later version, and Microsoft Win32 Extension
- A mouse or other pointing device

Before proceeding with the installation make a backup copy of your CADImage/SCAN distribution diskette(s), and store the original CADImage/SCAN diskette(s) in a safe place.

> All software mentioned in the system requirements (i.e., DOS, Windows, and Win32 Extension) must be installed prior to installing CADImage/SCAN.

1. Insert the CADImage/SCAN distribution disk in drive A (or B).
2. Start Windows.
3. In Program Manager, select Run from the File menu.
4. Type `a:setup` (or `b:setup`) in the Command Line Box.
5. Choose the OK button.
6. Follow the setup instructions on the screen.

After installing all the files, the Setup program creates a CADImage/SCAN for Windows program group and places the CADImage/SCAN icon in the group.

To start CADImage/SCAN for Windows:

1. In the Windows Program Manager, open the CADImage/SCAN program group.
2. Double click the CADImage/SCAN icon.

3. CADImage/SCAN starts and displays the Scanning Station.

CADImage/SCAN automatically searches for the memory location of the SCSI interface board. If unsuccessful, you must properly resolve conflicts with other I/O boards. Please refer to the ScanPlus III Hardware User's Guide for SCSI interface board setup information.

2.3 Installing CADImage/SCAN for Windows NT

The system requirements are:

- IBM PC, PS/2, or compatible (386 or higher model processor, 486 recommended)
- Minimum 16 Mb RAM (24 Mb recommended), hard disk and floppy drive
- VGA or compatible graphic display
- A mouse or other pointing device

Before proceeding with the installation make a backup copy of your CADImage/SCAN distribution diskette(s), and store the original CADImage/SCAN diskette(s) in a safe place.

1. Start Windows NT.
2. Log in as a member of the Administrator group.
3. Insert the CADImage/SCAN backup diskette in floppy drive A (or B).
4. In the Program Manager, choose Run from the File menu.
5. Type `a:setup` (or `b:setup`) in the Command Line Box.
6. Choose the OK button.
7. Follow the setup instructions on the screen.
8. Restart Windows NT.

After installing the files, the Setup program creates a CADImage/SCAN for Windows program group and places the CADImage/SCAN icon in the group.

To start CADImage/SCAN for Windows NT:

1. Open the CADImage/SCAN program group.

2. Double click the CADImage/SCAN icon.

3. CADImage/SCAN starts and displays the Scanning Station.

CADImage/SCAN automatically searches for the memory location of the SCSI interface board. If unsuccessful, you must properly resolve conflicts with other I/O boards. Please refer to the ScanPlus III Hardware User's Guide for SCSI interface board setup information.

2.4 Installing CADImage/SCAN for Macintosh

The system requirements are:

- Apple Macintosh
- 1 Mb RAM, hard disk and floppy drive
- System 6.0.7, 7.0 or later version

1. Find an unused SCSI address number for the scanner. SCSI device numbers 0 and 7 are normally occupied by hard disk (0) and processor (7).

2. Before proceeding with the installation make a backup copy of your CADImage/SCAN distribution diskette(s) and store the original diskette(s) in a safe place.

3. Insert the diskette in your floppy drive, open it, and drag CADImage/SCAN to your hard disk.

2.5 Installing CADImage/SCAN for SunOS

The system requirements are:

- Sun SparcStation or other Sun 4 machine.
- SunOS 4.1.3 and OpenWindows 3.0
- Hard disk and floppy or tape drive

2.5.1 Preparations

1. Find the name of the current configuration file. The name is shown when you log on to the computer. The name of the factory configuration file is GENERIC_SMALL.

2. Decide on a new configuration file name.

3. Find an unused SCSI address number for the scanner. SCSI device numbers 3, 4, 5, 6 and 7 are normally occupied by hard disk (3), streamer (4 and 5), CD-ROM (6) and the processor (7).

Before proceeding with the installation make a backup copy of your CADImage/SCAN distribution diskette(s), and store the original diskette(s) in a safe place.

2.5.2 Installing CADImage/SCAN and the Scanner Driver

1. Log on as root and only user on the computer.
2. Change the directory to where you want to install CADImage/SCAN. For example, type:

   ```
   cd /usr/app/cis
   ```

3. If installing from diskette, insert the backup diskette in the floppy drive and type:

   ```
   tar xvf /dev/fd0
   ```

   If installing from tape, insert tape in the streamer and type:

   ```
   tar xv
   ```

4. Continue with:

   ```
   ./install
   ```

   Answer the prompted questions regarding the three items described in the section above on preparations.

To start CADImage/SCAN on the Sun:

1. Eject the disk by typing:

   ```
   eject
   ```

2. Reboot the Sun workstation.
3. Start OpenWindows.
4. Change to the directory where CADImage/SCAN is installed by typing:

   ```
   cd {directory where CADImage/SCAN is installed}
   ```

5. Start CADImage/SCAN by typing:

```
cis
```

If for some reason you wish to deinstall the driver, type:

```
./install -r
```

2.6 Installing CADImage/SCAN for Sun Solaris

The system requirements are:

- Sun SparcStation or other Sun 4 machine
- Solaris and OpenWindows 3.0
- Hard disk and floppy or tape drive

Before proceeding with the installation make a backup copy of your CADImage/SCAN distribution diskette(s), and store the original diskette(s) in a safe place.

2.6.1 Installing CADImage/SCAN and Scanner driver

1. Log on as root and only user on the computer.
2. Change the directory to where you want to install CADImage/SCAN. For example, type:

   ```
   cd /usr/app/cis
   ```

3. If installing from diskette, insert the backup diskette in the floppy drive and type:

   ```
   eject -d
   ```

   to determine the proper name of the diskette drive

4. Type:

   ```
   tar xvf {name of diskette drive)
   ```

5. If installing from tape, insert the tape in the streamer and type:

   ```
   tar xv
   ```

6. Continue by typing:

   ```
   ./install
   ```

To start CADImage/SCAN on the Sun:

1. Type:

   cd {directory where CADImage/SCAN is installed}

2. Start CADImage/SCAN by typing:

   cis

3. To eject the diskette, type:

   eject

4. Reboot the Sun workstation.

If for some reason you wish to deinstall the driver, type:

```
./install -r
```

2.7 Installing CADImage/SCAN for HP UNIX

The system requirements are:

- HP9000 model 700 workstation
- HPUX 8.0.7 or later and Motif
- Hard disk and DAT tape drive

To install CADImage/SCAN on HP 700 workstations:

1. Login as root.

2. Change the directory to where you want to install CADImage/SCAN. For example, type:

   cd /usr/app/cis

3. Insert the DAT tape in the tape drive and type:

   tar xv

4. Type:

   ./install

To start CADImage/SCAN on the HP:

1. Type:

   cd {directory where CADImage/SCAN is installed}

2. Start CADImage/SCAN by typing:

```
cis
```

2.8 Installing CADImage/SCAN for IBM RS6000 UNIX

The system requirements are:

- IBM RS6000 workstation
- AIX 3.2 or later and Motif
- Hard disk and floppy drive

To install CADImage/SCAN on IBM RS6000 workstations:

1. Login as root.
2. Change the directory to where you want to install CADImage/SCAN. For example, type:

```
cd /usr/app/cis
```

3. Insert the diskette in the floppy drive and type:

```
tar xvf /dev/rfd0
```

4. Type:

```
./install
```

To start CADImage/SCAN on the IBM RS6000:

1. Type:

```
cd {directory where CADImage/SCAN is installed}
```

2. Start CADImage/SCAN by typing:

```
cis
```

2.9 Installing CADImage/SCAN for SGI Indigo UNIX

The system requirements are:

- Silicon Graphics Indigo workstation
- IRIX 4.0.5 and Motif

- Hard disk and floppy drive

To install CADImage/SCAN on Indigo workstations:

1. Login as root.
2. Change the directory to where you want to install CADImage/SCAN. For example, type:

   ```
   cd /usr/app/cis
   ```

3. Insert the diskette in the floppy drive and type:

   ```
   tar xvf /dev/rdsk/fds0d{slot no.of floppy}.3.5hi
   ```

4. Type:

   ```
   ./install
   ```

To start CADImage/SCAN on Indigo:

1. Type:

   ```
   cd {directory where CADImage/SCAN is installed}
   ```

2. Start CADImage/SCAN by typing:

   ```
   cis
   ```

2.10 Installing CADImage/SCAN on DEC UNIX

The system requirements are:

- DecStation 5000 workstation
- ULTRIX 4.3a or later and Motif
- Hard disk and floppy drive

To install CADImage/SCAN on DecStation workstations:

1. Login as root.
2. Change the directory to where you want to install CADImage/SCAN. For example, type:

   ```
   cd /usr/app/cis
   ```

3. Insert the diskette in the floppy drive and type:

   ```
   tar xvf /dev/rfd0
   ```

4. Type:

```
./install
```

To start CADImage/SCAN on DecStation:

1. Type:

   cd (directory where CADImage/SCAN is installed)

2. Start CADImage/SCAN by typing:

```
cis
```

3. Main & File Menus

When you start up CADImage/SCAN, you will see the CADImage/SCAN Main menu in Figure 3-1, from which you can start the operation station screens: Scan, Convert, View, and Print.

If no scanner is attached to the SCSI bus you will see the following message:

Could not find scanner

You must install the scanner before using CADImage/SCAN, please refer to the Chapter 2, "Installation."

The following chapters detail how to control the basic functions of CADImage/SCAN, e.g. to scan, convert, view, and print drawings.

The File selection in the Main menu allows you to set up scanner device options with the Scan Setup selection as well as other options. Ending CADImage/SCAN is done by selecting Exit.

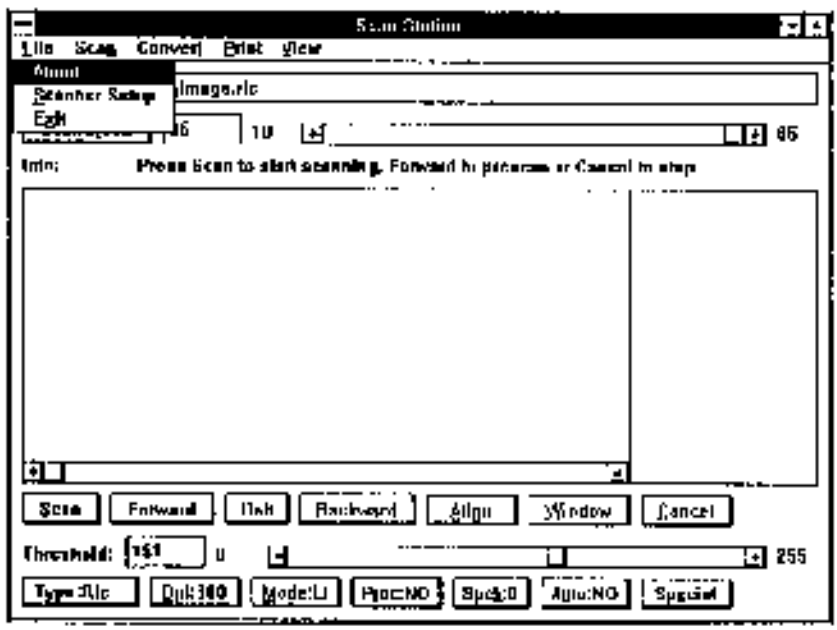

Figure 3-1 Main Menu

For DOS and Windows, underlined letters in menu, button and dialog names indicates that they can be activated by pressing the ALT key together with the underlined letter.

3.1 Scanner Setup Menu

The Scanner Setup selection in the File menu allows you to select the active scanner, the load method, and fine adjust the scanner's vertical precision setting.

3.1.1 Select Scanner

Pressing the Choose Scanner button in the Scanner Setup menu allows you to choose the active scanner if more than one is installed on the SCSI port (on different SCSI addresses).

3.1.2 Select Load Method

You can choose to select two different load methods:

Manual Press the Start button on the scanner to load the inserted original into the scanner.

AutoLoad The scanner automatically loads the original when inserted into the scanner.

3.1.3 Vertical Precision Setting

You can fine adjust the scanner's vertical precision setting to a very precise accuracy, much better than required for most applications. The factory setting is zero.

Should your application (e.g. maps) require very high accuracy, you can modify vertical precision in increments of 0.1 promille between +10 and -10 promilles with the slider.

Positive settings mean that the distance between scan lines is incremented, and negative settings mean that the distance between scan lines is decremented.

When you leave the Setup menu, the modified figure is stored in non-volatile memory in the scanner, and can only be changed by re-entering Setup.

To measure the vertical precision for adjustment:

1. Scan a precision original.

2. Bring the scanned drawing into your CAD system or other application.

3. Measure the vertical distance between two points in the image, then measure the distance between the same two points on the original.

4. Compare the distances then set the vertical precision to adjust for any difference.

> Caution should be taken at all steps in the procedure with regard to stability and temperature sensitivity of the original and measurement ruler used. Also you should scan at the resolution you would actually be using for scanning the originals.

3.2 Save Settings on Exit

The "Save settings on exit" selection in the File menu automatically saves the settings for all menus and buttons to the CIS.INI file in the CIS directory at the end of your session with CADImage/SCAN. The initial settings are automatically loaded the next time you start CADImage/SCAN.

3.3 Save Settings

The "Save settings" selection in the File menu, pops up a file box to save the present settings of all menus and buttons in CADImage/SCAN to a user specified filename (extension .INI).

3.4 Load Settings

The "Load settings" selection in the File menu pops up a file box to load a previously saved file containing settings of the menus and buttons in CADImage/SCAN.

4. Scan Menu

To start scanning operations, select Scan from the Main menu. You will see the Scanning Station screen shown in Figure 4-1. From the Scanning Station, you can directly control all aspects of scanning a drawing. The Scanning Station screen is divided into five major areas:

- **File and Scanwidth**

  At the top of the Scanning Station are the input fields for the destination file and the scan width. Always input these options before starting the scan or prescan, as they cannot be changed on the fly.

  You can enter the destination directory and file name by typing them into the input field or by selecting them from a pop-up box after pressing the File button.

  Likewise, you can enter the scan width for the drawing to be scanned by typing it into the input field or by setting it with the Scanwidth slider (the units correspond to the scale displayed on the front of the scanner).

  Press the Scanwidth button to select standard paper sizes or manually set the scan width, scan length, and offset.

- **Info**

  At the lower top of the Scanning Station is the Info line displaying status or actions to be taken. Press the Info button to show the drawing width and length in pixels along with the resolution and size of the previously scanned file.

- **Detail and Overview windows**

  In the middle of the Scanning Station is the "detail window" on the left side and the smaller "overview window" on the right side. During scan and prescan, the overview window displays the entire drawing while the detail window shows a zoom-in of an area of the drawing pointed to in the overview window.

  During prescan you can use the mouse to point and click on any area in the overview window to zoom in for a detailed view. During the actual scan-to-file, you must use the mouse in the overview window or the slider under the

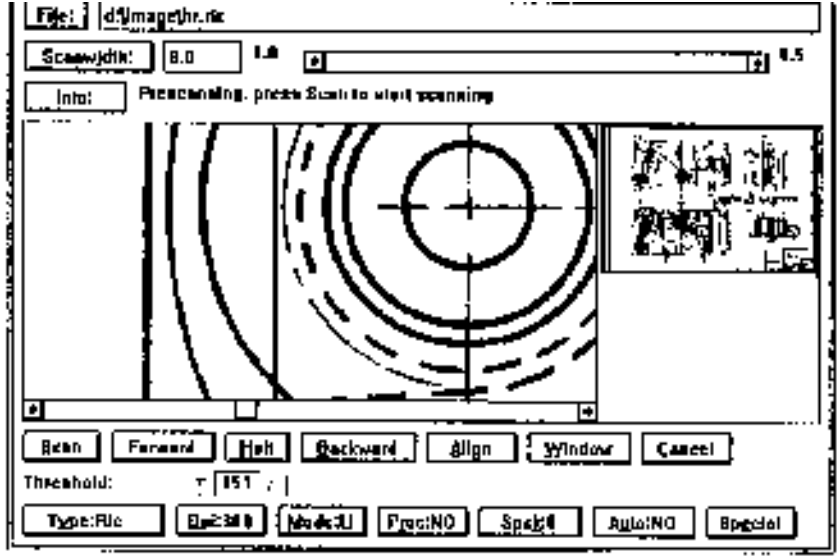

Figure 4-1 Scanning Station Screen

view window to move the zoom-in view horizontally along the line of scanning (for DOS and Windows you can also use the left and right arrow keys).

- **Scanning control panel**

  Under the detail window are the buttons that control the scan and prescan operations together with the controls for setting threshold.

- **Scanning options**

  To set up the basic scanning options for the ScanPlus III, click on the corresponding buttons in the bottom line of the Scanning Station screen (see Section 4.2, "Setting the Scanning Options," for detailed information).

4.1 Scanning

Use the scanning control panel to scan a drawing. The Scan button initiates a scan-to-file. The Forward button starts a prescan of the drawing.

Filename, Scanwidth, DPI, and Mode must be set up before initiating scan or prescan, since they cannot be changed during operation. All other settings may be changed during prescan.

4.1.1 Prescanning Operations

After you have inserted the drawing into the scanner, start prescan with the Forward button.

Forward, Halt, and Backward buttons—Use these buttons to alter the direction (Forward/Backward) and loop (Halt) on a spot of your choice. At this time, you can view and select different scanner setups, such as threshold, through the detail view window in order to find the solution that best fits the particular drawing.

Click positioning in the overview window—A convenient alternative for positioning the detail view window in the drawing is to point and click with the mouse in the overview window.

Threshold —The Threshold control (setable from 0-255) is found in the lower left area of the control panel. To set it, use the mouse to click the up and down buttons. You can change the threshold at any time, even during scan-to-file, but it may take a while to show the change on the screen due to internal buffering of data in the scanner. Select the 2-D Adaptive Threshold from the Auto menu to see the adaptive threshold setting controls. For further information, see Section 4.4, "AutoScan."

Scan window—Press the Window button on the control panel to set up a scan window. Use the scan window to "cut out" a portion of the drawing for scanning.

To define the scan window:

1. Point and click in the overview window one or more times until the detail window view displays the area where you want the first corner of the scan window.
2. Point and click on the exact position in the detail window to input this value.
3. Repeat for the second corner of the scan window.

You can redo your scan window setup by pressing the Window button again.

An alternative to the above interactive method is to set up the scan window directly by pressing the Scanwidth button and entering the offset, scan width, and scan length values in the dialog.

Alignment—A drawing that has not been perfectly inserted into the scanner can be electronically deskewed (between -5 and +5 degrees) during scanning. To deskew the drawing:

1. Press the Align button on the control panel to initiate alignment setup.
2. To input the first point of the alignment line, point and click in the overview window one or more times until the detail window view shows where you want the first point.
3. Point and click on the exact position in the detail window to input this value.
4. Repeat for the second point of the alignment line.

The alignment line and the drawing will then be rotated to be horizontally aligned simultaneously with scanning. The alignment setup can be redone by pressing the Align button again.

4.1.2 Scan-to-File

Press the Scan button to begin scan-to-file. The scanner repositions the drawing then begins scanning. During scanning, the scanned image is displayed in the view windows of the Scanning Station. You can move the detail view horizontally along the line of scanning by clicking in the overview window or the slider below the detail window (for DOS and Windows you can also use the left and right arrow keys).

Threshold—You can change the threshold during scanning using the controls on the control panel, e.g., to compensate for dark or light parts of the drawing.

AutoScan—If one of the adaptive threshold options was selected prior to the start of the scan, you can automatically perform an investigative scan prior to scan-to-file, dependent on your scanner model (see Section 4.2, "Setting the Scanning Options," for details).

Upon reaching the end of the drawing, you can terminate the scan by pressing the Cancel button on the control panel or by activating one of the buttons on the ScanPlus III operator panel.

The scanned part of the drawing will be saved to disk under the file name specified with a three-letter file format type extension automatically added (for scanned file format abbreviations see Chapter 8, "Supported File Formats").

4.2 Setting the Scanning Options

To set up the scanning options for the scanner, click on the corresponding icons on the bottom line of the screen then select an item from the pop-up list.

- **Type**

  You can select the destination file-format type here. A description of all supported file formats is found in Chapter 8, "Supported File Formats."

  For certain general image, grayscale, and print/plot file formats, additional setup information may be input by pressing the SetUp button for the selected file format. Detailed information on this is found in Chapter 8.

  If you select a file format that supports grayscale scanning (e.g., .TIF, .PCX or .IGS), you must also select "Grayscale" under Mode (see Mode below).

- **DPI**

  You can set the resolution to any of the resolutions supported by the scanner. CADImage/SCAN automatically detects the resolutions supported by the attached ScanPlus III and displays only those applicable. The Phys.Res. selection, used when scanning in grayscale mode, is the actual unscaled physical resolution of the attached scanner.

- **Mode**

  Line—This mode uses thresholds to determine if a pixel is black or white. Use this mode for drawings and line art.

  Grayscale—In this mode, 256 gray levels are recognized for each pixel (1 byte, 8 bits per pixel).

  Grayscale mode locks the Auto-threshold selection to OFF. You can set the threshold only for display purposes through the Special menu.

- Proc

  Dynamic—The scanner analyzes the information from the drawing and detects and emphasizes area edges, fine lines, and small details. This option is mostly used with

maps and difficult drawings with weak details. For normal drawings, better results are obtained without it.

Enhanced—If line enhancement is on, lines represented as thinner than one pixel will be increased to one pixel width. Lines represented as one or more pixels in width will also be increased by one pixel.

Dynamic+Enhanced—Activates both of the above options.

Dynamic and Dynamic+Enhanced cannot be selected together with an Auto selection.

- **Spck**

  Sets the size of the sides of a square box in pixels and, by removing the speckles fitting within this square, filters speckles on-line during scanning.

- **Auto [AutoScan]**

  None—None of the below Auto selections is active; scanning is progressing in the fixed threshold or grayscale mode.

  Histogram—After pressing the Scan button, and prior to scan-to-file, the scanner automatically does an investigative scan of the original and returns it to the starting position.

  The scanner analyzes the image and displays a histogram of the distribution of graytones in the image together with a proposed threshold setting, computed algorithmically. You can accept the proposed value or change it with the threshold slider, thereby choosing an optimal threshold value. For more details on using histograms, see Section 4.3, "Histogram Analysis."

  GL—Global Autothreshold—This option performs the histogram analysis described above, but scan-to-file proceeds automatically using the computed global threshold value (without display of the histogram).

  Recall—Recalls the results of a previous histogram scan without a new investigative scan.

The Auto selections described below are dependent on whether or not your scanner has a built-in Digital Signal Processor (DSP). The ScanPlus III has a DSP; the ScanPlus II does not.

ScanPlus III

The scanner supports 2-D Adaptive Thresholding without the need for an investigative prescan.

AN-Adaptive Normal—This selection is the normal adaptive mode used with low contrast and difficult to scan drawings. The two controls, Adaptive Level and Background Suppression, are set for optimal results (see Section 4.4, "AutoScan," for details).

AH-Adaptive High Contrast—This selection is the high contrast adaptive mode used with high contrast and normally easy to scan drawings (often scanning with Fixed Threshold can give better results). The two controls, Adaptive Level and Background Suppression, are set for optimal results (see Section 4.4, "AutoScan," for details).

ScanPlus II

The scanner supports Auto thresholding with an investigative prescan required.

ST-Strip Autothreshold—Divides the drawing into horizontal strips and automatically computes a best threshold value for each strip during an investigative scan of the whole drawing (see Section 4.4, "AutoScan," for details). Scan-to-file proceeds automatically using the computed threshold values.

TI-Tiled Autothreshold—Divides the drawing into squares (tiles) in both horizontal and vertical directions and automatically computes a best threshold value for each tile during an investigative scan of the whole drawing (see Section 4.4, "AutoScan," for details). Scan-to-file proceeds automatically using the computed threshold values.

- **Special**

The Special button brings up a menu where one or more of the following options can be selected independently (se-

lections are only maintained while you stay in the Scan Station, leaving Resets to OFF).

Batch—This option adds a three-digit number to your filename (in addition to the three-letter file-format identifier) and is incremented automatically for each scan-to-file (e.g., name001.rlc, name002.rlc, etc.).

When you are running batches of drawings, you can speed up loading the drawings into the scanner by selecting the AutoLoad option in Scanner Setup found in the File menu.

Mirror—It is sometimes necessary to scan a drawing on transparent film from the backside due to the toner being on that side of a film. This option will mirror the drawing during scanning to correct for this.

Reverse—This option reverses the image as a negative, with black parts becoming white and white parts becoming black.

Display Off—Disables the graphic display during operations for speed-up.

Graytone Threshold—Select a value between 0 and 255 to threshold the scanned graytones for display purposes only. You can only use this option when Grayscale scanning is selected in the Mode menu.

4.3 Histogram Analysis

Histogram analysis is based on the fact that a normal drawing is not all black and white. It might be dark blue or brown lines on light blue or brown background. When the camera in the scanner looks at a drawing, it converts what it sees to grayscale levels between 0 and 255. A very black background is represented by a high value and a very white background is represented by a low value. The light and dark gray, blue, brown, or any other tone is represented as grayscale values in between.

When the scanner performs a histogram analysis, it counts the number of pixels found at each of the 256 gray levels. CADImage/SCAN presents these counts to you in a graphical manner, as shown in the figure below. On the horizontal axis you have the grayscale level and on the vertical axis you have

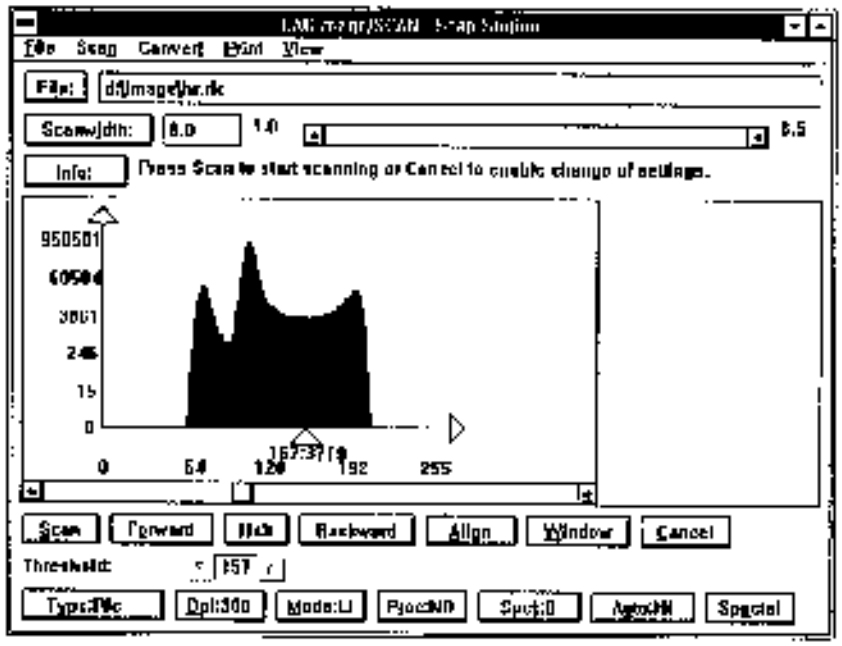

Figure 4-2 Histogram Screen

the accumulated count of pixels at each individual grayscale level.

The arrow with the value indicator attached shows the line position and displays:

Threshold value:number of pixels found at this value

The initial threshold value displayed on the screen is a computed "good value" based on algorithmic analysis of peaks in the histogram. You can change the position of the value indicator line by dragging the threshold slider with the mouse to a new threshold value.

As you change the threshold value, the pixel count indicator gives you the exact number of pixels encountered at the grayscale level of the indicator position found within the investigated scanned area. When you scan with a specific threshold, all gray tones lower than this threshold will be represented as white pixels, and all gray tones over this threshold will be represented as black pixels.

In most cases, you will see a histogram with two peaks (see Figure 4-2). If you have a third peak at a low gray tone level, it is because the scanner cameras have seen some of the scanner's own white reference background. Narrow the scan width setting to the width of the drawing to avoid this. Of the two other

peaks you see, the first larger one represents the background information (the lightest gray tones) of the scanned original, and the second smaller one represents the line information (the darkest gray tones) in the drawing.

Normally the best threshold selection is in the deepest part of the valley between the two peaks and closest to the larger peak representing the background information in the drawing, as shown in Figure 4-2.

In many cases, things will not be as simple as in the figure, but by using the histogram analysis intelligently, you will often be able to get good scanning results from poor original material.

4.4 AutoScan

The available AutoScan selections are dependent on whether or not your scanner has a built-in Digital Signal Processor (DSP). The ScanPlus III has a DSP; the ScanPlus II does not. With a DSP, the scanner supports 2-D Adaptive Thresholding without the need for an investigative prescan. Without DSP, the scanner supports Global, Strip, and Tiled Auto Thresholding.

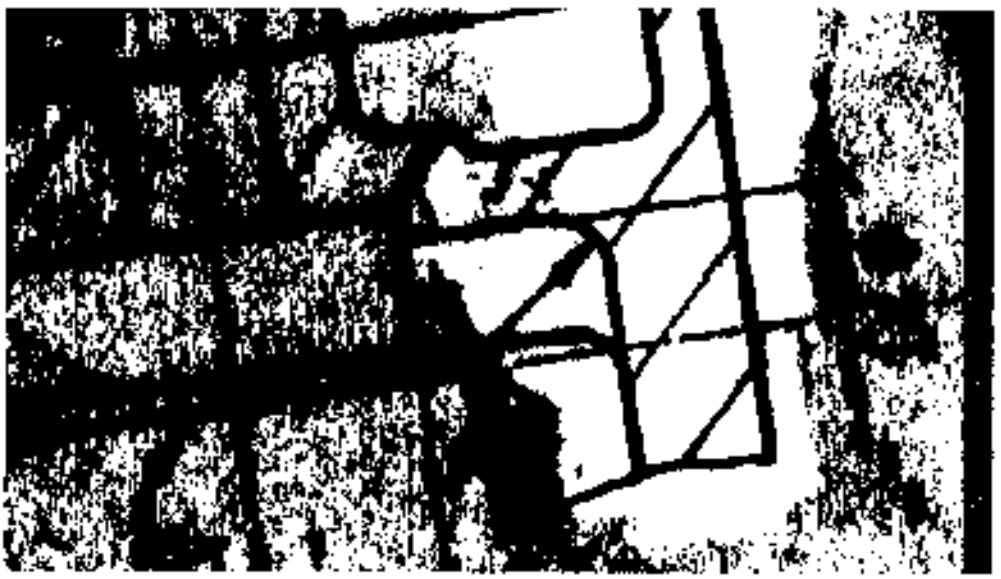

Figure 4-3 Original without 2-D Adaptive Threshold

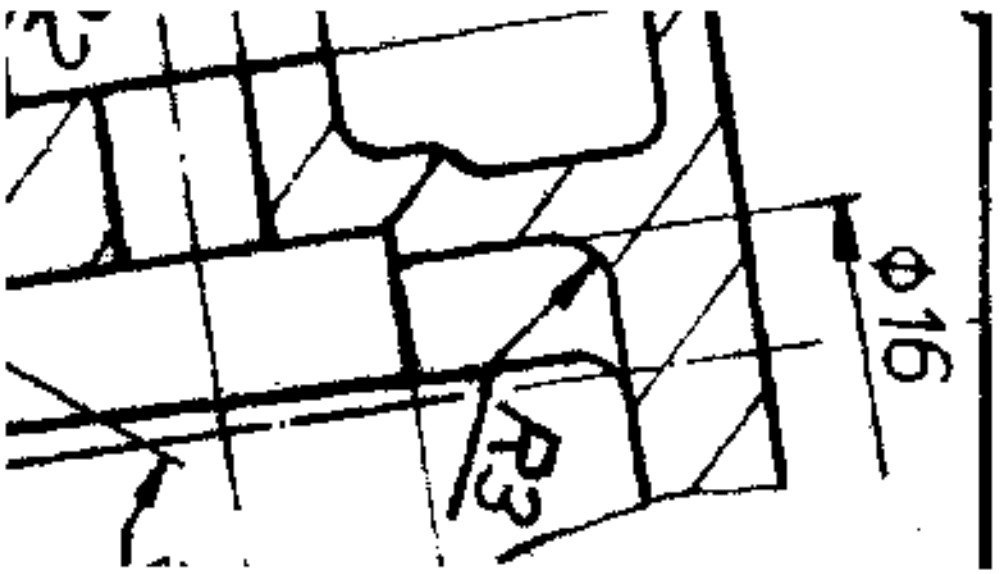

Figure 4-4 Original after 2-D Adaptive Threshold

- **2-D Adaptive Thresholding**

  The 2-D Adaptive Threshold is based on the scanner's built-in high speed Digital Signal Processor (DSP) performing a two-dimensional analysis of the grayscale information of each pixel in relation to its neighboring pixels, in real-time while scanning the drawing.

  Two different 2-D Adaptive Threshold selections are available: AN for low contrast, difficult to scan drawings and AH for high contrast, normally easy to scan drawings. The controls for both are (see Figure 4-5):

  Adaptive Level (0-40)—This works like a threshold: the lower the value, the greater amount of background that is picked up. Normal range is 3-15, with a setting of 10 working well with most drawings.

  Background Suppression (0-12)—This is normally set to zero, but is raised to suppress the background influence in drawings with dark or patched multilevel background.

  Because the DSP works in real-time, the settings can be changed on-line during both prescan and scan-to-file. It may take a little while to show the change on the screen due to internal buffering of data in the scanner.

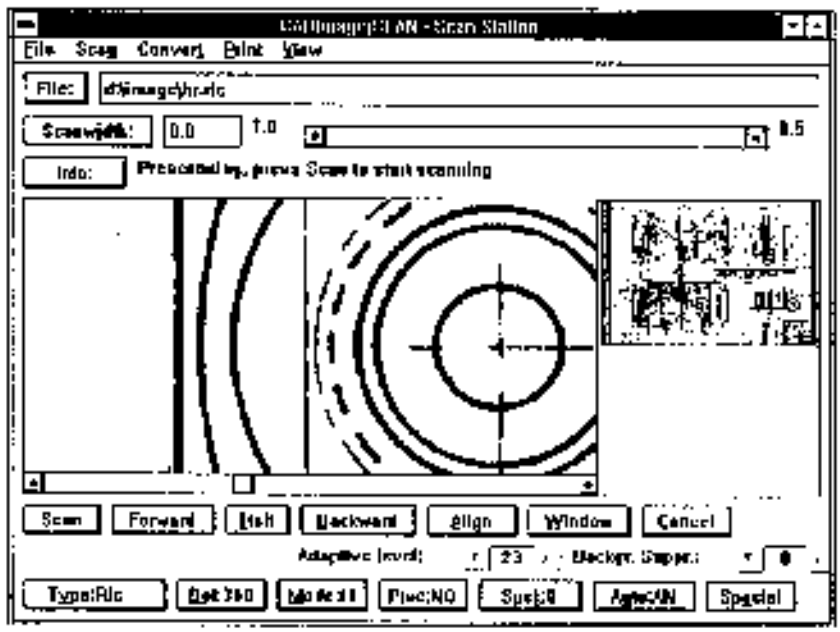

Figure 4-5 2-D Adaptive Controls

To set the adaptive controls for a difficult drawing:

1. Start prescan by pressing Forward.
2. Position the detail window over the difficult area then press Halt to scan forwards and backwards, continuously displaying that area in the detail window.

Now while interactively viewing the results on the screen only on the down-strokes:

1. Adjust the Adaptive Level for the best result.
2. If borders between lighter and darker areas (patches) in the background show, adjust the Background Suppression up until they disappear.
3. Afterwards adjust the Adaptive Level.

- **Global Auto Thresholding**

  With this selection, the drawing is scanned investigatively. Next a global single threshold value is computed based on the algorithmic analysis of the grayscale histogram. After automatically returning the drawing to start, scanning progresses with the found threshold value.

- **Strip Auto Thresholding**

  The whole drawing is scanned investigatively and divided into horizontal strips. For each strip, an individual threshold value is computed based on the algorithmic analysis of its grayscale histogram. After automatically returning the drawing to start, scanning progresses with the scanner changing the threshold value for each strip, thereby compensating for variations in the drawing background and information levels in the vertical direction.

- **Tiled Auto Thresholding**

  The whole drawing is scanned investigatively and divided into a grid of squares (tiles) in both directions. For each tile, an individual threshold value is computed based on the algorithmic analysis of its grayscale histogram. After automatically returning the drawing to start, scanning progresses with the scanner changing the threshold value for each tile, thereby compensating for variations in the draw-

ing background and information levels in both horizontal and vertical directions.

4.5 Scanning Directly to a Plotter or Printer Device

You can have the scan output directly to a plotter or printer device instead of to a file by choosing one of the print/plot formats in the file selection dialog. This allows you to clean up an old faded or stained drawing using the 2-D Adaptive or Auto Threshold features of the scanner. Refer to Chapter 8, "Supported File Formats," and Appendix B, "Plotter Device Configuration," for information on how to set up your plotter or printer.

5. Convert Menu

To convert a drawing, select Convert from the Main menu. You will see the Convert Station screen shown in Figure 5-1. From the Convert Station, you can directly control all aspects of conversion among different drawing file formats. The Convert Station screen is divided into five major areas:

- **Source and Destination File Names**

  At the top of the Convert Station screen are the input fields for the source and destination file names. The filenames are automatically appended with the three-letter extension corresponding to the file format type chosen (e.g., .RLC or .GP4).

  Press the InFile button to pop up a selector box for easy selection of the source directory and filename.

  Press the Tag button to select multiple source files for batch conversion. The files displayed for selection are those in the directory specified in the source file field above. During a batch conversion, the destination file name is automatically set the same as the source file name. If you select the same file format type and directory for the source and destination files, the destination file will overwrite the source file during conversion (this has the advantage of saving disk space, but be careful not to destroy source files inadvertently).

  Press the OutFile button to select the destination directory and filename.

- **Info**

  At the lower top of the Convert Station is the Info line, displaying status or actions to be taken. Press the Info button to show the drawing width and length in pixels along with the resolution and size of the selected InFile.

- **Detail and Overview windows**

  In the middle of the Convert Station are the "detail window" on the left side and, on the right side, the smaller "overview window." During conversion, the overview window displays the entire drawing being converted while the detail

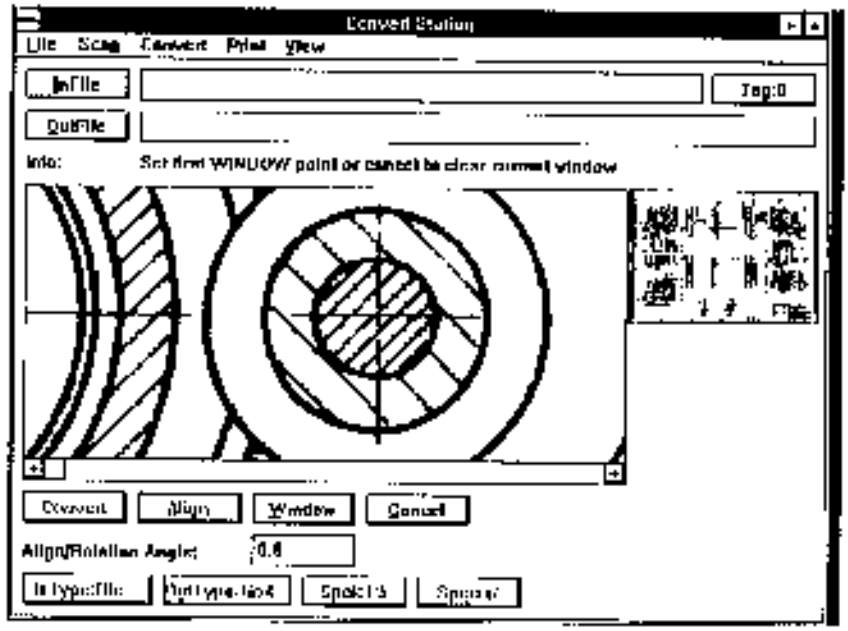

Figure 5-1 Convert Station Screen

window shows a zoom-in of an area of the drawing pointed to in the overview window.

During setup, use the mouse to point and click in the overview window to zoom in for a detailed view and precise definition of a convert window or alignment line. During the actual convert-to-file, you may use the mouse in the overview window or the slider under the detail window to move the zoom-in view horizontally along the line of conversion (for DOS and Windows you can also the left and right arrow keys).

- **Conversion control panel**

  Under the detail window are the buttons for control of the conversion and conversion setup operations.

- **Conversion options**

  To set up the conversion options, click on the corresponding icons on the bottom line of the Convert Station screen (see Section 5.2, "Setting the Conversion Options," for detailed information).

5.1 Converting

To convert a drawing, use the buttons on the control panel. Preconversion operations can be performed prior to actual convert-to-file, where horizontal alignment can be defined or a window can be set up to convert a part of the drawing.

The Convert button will initiate a conversion to file. The Align or Window button will start preconversion operations.

Source and destination directories, file names, and source file format type must be set up before initiating conversion or preconversion operations, as they cannot be changed during operation. All other settings may be changed during preconversion operations.

5.1.1 Preconversion Operations

Conversion Window—To set up a window for converting a portion of a drawing:

1. Press the Window button on the control panel.
2. To input the first corner of the conversion window, point and click in the overview window one or more times until the view in the detail window displays the area where you want the first corner.
3. Point and click on the exact position in the detail window to input this value.
4. Repeat for the second corner of the conversion window.

You can redo your conversion window setup by pressing the Window button again.

Alignment—You can realign a drawing that has been skewed during scanning by pointing out an alignment line in the drawing. The alignment line and the drawing will then be rotated to be horizontally aligned during the conversion.

1. Press the Align button on the control panel to initiate alignment setup.
2. To input the first point of the alignment line, point and click in the overview window one or more times until the view in the detail window displays the area where you want the first point.

3. Point and click on the exact position in the detail window to input this value.

4. Repeat for the second point of the alignment line.

The deskew angle now set up for use during the convert-to-file is now shown in the Align/Rotation angle field. You can redo your alignment setup by pressing the Align button again.

Align/Rotation Angle—The rotation angle (0–360 degrees) is displayed and may be changed by typing in this field.

5.1.2 Convert to File

Press the Convert button to start conversion to file. During conversion, the image is displayed in the view part of the Convert Station. The detail window view can be moved horizontally along the line of conversion using the slider under the window (for DOS and Windows you can also use the left and right arrow keys).

Conversion terminates when the end of the drawing is reached or when the Cancel button on the control panel is pressed. The converted part of the drawing will be saved to disk under the file name specified with the three-letter destination file format type identifier extension automatically added (see Chapter 8, "Supported File Formats," for details).

When performing a batch conversion of multiple drawings (using the Tag button), the drawings are automatically converted to the directory specified with the same filenames as their source files.

5.2 Setting the Conversion Options

To set up the conversion options, click on the corresponding icon in the bottom line of the screen, then select an item from the pop-up list.

- **InType**

  Select the source file format type. A description of all supported file formats is found in Chapter 8, "Supported File Formats." File formats with several options are automatically detected during conversion (e.g., TIF compression type, black and white, or grayscale).

When converting from a grayscale file to a bitmapped file format (e.g., from .TIF to .RLC), the Special menu allows you to specify a threshold value (range 0–255) for conversion to two-level black and white. This setting also govems the display during conversion.

- **OutType**

  Select the destination file format type. A description of all supported file formats is found in Chapter 8. For certain general image, grayscale, and print/plot file formats, additional setup information may be input by pressing the SetUp button for the selected file format. Detailed information on this is found in Chapter 8.

- **Spck**

  Speckles are filtered on-line during conversion by setting the side size of a square box in pixels (0–255) and by removing the speckles within the square.

- **Special**

  The Special button brings up a menu where one or more of the following options can be selected independently (selections are only maintained while you stay in the Convert Station, leaving resets options to OFF).

  Mirror—It is sometimes necessary to scan a drawing on transparent film from the backside due to the toner being on that side of a film. This option mirrors the drawing during conversion to correct for this.

  Reverse—During conversion, this option reverses the image as a negative with black parts becoming white and white parts becoming black.

  Display Off—Disables the graphic display during operations for speed-up.

  Grayscale Threshold—Select a value between 0 and 255 to threshold a grayscale file for conversion to a line mode file format. Also used for display during conversion (e.g., conversion of a grayscale file to another grayscale file format).

6. View Menu

To start viewing a drawing, select View from the Main menu. You will see the View Station screen shown in Figure 6-1. From the View Station, you can directly control all aspects of viewing and zooming of different drawing file formats. The View Station is divided into four major areas:

- **Directories and file name**

  At the top of the View Station is the input field for the source directory and file name. The source file name may be typed into the input field or selected from the pop-up box displayed by pressing the File button.

- **Info**

  At the lower top of the View Station is the Info line displaying status or actions to be taken. Press the Info button to show the drawing width and length in pixels along with the resolution and size of the selected source file.

- **View window**

  In the middle of the View Station is the view window. The view window initially displays the entire drawing and allows you to zoom-in to any selected area of the drawing.

- **View control panel and file format options**

  Under the view window are the buttons used to control viewing, zooming, and selecting the source file format type. The Special Options button selections, Reverse and Mirror, function as described for the Convert Station (see Chapter 5).

6.1 Viewing

To view a drawing or to zoom in on a drawing, use the buttons on the control panel. To view a file:

1. Press the View button.
2. You will see a full overview of the drawing file selected. This view allows you to point out a window in the drawing for zooming.

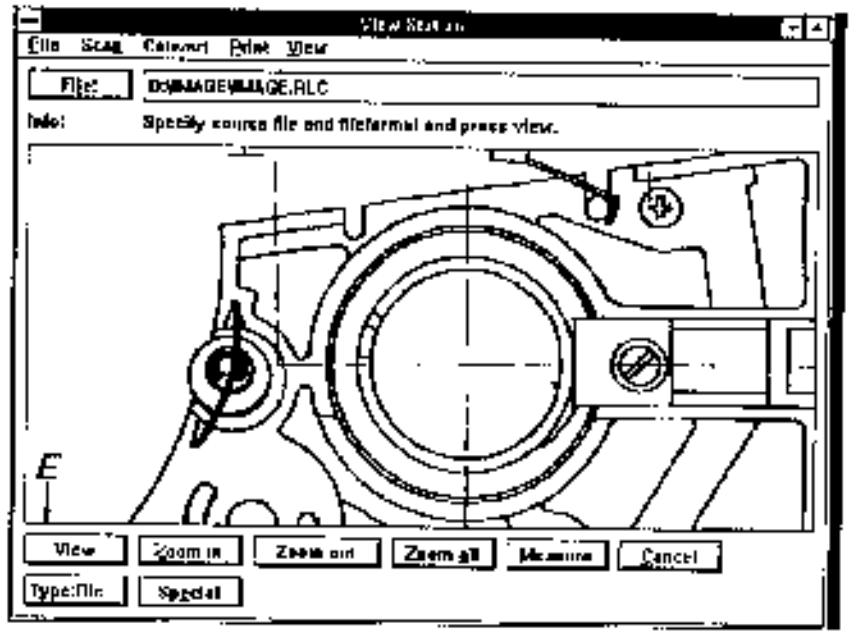

Figure 6-1 View Station Screen

3. Position the mouse on the detail you wish to zoom in on, then click and drag the mouse until you have covered the level of detail you want.

4. Click again and press the "Zoom in" button. Zoom-in can be repeatedly done until the pixel level is reached.

   After zooming in, you can push the "Zoom out" button to get back to the previous view or the "Zoom all" button to view the entire drawing once again.

When viewing a grayscale file, the Special menu allows you to specify a threshold value (range 0-255) for conversion to black and white on the display.

Press the Measure button to measure the angle and distance between two points in the drawing. Point and click to input the first and second point. Each time the screen will zoom in to the pixel level for precise placement of the point.

7. Print Menu

To start printing operations, select Print from the Main menu. You will see the Print Station screen shown in Figure 7-1. From the Print Station, you can directly control all aspects of printing a drawing. The Printing Station screen is divided into five major areas:

- **Source file name**

  At the top of the Print Station screen is the input field for the source file name. The source file name may be typed into the input field or selected from the pop-up box by pressing the InFile button.

  Press the Tag button to select multiple source files for batch printing. The files displayed for selection are those in the directory specified in the source input field above.

- **Info**

  At the lower top of the Print Station is the Info line displaying status or actions to be taken. Press the Info button to show the drawing width and length in pixels along with the resolution and size of the selected source file.

- **Detail and Overview windows**

  In the middle of the Print Station screen are the "detail window" on the left side and the smaller "overview window" on the right side. During print and preprint operations, the overview window displays the entire drawing to be printed, and the detail window shows a zoom-in to a selected area of the drawing.

  During preprint, use the mouse to point and click on any area in the overview window to zoom in for a detailed view. During actual printing, you must use the mouse with the slider under the detail window to move the zoom-in view horizontally along the line of printing (for DOS and Windows you can also the left and right arrow keys).

- **Printing control panel**

  Under the detail window are the buttons used to control the printing and preprinting operations.

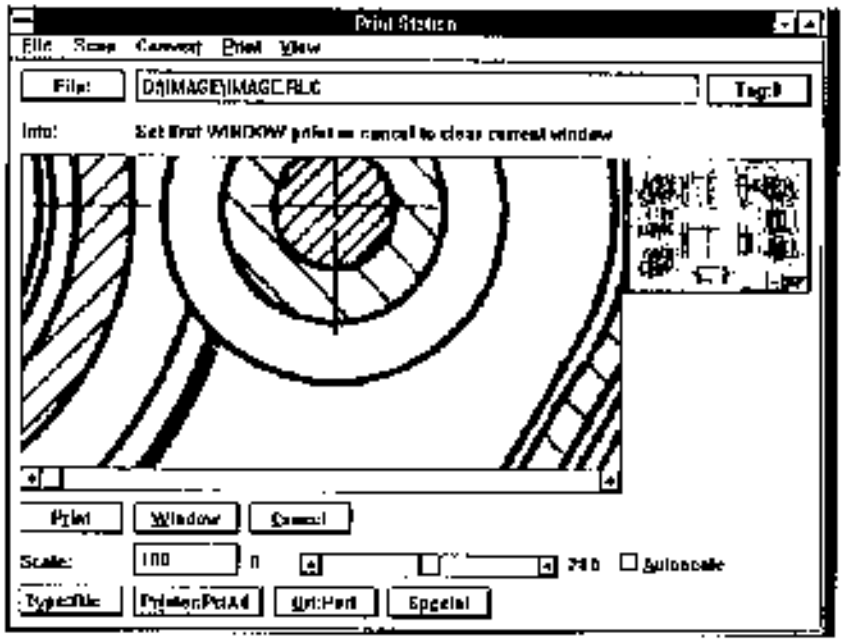

Figure 7-1 Print Station Screen

- **Printing options**

  To set up the source file format type and basic print options, click on the corresponding icons in the bottom line of the Print Station screen. The Special button allows selection of Reverse and Mirror printing.

7.1 Printing

Use the buttons on the control panel to print a drawing. Preprint operations can be performed prior to actual printing, where a window can be set up to print a portion of the drawing.

The Print button initiates actual printing to device or file. The Window button starts preprinting operations.

The source directory, file name, and source file format must be set up before initiating printing or preprinting operations as they cannot be changed during operation. All other settings may be changed during preprinting operations.

7.1.1 Preprinting Operations

Printing Window—Press the Window button on the control panel to initiate setup of a printing window. A printing window selects a portion of the drawing for printing.

To select a printing window:

1. Point and click in the overview window one or more times until the view in the detail window shows where you want the first corner.

2. Point and click on the exact position in the detail window to input this value.

3. Repeat for the second corner of the printing window.

You can redo your printing window setup by pressing the Window button again.

Scaling—The set the scale of the drawing to be printed, enter a number from one and up, where one corresponds to the output being 1/100 of the original size and 200 corresponds to the output being twice as big as the original. A value of 100 will give you a 1:1 copy.

There is also an Auto selection that scales your drawing to fit the width of your output device.

7.1.2 Printing to Device or File

Use the Print button to start printing. During printing, the image is displayed in the view part of the Print Station screen. The detail window view can be moved horizontally along the line of printing using the slider under the view window (for DOS and Windows you can use the left and right arrow keys).

Printing is terminated when the end of the drawing is reached or by pressing the Cancel button on the control panel.

When printing to file, a file selector box pops up to specify the destination directory and file name. The printed part of the drawing will be saved to disk under the file name specified with the three-letter file extension identifying the printer or plotter device (see Chapter 8, "Supported File Formats," for details).

Use the Tag button to batch print multiple drawings to file. Specify only the destination file for the first drawing. Subsequent drawings are automatically printed to the same directory as the first, but with the same file names as their source files.

7.2 Setting the Printing Options

Set up the basic printing options by clicking the corresponding icon in the bottom line of the screen then selecting an item from the pop-up list.

- **Type**

  You can select the source file format type. A description of all supported file formats is found in Chapter 8, "Supported File Formats." File formats with several options are automatically detected during conversion (e.g., TIFF compression type, black and white, or grayscale).

  When printing from a grayscale file, the Special menu allows you to specify a threshold value (range 0–255) for conversion to black and white. This setting also governs the display during printing.

  The PLOTF selection transparently plots a previously generated plot/print file to the selected plotter or printer (see Printer button below). The sizing information is embedded in the plot/print file when it is generated, therefore set up in the Print Menu for the selected plotter or printer is disregarded except for output port or device.

- **Orientation**

  You can select Portrait or Landscape orientations. In Portrait, the output is not rotated; in Landscape, the output is rotated 90 degrees.

- **Special**

  The Special button selects Mirror, Reverse, Display Off, and Grayscale Threshold as described in Chapter 5, "Convert Menu."

- **Printer**

  Press the Printer button to selec an output device, as shown in Figure 7-2. The number of printer and plotter devices supported depends on your computer and operating system (see Appendix B, "Plotter Device Configuration," for a list of all supported plotters and printers).

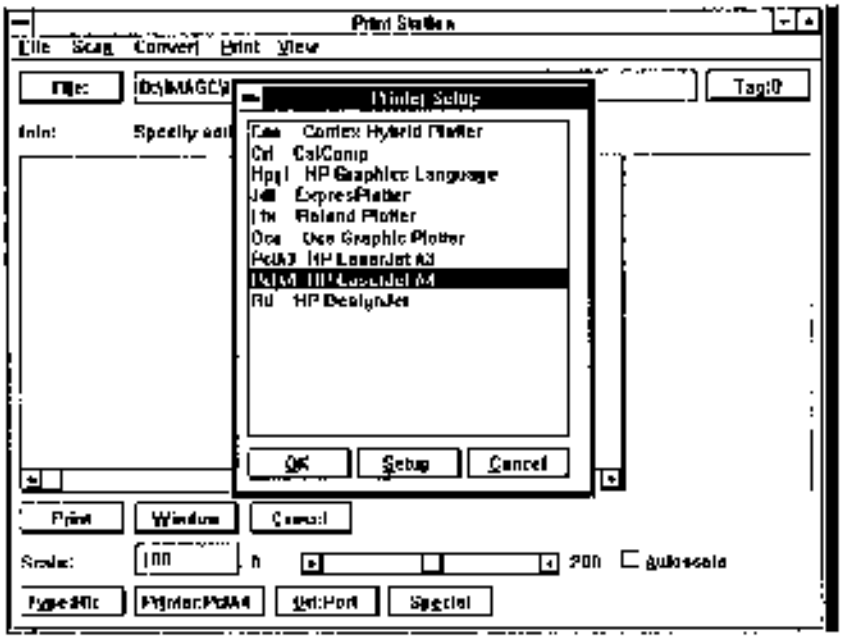

Figure 7-2 Selecting the Output Device

For Windows, the list of selectable output devices may be extended by a Windows driver selection. Use Setup to pop up the normal Windows printer set-up dialog.

For Mac, the list of selectable output devices may be extended by a Mac driver selection. Use Setup to pop up the normal Mac printer set-up dialog.

To set up additional device-specific information, select a device then press the Setup button (see Appendix B "Plotter Device Configuration").

The Printer button also sets up the output port to your printer or plotter device. For DOS and Windows, select one or more of the following:

LPT1	Print to device on parallel port 1
LPT2	Print to device on parallel port 2
COM1	Print to device on serial port 1
COM2	Print to device on serial port 2
Dev.I/F	Print to device on special interface card
File	Print to disk file.

For UNIX, the ports in above list will be replaced by the list of installed logical printers.

When you select to print to file in the Setup dialog, a file extension is automatically added to the file name in order to identify the printer or plotter device selected (see Chapter 8, "Supported File Formats," for details on printer format types).

8. Supported File Formats

Presently CADImage/SCAN supports more than 40 different industry standard file formats, ensuring compatibility with the maximum number of general and special applications within CAD, DTP, FAX, and graphics.

The raster file formats supported are split into five groups:

- General image file formats
- FAX file formats
- Scanned DXFTR and DXBTR trace subset files
- Grayscale file formats
- Plot/print file formats

For raster file formats, CADImage/SCAN supports:

- Scanning to any of the 44 industry standard file formats
- Converting from any file format (except the plot/print file formats) to any other file format (including the plot/print file formats).
- Viewing and zooming-in any of the file formats (except the plot/print file formats).
- Plotting and printing from any file format to any of the supported inkjet, electrostatic, or thermal plotters, laser printers, and plot/print file formats.

8.1 General Image File Formats

PCX—Black & white file format used by PC Paintbrush from Z-Soft Corporation. PCX is a very useful format in connection with a great number of applications.

IMGCM—File format used for the CADmate raster-to-vector conversion package, as well as for the general raster format (Eyestar format) supported by Microtek desktop scanners.

IMGCC—File format used for AutoDesk's CADcamera raster-to-vector conversion package (similar to Datacopy Inc. IMG format).

IMGGEM—Used by Digital Research Inc. GEM applications, such as GEMpaint and GEMscan. Note that many GEM applications are rather limited in the size of image they are able to load.

RLC—Used by Image Systems CADOverlay and ViewBase. CADOverlay can be used to import raster images as an overlay in AutoCAD.

RLC2—Image Systems enhanced RLC file format, containing additional information at the end of the file. Since RLC and RLC2 are compatible, except for this additional information, both formats are supported by the CADImage RLC choice.

IG4—Image Systems Group4 compressed format.

SCN—Used by Eldak's raster-to-vector conversion package and by Eldak's raster editor (similar to Scan-Graphics Inc. SCN format).

RNL—Used by GTX corporation overlay CAD systems and raster-to-vector conversion systems.

RAS—Sun raster format.

EPS—Encapsulated Postscript format. Works with many desktop publishing software packages.

CUT—For the Media Cybernetics Dr. HALO raster editor.

HRF—Hitachi Inc. CADCore format.

GP4 Type1—CALS untiled format, compatible with CCITT Group4 format.

GP4 Type2—CALS tiled format, compatible with CCITT Group4 format.

> CALS gives very compact image files. This format is standardized for CALS (Computer Acquisition and Logistics System, MIL-R-28002A) and ISO-ODA document exchange. Tiled Raster (Type2) is further described in NISTIR 4567: "Tiled Raster Graphics and MIL-R-28002A, A Tutorial and Implementation Guide."
>
> The GP4 file format contains a CALS header, which can be edited by a text editor to include the required information. The orientation information in the header is entered

by the operator through the Setup button in the Scan or Convert file format type selector (see Section 8.7, "Setting the CALS GP4 Orientation," for details).

RST—Indigo Graphics Systems Inc. raster format.

GR4AB—ABB Engineering Automation Inc. format compatible with CCITT Group4 format.

VIFAB—ABB Engineering Automation Inc. format compatible with run length compressed format.

CITIN—Intergraph Inc. format compatible with CCITT Group4 format (Intergraph Type 24).

RLEIN—Intergraph Inc. format compatible with run length compressed format (Intergraph Type 9).

TIFF—Tag Information File Format, Aldus/Microsoft Spec., is a standard file format used by many raster and desktop publishing programs. It is also the standard image file format for many image processing/enhancement programs.

The SetUp button in the file selection dialog will allow you to select TIFF compression type (e.g. uncompressed, packbits, Group 3 or Group 4) and specify rows per strip (or default). Also, for the uncompressed and packbit type, you can select black and white or grayscale (see Section 8.4, "Grayscale File Formats").

When a TIFF file is used as source in Convert, View or Print, CADImage/SCAN autodetects which of the below compression methods, black and white or grayscale was selected when the TIFF file was generated.

- *TIFF Uncompressed*—Uncompressed black and white or grayscale version of TIFF, supported by many vendors, e.g. IBM-CAD.
- *TIFF Packbits*—Packbits byte oriented run length compressed black and white version of TIFF, similar to Macintosh packbit format.
- *TIFF Group 3*—Group 3 run length compressed black and white version of TIFF, supported by many vendors.
- *TIFF Group 4*—Group 4 compressed black and white version of TIFF, supported by many vendors, e.g. UNISYS.

A special case is the Wicks & Wilson aperture card file format, which is a separately selectable variant of TIFF:

- *TIFF Wicks & Wilson*—Uncompressed black and white TIFF variant compatible with the Wicks & Wilson aperture card scanner. Since it is used with microfilm negatives, the image is reversed.

8.2 FAX File Formats

When scanning or converting to a FAX file format, multiple output files are generated, each corresponding to a normal FAX size file (Letter or A4 size). The files are numbered with the extension .001, .002, ... .00n. All these files can then be sent to normal Group 3 FAX machines from the workstation using a FAX board.

FAX—Format (Ver. 3.3c) for the Gamma FAX board.

FAX2—Enhanced format (Ver. 4.2) for newer Gamma FAX boards.

PCXMU—A generic FAX file format. The scanned file is stored in multiple files and each file is in the PCX format.

8.3 Scanned DXFTR/DXBTR Trace Subset Files

DXFTR—A trace subset of the general Drawing Exchange File format (DXF), supported by many CAD systems, including AutoCAD. As DXF is written as a simple ASCII file, it is easily exported to other computer systems.

DXBTR—A trace subset of AutoCAD's Drawing Exchange Binary File format (DXB). It is stored as binary data in a much more compressed form than DXF (about ten times more compressed).

Use the Setup button in the File menu to setup transformation parameters (see Section 8.6, "Scan and Convert to DXFTR and DXBTR," for details).

CADImage/SCAN only works with the trace entity subset of the DXF/DXB formats. Therefore, once a scanned DXFTR/DXBTR file has been modified in the CAD system, it cannot be further converted or printed by CADImage/SCAN.

8.4 Grayscale Formats

TIF—Uncompressed 8-bit grayscale version of TIFF. Use the SetUp button in the File menu to select the grayscale option (see TIF file format in Section 8.1 for setup).

TIF—Packbit compressed 8-bit grayscale version of TIFF. Use the SetUp button in the File menu to select the grayscale option (see TIF file format in Section 8.1 for setup).

IGS—Image Systems' uncompressed grayscale format.

PCX—Grayscale 8-bit format as defined by Z-Soft for PC Paintbrush widely used with many applications. Use the SetUp button in the File menu to select the grayscale option.

> In the Scan Station, the grayscale file formats are selectable only when Mode is selected to "Grayscale."

Conversion between the above grayscale formats is supported with grayscales maintained.

Conversion of above grayscale formats to a line mode format, along with printing or viewing grayscale files, is supported by specifying a threshold value between 0 and 255 in the Special menu.

Conversion of a line mode format to one of the above grayscale file formats is supported by mapping 0 and 1 to 0 and 255.

> Grayscale formats produce very large files. For example, an E-size drawing scanned at 300 dpi results in a file size of 150 Mb.

8.5 Plot/Print File Formats

If you select to scan, convert, or print to a plot/print file format, the SetUp button in the file format selection dialog allows to you specify the target plotter or printer device parameters (see Appendix B, "Plotter Device Configuration"). This information is embedded in the print/plot file when generated, and cannot be changed when the file is plotted to a device (e.g., by the transparent PLOTF command in the Print menu).

PCL—File format for HP LaserJet-compatible laser printers.

PLT (HPGL)—File format for electrostatic, thermal, and ink-jet plotters having an HPGL controller. When connecting the workstation to an HPGL plotter, you should make sure that the hardware flow control over the parallel or serial interface is implemented according to the manufacturer's specification in order to ensure that the computer does not output data faster than the plotter can process. Also, some plotters are limited to the number of HPGL vectors they can process simultaneously, which limits the size of drawings that can be plotted. The method for HPGL output implemented by CADImage/SCAN generates large numbers of horizontal vectors.

VER—VersaTec Inc. CADMate electrostatic, large format plotter raster output file format.

LTX—Roland Inc. LTX420L, LTX420, LTX320L, and LTX320/321 thermal large format plotter raster output file format.

CRF—CalComp Inc. DrawingMaster thermal large format plotter raster output file format.

JDL—Japan Digital Laboratory Inc. Express Plotter thermal large format plotter raster output file format.

ATL—Atlantek Inc. 24" thermal plotter raster output file format.

CON—Contex Hybrid thermal plotter raster output file format.

SCM—System Partner GMBH. SCANmate electrostatic, large format plotter raster output file format.

OCE—Océ Graphics thermal plotter raster output file format.

RTL—Hewlett Packard Raster Transfer Language output file format supported on the HP7600, HP DesignJet, and the NovaJet plotters.

GRA—Graphtek thermal plotter raster output file format.

8.6 Scan and Convert to DXFTR and DXBTR

If you select to scan or convert to the trace subset formats DXFTR or DXBTR, the SetUp button in the file selection dialog will allow you to specify:

Error, Speckle, Layer, and Unit

These parameters control the raster-to-CAD trace entity transformation that takes place on the fly during scanning or conversion.

Error (range 0 to 15)—Maximum allowed error in generating the CAD trace entities. A small value (0 or 1) gives the finest resolution and detail, but also the largest file sizes and scan/convert times. Caution: Value 0 results in approximately three times larger files than value 1. A medium value of gives a reasonable resolution for most purposes while larger values tend to roughen the edges and make the text unreadable.

Speckle (range 0 to 15)—Sets the sides a square box in pixels to be a filter for removing smudges during Scan/Convert. The value should normally be equal to or less than the error value above. Also, be aware that large values can remove significant details from the drawing.

Layer (range 0 to 99)—Sets the layer number in the CAD system that the DXFTR or DXBTR file will import to.

Unit (I or M)—Sets the scale of the scanned/converted file to either inches (I) or millimeters (M). This setting should correspond to the unit used in your CAD system.

8.7 Setting the CALS GP4 Orientation

If you select Scan or Convert to CALS GP4 format, the SetUp button in the File menu allows you to input the pel/path orientation and store it into the GP4 CALS file header of the document to be scanned or converted.

The CALS GP4 pel/path orientations available are:

00/270 (default)
90/270
180/270
270/270

For CALS GP4 documents, the manner in which the ODA raster architecture deals with orientation requires the use of two operations. The pel-path and line-progression directions specified for the document at interchange time will guide the reader during the imaging process. To get proper viewing, take the pels from a compressed or uncompressed data stream (file) and place them on the screen or paper in the directions indicated. The decoding program lays down the first line of pels along the pel-

8.4 Grayscale Formats

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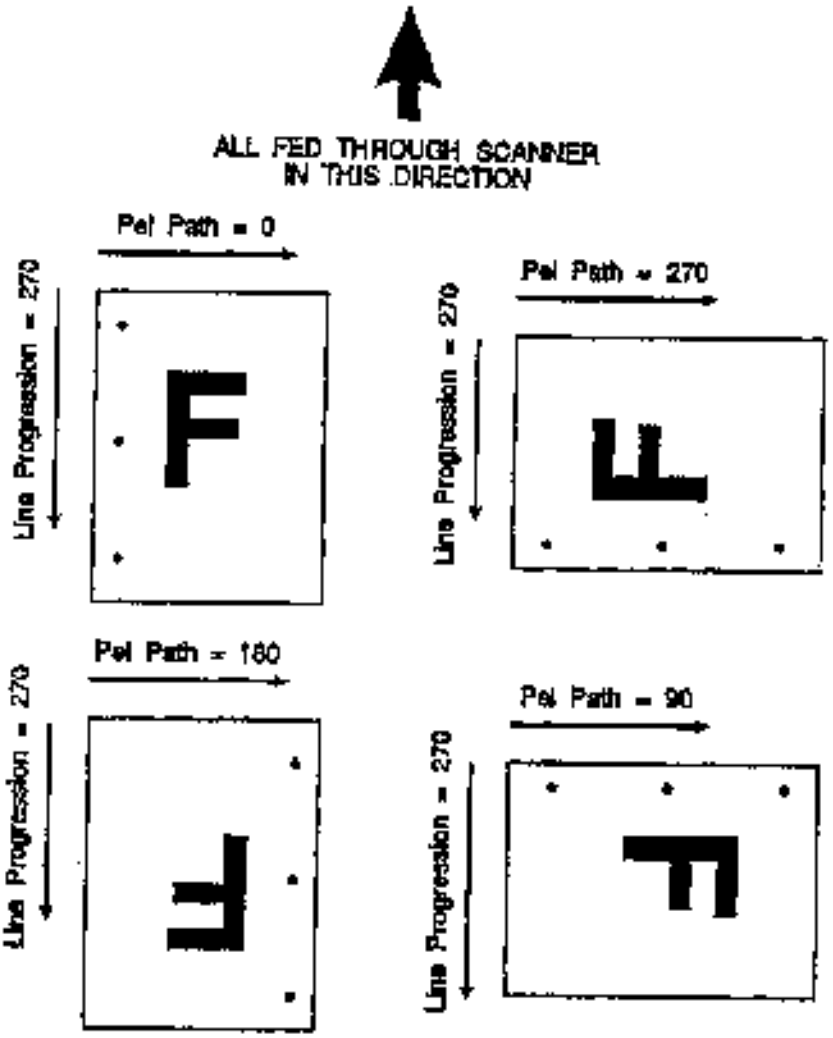
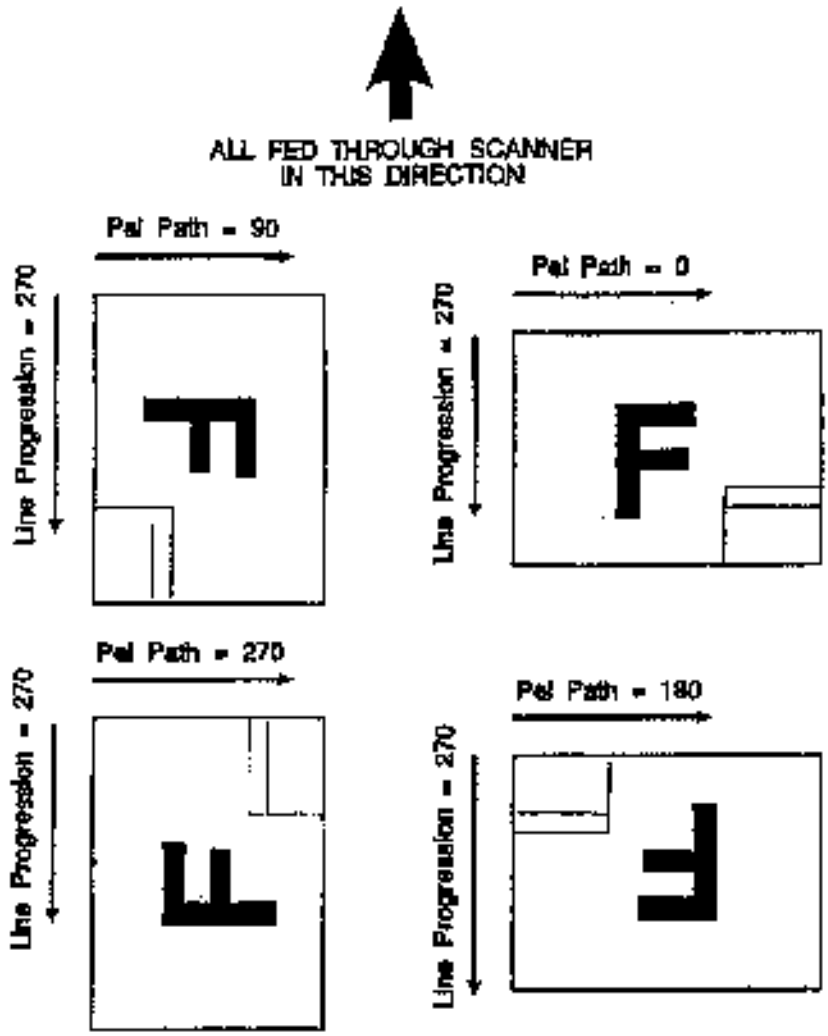
PCL—File format for HP LaserJet-compatible laser printers.



Note 1: The pel path direction is measured in degrees counterclockwise from the positive horizontal axis (east).

Note 2: The line progression direction is measured in degrees counterclockwise from the pel path direction.

Figure 8-1 CALS Positioning of Portrait Document



Note 1: The pel path direction is measured in degrees counterclockwise from the positive horizontal axis (east).

Note 2: The line progression direction is measured in degrees counterclockwise from the pel path direction.

Figure 8-2 CALS Positioning of Landscape Document

8.8 Files Scanned at 1000 DPI and Above

Some scanner models support scanning at very high resolution. When scanning at the maximum width (8.5 on the front measurement ruler) at 1000 dpi, the scanner produces approximately 36,000 pixels/line. This results in a problem with some file formats that were designed to accept a maximum width of approximately 32,000 pixels (signed two bytes).

The file formats with this limitation are: PCX, CUT, RLC, VIF, IMGCC, IMGCM and IMGGEM. In CADImage/SCAN, this problem is handled by writing the correct value to the width field in the file header. This means that CADImage/SCAN will work correctly with these formats; whether third party software will work with these files depends on the implementation. An example of a program that works correctly with the files is CADOverlay ESP, Version 3.5, although RLC originally was designed to handle a maximum of 32,000 pixels. If your software cannot handle the wide files correctly, you have the following options:

- Scan at 800 dpi
- Limit the scan width to 7.5
- Have the third party software vendor change how they read the files

9. Raster Drawings & CAD Systems

The data that CADImage/SCAN receives in a scanned file are raster data. Raster information is stored as a matrix of picture elements called pixels. Each pixel is a bit determined by whether the original was black or white at that point. During scanning, compressed raster format files can be generated from the raster data. The grayscale scanning mode generates grayscale files, which are not discussed in this chapter.

Files in CADImage/SCAN supported raster formats can be loaded into applications designed to work with raster information, such as CAD overlay programs, raster-to-vector (RTV) programs, raster editors, graphics, desktop publishing, FAX, and drawing archival programs.

When you work on large compressed files with a raster-based application, you should be aware that the application normally decompresses the file, so you will need enough free space on your disk. For example, an E-size drawing scanned at 300 dpi will need nearly 16 Mb. To calculate how much disk space you may need to edit a drawing, use the following formula:

(Scan Width x Resolution x Scan Length x Resolution)/8

9.1 Vector-based Applications

Many programs working with graphics, such as CAD programs like AutoCAD or draw programs like GEMdraw, use vectors. Vector information is stored as drawing entities, such as *line from point A to point B* or *Circle with center C and radius R.*

There are three ways of working with vector-based applications:

- Use a hybrid CAD system that accepts both raster and vector data.
- Use raster data with a CAD overlay program. For small or simple drawings you can use the DXFTR/DXBTR trace subset of the DXF/DXB file formats, which can be generated by CADImage/SCAN and which may be imported into many CAD systems.
- Use automatic raster-to-vector conversion.

9.2 Hybrid CAD Systems

Hybrid CAD systems capable of working directly with both raster and vector data are becoming increasingly popular. Examples are Intergraph, IBMCAD, NovaCAD, CADCore, and many more. Through the addition of raster overlay software, programs such as AutoCAD and VersaCAD also fall into this bracket.

9.3 CAD Overlay Programs

When you use overlay programs, you do not have to go through the raster-to-vector conversion process. Instead you can bring in the raster image as an overlay to your CAD system (comparable to using a transparency over your original).

> If the overlay program is not a part of your CAD system, the CAD program will not know that the overlay is there, so you cannot use functions like "Snap".

One use of the overlay technique is to trace vectors over the image, enabling you to create a fully vectorized drawing. Another is to place a drawing (e.g., electrical, heating, or water installation) on top of your image.

With the newest overlay programs (e.g., CADOverlay ESP from Image Systems or CADRaster from Tessel AB), you can work with composite raster and vector drawings directly on-screen in the CAD system, deleting and replacing parts of the raster image with CAD-drawn parts, then storing and printing the hybrid drawing.

9.4 Using DXFTR and DXBTR Files

CADImage/SCAN's ability to scan or convert drawings directly to DXFTR or DXBTR formats is a handy feature. With small or simple drawings, it can provide a quick entry into CAD systems; for larger and more complex drawings, the use of separate CAD overlay programs or raster-to-vector conversion programs is always recommended.

DXFTR and DXBTR are trace entity subsets of the widely used DXF and DXB CAD formats. The following are examples of their use with AutoCAD:

- To load a DXFTR file into AutoCAD, use the command DXFIN.
- To load a DXBTR file into AutoCAD, use the command DXBIN.

Once you have the drawing in AutoCAD, you may use all the normal AutoCAD commands to scale, zoom, rotate, erase, and edit all or individual parts of your drawing. Most importantly, you can print and plot the drawing directly from AutoCAD. If you output to a pen plotter, use the "fill off" command and limit the size of the drawing, since trace entities are used to describe the drawing elements.

You can now make modifications to the drawing in AutoCAD simply by drawing the changes and deleting areas of the imported entity drawing directly affected. You can overdraft parts of the drawing using AutoCAD commands, such as polylines, three-point circles, and arcs, before deleting the affected trace entities. Output (print or plot) the combination of your modifications and the originally scanned drawing. As DXFTR/DXBTR trace entities preserve the width of lines in the scanned drawing, the output will be close to the original.

In some instances, it can be very useful to keep the scanned DXFTR/DXBTR drawing unchanged, then overlay new information (e.g., new wiring and tubing on an existing building drawing), and print or plot the combined drawing.

You can also use the DXFTR/DXBTR file as a background for tracing the whole drawing quickly and accurately, creating a normal AutoCAD drawing.

To make it easy to discern the modifications and tracings you make from the original drawing, keep the scanned DXFTR/DXBTR file in a separate layer using a color not used by other layers. This allows you to remove it with a single command if you have done a complete digitization, leaving only the AutoCAD drawing.

If you use DXFTR/DXBTR files to digitize your drawings on the screen, the default settings **speckle = 4** and **error = 4** are probably correct. If you want to use the files to change parts of a drawing then print/plot the combination, you might want to experiment with lower settings of error and speckle to gain higher quality output. To do this, scan to a raster format (e.g. RLC format) then convert to DXFTR/DXBTR until you have found a

proper setting. You should be aware that the scanning/converting time and file sizes grow very rapidly at the lower settings of the **error** parameter (e.g., 0 and 1). DXBTR format is preferable to DXFTR, since its files are only about 10% as large. Even if your application can only use DXFTR files, you can still save disk space by scanning and storing in DXBTR then using CADImage/SCAN to convert from DXBTR to DXFTR before loading the file.

When you have made changes to a file in your CAD system, CADImage/SCAN can no longer convert between the DXFTR and DXBTR files because it only works with a trace subset of the DXF and DXB formats.

9.5 Raster-to-Vector Conversion

The process of raster-to-vector conversion is called vectorization. To vectorize a file, you must use a raster-to-vector (RTV) conversion program. Automatic raster-to-vector conversion programs have made rapid progress in recent years, and time should be spent in evaluating and selecting a program that matches your type of drawings and applications.

Vectorization is processor-intensive, even on state-of-the-art workstations, and vectorization of big drawings with lots of information may take some time. You can use batch files to vectorize several drawings while you are not using the workstation. When you have vectorized your drawings, you must expect to spend some time cleaning up the drawings.

When you run your vectorization program, you should consider the following:

- Some vectorization programs create very large files (15-20 Mb). Make sure that there is enough space on the hard disk for such files, and that there are no bad sectors. It can be very frustrating to have your vectorization program crash after several hours of work.

- Whenever possible, scan originals instead of copies. Only a high quality original will provide a high quality vectorized file. Low quality drawings will produce very large files with many small vectors.

- Most vectorization programs automatically discard isolated spots, so it is better to use a scanner threshold that produces a dark image with some spots rather than an image in which lines have breaks in them, thus producing many vectors.

If your vectorization program hangs or stops and you have no disk problems, you must do one or more of the following:

- Make sure you unload any unnecessary memory resident programs and device drivers before you start vectorization. The amount of available memory will greatly affect some vectorization programs' processing time, and some vectorizers will even hang up if there is not enough memory.

- Examine the image with a raster editor to see if the drawing was scanned with too high of a threshold, making many broken lines. If so, rescan with a lower threshold.

- If the drawing is very complex, you might remove drawing captions and other text with a raster editor before vectorization.

- If the drawing is very large and complex, you can split the image into several drawings, using the CADImage/SCAN Window facility in the Convert menu. Vectorize each part of the drawing and reassemble in your CAD system.

A. Glossary

CALS

Computer-aided Acquisition and Logistics Support (CALS) standard, a U.S. Defense Department and industry initiative that addresses the design, manufacture and support issues of generation, access, management, and use of technical data in digital form.

CCITT GROUP 3

Standard run length compression format used with FAX transmission. It utilizes modified Huffman coding to further compress the run length numbers. Most scanner file formats are dialects of this format.

CCITT GROUP 4

Two-dimensional compression format, giving very compact image files. Standardized by CALS (Mil 28002) and ISO-ODA for drawing archival and interchange.

COMPRESSED

Reduces file and image sizes of raster images by encoding the data (See also Run Length Encoding and CCITT Group 3).

DISPLAY

Also called GRAPHIC DISPLAY or MONITOR. Refers to the computer screen attached to your computer, or to the portion of a drawing image, menu, etc. shown on the computer screen.

HISTOGRAM

A bar graph representing the statistical distribution of grayscale in an image. Each column represents the number of pixels at that gray level.

PIXEL

Also called DOT. A single element of picture information, representing a small area in the raster image. The value of a pixel depends on the luminance of the area, and is either a single bit for a binary (black and white) image, or multi-bit for a grayscale image.

PROM

Programmable Read Only Memory

RAM

Random Access Memory

RASTER FILE

Also called RASTER IMAGE or BITMAPPED IMAGE. A picture composed of individual dots (picture elements, pixels) the way a scanner sees it. The rows in a high-resolution raster file typically contain 200 or 300 dots per horizontal inch of the original drawing, and there are typically 200 or 300 rows per vertical inch. As each of these dots is defined by location and whether it is *on* or *off*, raster images have large data files.

RESOLUTION

Defines the level of detail that can be captured or shown by a scanner, display, or output device. On scanners, the resolution is defined by the number of dots (pixels) per inch (dpi) that can be captured horizontally and vertically, e.g. 300 dpi equals 90,000 pixels per square inch.

RUN LENGTH ENCODING

A method of compressing raster or bitmap data by representing "runs" of white or black dots along a scanned line as the number of dots in each run. Many variations exist of this scheme with varying compression efficiency. Typically, run length compression formats yield a file 20-25% the size of an uncompressed file.

SCANNING

The process of running a hard copy drawing or document through an optical scanner. The scanner produces a digital image (raster image) of the hard copy drawing, which is stored in RAM or on a disk.

VECTOR FILE

Also called VECTOR DRAWING. Consists of mathematically defined elements such as: *Line from A to B, Circle with center and radius* CAD systems use vector drawings because of their accuracy and relatively low memory and data file sizes compared to raster images.

VECTORIZATION

Also called RASTER-TO-VECTOR CONVERSION (RTV). The process of automatically converting a raster (bit-mapped) image into a vector (CAD) drawing.

B. Plotter Device Configuration

This appendix details the setup of device specific options for interfacing printers and plotters with CADImage/SCAN for direct output. Note that not all the listed printers and plotters are available on all computer and operating system platforms.

The parameters are set up via the Setup button in the Printer selection dialog in the Print Menu. Also the output port or device driver to the printer or plotter is selected via the Setup button (see Chapter 7, "Print Menu," for details).

B.1 Versatec Plotter Parameters

Input the "bytes/line" and "dots/inch" parameters from the list below, corresponding to your Versatec plotter model.

Input the "port number" (1, 2, 3, or 4) according to the setup of your Versatec device interface.

You can further select the output to be "direct" or "spooled" on the disk. Spooled output will run the plotter more smoothly and create less toner smearing, but requires temporary space on your disk.

List of Versatec Models					
Monochrome Plotters			Color Plotter in Monochrome Mode		
Model	Bytes/Line	DPI	Model	Bytes/Line	DPI
V80	264	200	2562	284	200
1100, 1110	128	100	2568	568	400
1200	264	200	2726M	296	300
2000, 2030	232	100	2766M	424	300
7222	528	200	CE3224	588	200
7422	1056	400	CE3424	1176	400
7224	576	200	CE3225	588	200
7424	1152	400	CE3425	1176	400
7225	588	200	CE3236	880	200
7425	1176	400	CE3436	1760	400
7236	880	200	CE3244	1076	200
7436	1760	400	CE3444	2152	400
7244	1076	200	8924-2x	588	200
7444	2152	400	8924-4x	1175	400
8222	528	200	8925-2x	588	200
8224	576	200	8925-4x	1176	400
8236	880	200	8936-2x	880	200
8242	1024	200	8936-4x	1760	400
8244	1076	200	8944-2x	1076	200
8510 CADmate	1320	300	8944-4x	2152	400
8624	576	200			
8624HR	1152	400			
8625	588	200			
8625HR	1176	400			
8636	880	200			
8636HR	1760	400			

B.2 CalComp DrawingMaster

Set "dots/inch" to 400 or 200 according to the DrawingMaster thermal plotter model.

B.3 SCANmate electrostatic plotter

Select "I/O address" (320, 330, 340, or 350) according to the setup of your device interface card for the System Partner Gmbh electrostatic plotter.

B.4 Roland thermal plotters

Select "Model" (LTX420L, LTX420, LTX320L, or LTX320/321).

B.5 HPGL plotters

For electrostatic, thermal, or inkjet plotters having an HPGL interface (Hewlett Packard Graphic Language), you can select "model", "paper size," and "port."

B.6 Atlantek thermal plotter

For the Atlantek 24" thermal plotter, input "bytes/line" (default 587) and "dots/inch" (200 or 300). Select "I/O Address" (320, 330, 340, or 350) according to the setup of your device interface card.

B.7 Contex Hybrid Plotter

Select resolution 200x400 or 200x200, and cut of paper between plots.

B.8 Océ Graphic thermal plotter

For the Océ G9800 thermal plotter, input "Scanlength" (default 14456). Select "I/O Address" (320, 330, 340, or 350) according to the setup of your device interface card, "Resolution" (300, 400, 406, or 600 dpi), and "Spooling" (on/off).

B.9 HP-RTL plotters

For the HP-DesignJet and NovaJet inkjet plotters, and the HP7600 electrostatic plotters, input "scanlength" (default setting 10800), and select "DPI" (default 300).

B.10 JDL Express plotters

For the JDL express thermal plotters, no parameter setup is necessary.

B.11 Graphtec Thermal plotter

For the Graphtec thermal plotters, select "model" (TM1010, TM1110, TM1210, or TM1310).

B.12 Laser Printers, PCLA4 and PCLA3

For HP LaserJet or compatible A4 (A-size) or A3 (B-size) laser printers, select "DPI" (default 300) and "Origin Offset."

with the program prove defective, you (and not CalComp or an authorized dealer) assume the entire cost of all necessary servicing, repair or correction.

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E. Index

A

B

C

D

E

F

G

H

I

J

L

M

N

O

P

R

S

T

U

V

W