TSVGA
GRAPHICS ADAPTER
USER'S MANUAL

(VESA & HI-COLOR)

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Inventory Check List

Your Display Card package contains the following items. Please check your items against the list, and contact your dealer immediately for a replacement in case of shortage.

[ ] TS VGA Card
[ ] TS VGA Card Utility #1
[ ] TS VGA Card Utility #2
[ ] TS VGA Card User's Manual

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SECTION 1: INTRODUCTION

1.1 Features

Congratulations on the purchase of your Display Card. We would like to take a moment to familiarize you with some of your new board's special features.

1. **VGA Compatibility**

   Your Display Card is based on ET4000 VGA Chip and BIOS, which provides proven full VGA BIOS and Registers compatibility.

2. **VGA-Sync: the One-Adapter-One-Monitor Solution**

   Your Display Card provides true pre-VGA (Hercules, EGA and CGA) compatibility. Unknown to most people, a VGA card needs more than BIOS and Registers compatibilities to provide full backward compatibility on a VGA monitor. It also requires frequency convertion capability, because VGA monitor operates at a different frequency from the pre-VGA monitors'.

   Many VGA cards do not provide reliable frequency conversion. To provide frequency compatibility, IBM depends on BIOS, which unfortunately is bypassed by many software including Microsoft Windows. Many VGA compatible cards use Interrupts to patch the incompatibility. However, Interrupts tend to cause unpredictable problems with LAN, EMS, co-processor applications.

3. **Extended Resolution and Colors on Standard Monitors**

   Your Display Card based on the ET4000 chip supports extended VGA modes conforming to generally accepted monitor frequency standards (many other VGA cards are not compatible with popular monitor standards in 256 colors mode or 1024x768 resolutions).

Resolution	Colors	Standard Monitor	Standard Frequency
640x480	16,256 *	IBM VGA	31.5KHz
800x600	16,256 *	NEC MultiSync 2A	35.5KHz
1024x768	16,256 **	IBM 8514	35.5KHz ***
1024x768	16,256 **	NEC MultiSync 4D/5D	48.0KHz
1024x768	16,256 **	NEC 5D	56.0KHz

* 256-color modes require 512KByte memory.
** 256-color modes require 1MByte memory.
*** Interlaced display mode. All other modes are non-interlaced display.

4. Software Drivers for Extended Modes

Following high resolution drivers are provided at no charge.

Microsoft Windows 2/386
GEM 2/3
Ventura 1/2
AutoCAD 2.6/9/10
Lotus 1-2-3 1A/2 (132x25/28/44, 80x60 text)
Word Perfect 5 (132x25/28/44, 80x60 text)

Due to the popularity of ET4000 VGA chip, most leading software will be supported.

5. 132-Column Text Display

Your Display Card provides 132-column text for Lotus 1-2-3, Symphony, Word Perfect, etc. on VGA and variable-frequency monitors.

132-column text display is widely used by popular emulator software to emulate terminals such as the DEC VT100 and the IBM 3278, which require 132 columns of text.

6. Multiple Soft Fonts

The Font Loader and Font Editor software included in the Utility Diskette let you design and use custom character fonts ideal for scientific and foreign language applications.

7. High Speed

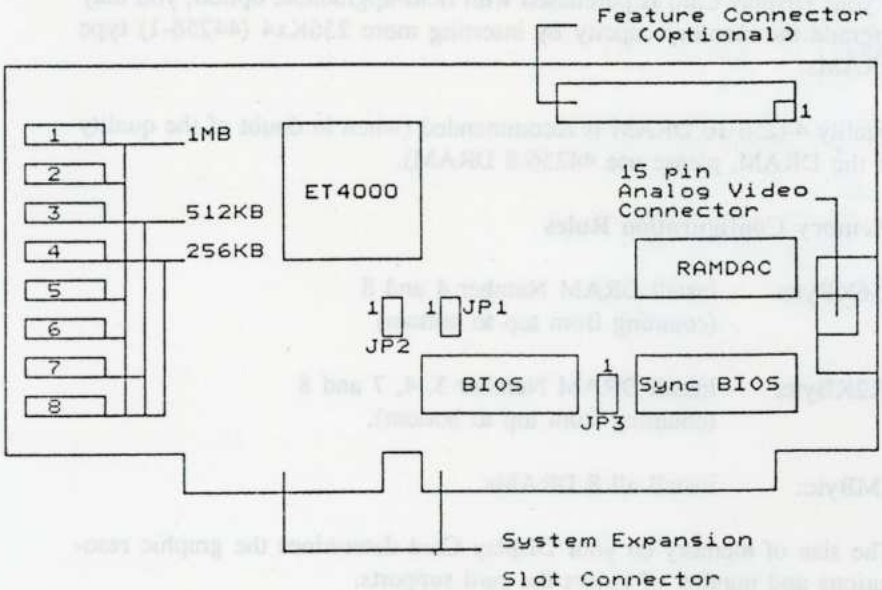
You Display Card uses the ET4000 VGA chip-the fastest VGA chip in the market. When installed with 512KByte or 1MByte memory, it is ideal for PC users requiring the best speed performance.

8. TURBO Mode

The TSVGA can boost the speed of text and graphics opeartions if JP3 is set to 2&3.
The ET4000 graphics chip used by the TSVGA Card is able to enhance its performance by setting its Bus access to zero wait states. This provides a direct increase in the speed of processing video information.
The TSVGA will provide a speed boost from 10% to 40% (depend on CPU board) when Turbo Mode is enable.

1.2 Layout

The figure below show the layout of your Display Card. Study it and make sure that you can identify the items shown since they will be referred to throughout this manual. Each item is described briefly.



1. Jumper Settings :

JP1 IRQ2 Line Status :
- 1&2 IRQ2 Enable
- 2&3 IRQ2 Disable (default setting)

JP2 MCS16 Line Status :
- 1&2 ET4000 VGA Chip Generate
- 2&3 External Decoder (default setting)

JP3 TURBO Mode :
- 1&2 Disable
- 2&3 Enable (default setting)

2. Memory Configuration

Your Display Card may come with three possible memory configurations: 256KByte, 512KByte or 1MByte. You may or may not field-upgrade the memory capacity depending on the model you have purchased.

If your Display Card is purchased with field-upgradable option, you may upgrade the memory capcity by inserting more 256Kx4 (44256-1) type DRAMs.

Quality 44256-10 DRAM is recommended (when in doubt of the quality of the DRAM, please use 44256-8 DRAM).

Memory Configuration Rules

256KByte: install DRAM Number 4 and 8 (counting from top to bottom)

512KByte: install DRAM Number 3, 4, 7 and 8 (counting from top to bottom)

1MByte: install all 8 DRAMs

The size of memory on your Display Card determines the graphic resolutions and number of colors the card supports.

The following resolutions/colors require 256KByte memory
- 320x200 in 256 colors
- 640x350 in 16 colors
- 640x480 in 16 colors
- 800x600 in 16 colors

The following resolutions/colors require 512KByte memory
- 640x480 in 256 colors
- 800x600 in 256 colors
- 1024x768 in 16 colors

The following resolutions/colors require 1MByte memory
- 1024x768 in 256 colors

3. Video Connector

This 15-pin output connector is where you connect all fixed frequency and compatibles or multi-frequency displays.

4. System Expansion Slot Connector

Your Display Card may come with either 16-bit bus or 8-bit bus. The 16-bit Display Card provides faster operation. However, an 8-bit Display Card may obtain equivalent performance to the 16-bit Display Card by loading its Video BIOS into PC/AT or PC/386's system RAM (ideally the Shadow RAM). A Utility for this purpose called FASTBIOS.SYS is included in the Utility Diskette.

The 16-bit Display Card is also compatible with the PC's 8-bit bus. The BIOS automatically switches to 8-bit operation when the Display Card is inserted into an 8-bit slot.

SECTION 2: INSTALLATION

2.1 Installation Requirement

1. **IBM Personal Computer**

   IBM Personal Computers manufactured prior to April 1983 must have a new ROM module installed on the system board before you install your Display Card.

   If you are not certain which ROM module is installed on your system board, run the following BASIC program.

   The program displays the date code of the ROM module installed on your system board. Enter the program exactly as shown. If the date displayed is earlier than 10/27/83, a new ROM module is required. The ROM is contained in the **BIOS Upgrade Kit** available from your IBM dealer. The IBM part number is 1501005.

```
10 DEF SEG=&HF000
20 FOR A=&HFFF5 TO &HFFFF
20 PRINT CHRS (PEEK(A));
40 NEXT
RUN
```

   Additional information on BASIC programs is available in BASIC manual.

2. **IBM Compatible Personal Computer XT, AT, 386**

   Your Display Card is compatible for use in these systems.

3. **Tools Required for Installation**

   Medium-size, flat-blade screwdriver

4. **Inventory checklist**

   Check your Display Card box to ensure that it contains the following items: The Display Card, Utility & Driver Diskette and User's Manual.

2.2 Installation Instruction

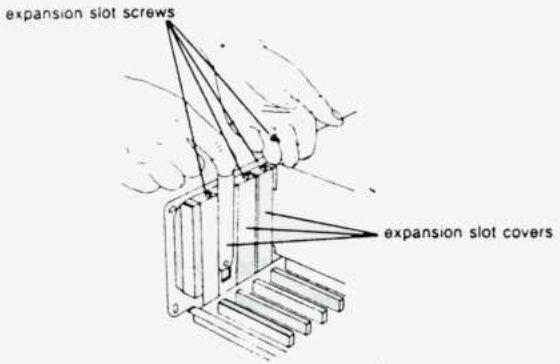
1. Power OFF any devices (printer, display, modem, etc.) you may have attached to your computer.

2. Power OFF your computer system.

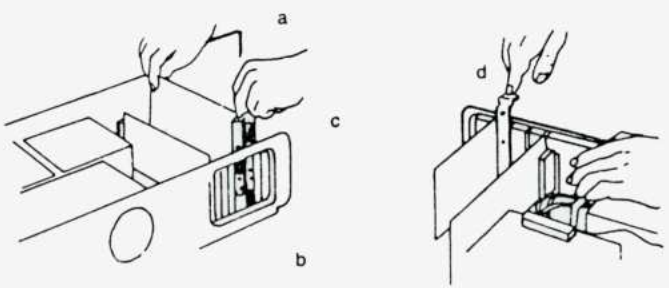
3. Disconnect all cables from the rear of your computer.

4. Remove the cover from the computer

5. Your Display Card can go into any unused slot on the computer mother-board. Remove the screw which holds the chosen expansion slot rear panel cover. Remove the cover and set the screw and cover aside.

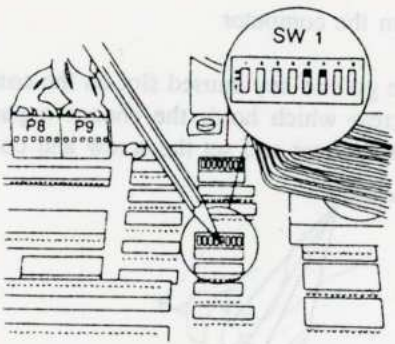


6. Install your display board. Insert the screw that was removed with the expansion slot and tighten firmly.



7. If you are installing your Display Card in an original IBM PC, please observe the following instructions. If you are installing the card in an XT, AT, PS/2 or any compatible devices, go to next step.

   Using the tip of a ballpoint pen or similar object, set levers 5 and 6 on switch block 1 on the motherboard of IBM PC (switch block 1 is the set closest to the expansion slots; it is marked as SW1) to the ON position. The ON and OFF positions are usually marked along the side of the switch.



8. Carefully slide the cover back over the computer. Install the mounting screws that hold the cover to the computer.

9. Reconnect all cables to the rear of the computer. If necessary, refer to the instructions supplied with your display monitor, printer or other equipment.

NOTE

Refer to the user's guide included with your computer system for additional instructions concerning the installation of options. Switch and/or jumper settings vary from system to system.

SECTION 3: SOFTWARE UTILITIES

3.1 Software on Your Utility Diskette

Following are descriptions of your Display Card's utilities and other files.

FASTBIOS.SYS	Speeds up video BIOS operations when used in 80286- and 80386-based systems. It must be installed as the FIRST device in the CONFIG.SYS file.
EANSI.SYS	Replaces the ANSI.SYS device driver supplied on your DOS system disk. EANSI.SYS is compatible with the standard ANSI.SYS, and additionally supports the extended screen modes provided by Display Card.
FONT.DOC	Contains the latest information on the Font Editor and Font Loader, describing new fonts and features. Print this file and read it before using the font software.
FEDIT.COM	The font editor, used to create new fonts and/or modify existing fonts. User's .FNT font files also included on your diskette.
FLOAD.COM	The font loader, used to load a selected font into video memory from disk.
VDIAG.EXE	Diagnostic file that tests the video modes of your Display Card and details the configuration of the system. This test can also be used to check/align your display monitor screen.
VMODE.COM	Utility program which is used to switch the card display modes (e.g. EGA, CGA Hercules, 132-column display, ect.)
README.DOC	Contains additional information which was not available at the time this manual was printed.

Following pages are detail instructions on how to use these Utilities.

3.2 Installing the FASTBIOS.SYS Device Driver

The FASTBIOS.SYS device driver is a file located on the Utility Diskette that is used to transfer the contents of the video ROM BIOS to PC system memory. This utility enhances video BIOS operation speed considerable when used in 80286- and 80386-based systems.

FASTBIOS.SYS is installed in the system CONFIG.SYS file with the following line

DEVICE=FASTBIOS.SYS

and must be the FIRST such device driver listed within the CONFIG.SYS file. If this is not done, the following message may result upon loading:

> FASTBIOS NOT INSTALLED — another (earlier installed) device driver has taken over the video interrupt; make sure the line DEVICE= FASTBIOS.SYS occurs first in your CONFIG.SYS file.

Should an attempt be made to install FASTBIOS.SYS in anything other than an 80286- or 80386-based system, the following message will result:

> FASTBIOS requires an 80286 or 80386 machine

When FASTBIOS.SYS is successfully installed the following message appears:

> FASTBIOS Installed

FASTBIOS.SYS, residing within CONFIG.SYS, can only be installed during system boot-up. Please remember to reboot your system after adding FASTBIOS to your CONFIG.SYS file, and ensure that FASTBIOS.SYS resides on the same directory as CONFIG.SYS.

Note: If your PC provides shadow RAM, please turn on the shadow RAM instead of using FASTBIOS.SYS device driver. Shadow RAM provides the same high speed BIOS operation as FASTBIOS.SYS without consuming your system memory capacity.

3.3 Using the Replacement ANSI Standard Console Driver

Format: **DEVICE=EANSI.SYS**

This command must appear in the configuration file (CONFIG.SYS) to install EANSI.SYS, just as the command to install the ANSI.SYS device driver that comes on the DOS diskette would appear. EANSI.SYS is compatible with the standard ANSI.SYS, and additionally supports the extended screen modes provided by your display Card. Once installed with the above command, EANSI.SYS provides all the screen control and keyboard remapping features of ANSI.SYS (see your DOS Technical Reference manual). EANSI.SYS is a replacement for ANSI.SYS, and the two should not be in use at the same time.

EANSI.SYS may be used to select the extended screen modes. This is accomplished by issuing an escape sequence with the "set mode" command, just as any standard mode would be selected with the normal ANSI.SYS. For example, screen mode 22 hex would be selected by sending the escape sequence:

(Esc)[=34h

to the screen. (Note that 34 is the decimal equivalent of 22 hexadecimal). To select other modes, simply replace 34 with the number of the mode you wish to select.

The available extended screen modes using an enhanced color display are as follow:

Mode	Columns	Row
34 dec (22 hex)	132	44
35 dec (23 hex)	132	25
36 dec (24 hex)	132	28
38 dec (26 hex)	80	60
2 dec (02 hex)	80	25

For example, to place the screen in 132-column by 44-row mode, do the following.
Place the DEVICE command:

```
DEVICE=EANSI.SYS
```

in the CONFIG.SYS file on a bootable disk, and place EANSI.SYS and BASICA.COM on that disk. Boot the system, and in response to the DOS prompt, type BASICA, then press ENTER and type the following BASIC commands:

```
OPEN "0", 1, "TEMP.DAT"
PRINT #1, CHR$(27); "[=34h";
CLOSE
SYSTEM
```

This creates the file TEMP.DAT, containing the escape sequence to select mode 22 hex, 132-column mode. In response to the DOS prompt, type

TYPE TEMP.DAT then press **ENTER**

which sends the escape sequence to the screen. The screen is immediately set to 132-column mode. Note that the escape sequence is not displayed; it is interpreted as a command rather than displayable text.

3.4 Using the Custom Font Loader and Font Editor

The Custome Font Loader and Font Editor let you instantly change the set of characters (character font) displayed on the screen. For example, the letter "A" could be displayed as ∇ or α or could even be changed to a different character entirely. This is very useful for scientific and foreign language application, as well as for simplay customizing the look of your screen.

Normally, fonts must be changed from within a program, but the Font Loader lets you change the displayed font with a single DOS command. You can load one of the several ready-made fonts provided on the Utility Diskette, or you can use the font editor to customize your own fonts.

The font software consists of:

FONT.DOC - the latest information about the font software, describing new fonts and features.

FEDIT.COM - the font editor, used to create new fonts and/or modify existing fonts. Start the Font Editor by typing the command "FEDIT" at the DOS prompt. Select the Help option in FEDIT's main menu for more information.

FLOAD.COM - the font loader, used to load a selected font into video memory from disk. Up to four fonts may be stored in video memory at once, with any one of the fonts selected for display. Type the command FLOAD, with no parameters, for more information on the use of this program.

Assorted fonts - fonts packaged on your Utility Diskette include the two standard fonts, font designed for the APL language, and a thin, single-dot font. You may modify any of these fonts as you wish with the font editor. Any file on the Utility Diskette with the extension .FNT contains a font.

NOTE

Fonts may be loaded in text mode only. When a font is selected to be displayed, every character on the screen is immediately displayed in that new font.

3.5 Using Diagnostic Test Program

Included in the Utility Diskette is a test program called **VDIAG.EXE** which can help you further verify that your card and attached display monitor are working properly.

1. At the DOS prompt, type VDIAG then press ENTER.

2. The test will start and prompt you with further instructions.

3.6 VMODE.COM for Software Mode Switching

VMODE - USING THE EXTENDED - COLUMN MODES

The TSVGA provides you with the capabilty to utilize extended column modes with text applications. This means that your TSVGA board , when interfaced with appropriate color display, can produce 132x60, 132x44, 132x28, 132x25, 100x40, 80x60 and 80x43 modes in addition to the 132-column display capabilty allows emulation of terminals that require 132 columns of text.

With the TSVGA board, you can switch back and forth between the 80-column display modes and the various extended-column display modes. To use VMODE, follow these steps :

1. First, be sure that the VMODE.COM utility is present on the disk you are using.
2. To switch to a different mode, type the mode you wish to use and then press ENTER :

Type

VMODE 40	-to switch to 40x25 mode
VMODE 80	-to switch to 80x25 mode
VMODE 43	-to switch to 80x43 mode
VMODE 60	-to switch to 80x60 mode *
VMODE 100	-to switch to 100x40 mode *
VMODE 25	-to switch to 132x25 mode
VMODE 28	-to switch to 132x28 mode
VMODE 44	-to switch to 132x44 mode
VMODE 132x60	-to switch to 132x60 mode

* Note : Not all modes are supported by all monitors. Attempting to use modes which your monitor does not support will produce unsatisfactory results.

Three additional modes are provided to enable you to change the scan line resolution. This is to accommodate some software that specifically looks for a particular number of scan lines. The 400 scan line mode provides the most pleasing text resolution.

VMODE 200 - to provide 200 scan lines in 40- or 80x25 text modes.
VMODE 350 - to provide 350 scan lines in 40- or 80x25 text modes.
VMODE 400 - to provide 400 scan lines in 40- or 80x25 text modes.

VMODE SCAN RATES

Additional modes are aviable to provide additional scan rates that may improve synchronization with a variety of monitors. Normally, the default scan rates are effective, but some monitors may require different scan rates for the most satisfactory display results. By setting these modes, frequencies are adjusted that affect displayed graphic modes. The following modes are available via the VMODE command.

Example : VMODE x

VMODE x Value	Modes affected	Vertical Refresh Rate	Horizontal Frequency	Resolution
35K	29,2A,30	56Hz	35KHz	800x600
38K	29,2A,30	60Hz	38KHz	800x600
45M	37i,38i	86Hz	35.5KHz	1024x768 interaced
65M	37n,38n	60Hz	49KHz	1024x768 non-interlaced

72HZ Modes

The following graphic (not text) modes can displayed after setting the display the vertical refresh rate to 72Hz. The 72Hz mode will provide a clearer display with less flicker on some monitors. Set the VMODE parameter to VMODE 72Hz. After this is done you can use VMODE to set the display to any of the graphic modes listed below.

VMODE x Value	Vertical Refresh Rate	Horizontal Frequency	Resolution
11 [72Hz]	72.70Hz	38.70KHz	640x480 *
12 [72Hz]	72.70Hz	38.70KHz	640x480 *
25 [72Hz]	72.70Hz	38.70KHz	640x480 *
**2E [72Hz]	72.70Hz	38.70KHz	640x480 *

* Monitor must be capable of 72.70Hz vertical and 38.70KHz horizontal frequency.

72MHz Modes

The following graphic (not text) modes can be displayed after setting the display the video clock speeds to 72MHz. The 72MHz mode will provide a clearer display with less flicker on some monitors. Set the VMODE parameter to VMODE 72m. After this is done you can use VMODE to set the display to any of graphic modes listed below.

VMODE x Value	Vertical Refresh Rate	Horizontal Frequency	Video Clock	Resolution
**37 [72m]	69.80Hz	56.30KHz	72.000MHz	1024x768
***38 [72m]	69.80Hz	56.30KHz	72.000MHz	1024x768

** Requires minimum of 512KB display memory.

*** Requires minimum of 1 MB display memory.

Note : Monitor must be capable of 70Hz vertical and 56.3KHz horizontal frequency.

Typing VMODE ? will display the full array of mode possibilities.

Users that are familiar whith the characteristics of their monitors will find these modes more useful.

Note : Choose modes/resolutions that are compatible with your video board configuration and monitor capabilities.

USING THE COMPATIBILITY MODES

Some programs are written to be run using specific modes or are written according to particular video standards. For example, there are programs that require a monochrome adapter or those that are written exclusively for a Color Graphics Adapter. When these kinds of programs are used, it becomes necessary to make your TSVGA board appear to be what the program requires. This is easily accomplished. In order to select a mode that will change the "appearance" of the video adapter to the software, you need only select the appropriate VMODE parameter. When another mode is needed or desired, you can simply select the mode using another VMODE parameter. In order to return to the default mode(VGA), type VMODE VGA or power down (the VGA mode will be in effect upon power-up). The following is a list of modes and their uses. A complete listing of available modes can be seen by typing VMODE ?.

VMODE CGA - To set the adapter for compatibility with the Color Graphics Adapter.

VMODE MDA - To set the adapter for compatibility with the Monochrome display Adapter.

VMODE HERCULES - To set the adapter for compatibility with the Hercules card.

VMODE EGA - To set the adapter for compatibility with the

Enhance Graphics Adapter.

VMODE VGA - To set the adapter for compatibility with the Video Graphics Array.

A typical use might be for using game software that requires CGA resolution. Using VMODE CGA will put the TSVGA board in CGA mode. If the software needs to be booted in order to work, you simply place the VGA in CGA - compatible mode with VMODE CGA, and warm-boot with your game diskette in the A : drive.

You may switch modes in this manner as often as you wish. VMODE ? will display a list of the available modes. Entering VMODE with no parameter will display a menu screen from which to choose a text mode.

SECTION 4: SOFTWARE DRIVERS

4.1 Read Me First

The dirvers included in your Utility Diskette and their instructions described on the following pages are for both 800x600 and 1024x768 resolutions. These are general drivers for various models of Display Cards based on ET4000 VGA compatible chip.

Please note that the size of the memory (DRAM) installed on your Display Card determines the graphics resolution and number for colors the Display Card provides.

If your Display Card has 256KByte memory, The following resolutions and colors are supported:

- 320x200 in 256 colors
- 640x350 in 16 colors
- 640x480 in 16 colors
- 800x600 in 16 colors

If your Display Card has 512KByte memory, the following resolutions and colors are supported:

- All of the above, plus
- 640x480 in 256 colors
- 800x600 in 256 colors
- 1024x768 in 16 colors

If your Display Card has 1MByte memory, the following resolutions and colors are supported:

- All of the above, plus
- 1024x768 in 256 colors

Please be sure that the model of Display Card you have purchased is capable of displaying the selected resolution in order to utilize the driver. Choosing a resolution other than your Display Card can support will bring unsatisfactory results.

4.2 AutoCAD 2.5 by AutoDesk, Inc.

The instructions which follow are applicable to users of Autodesk's Inc. AutoCAD Version 2.5. Please be sure that your monitor is capable of displaying 800x600 and/or 1024x768 resolutions in order to utilize this driver. Choosing a higher resolution than your monitor is capable of displaying will bring unsatisfactory results.

The Utility Diskette contains the AutoCAD ADI driver program named **DSVGA.EXE** under **ACAD2** sub-directory.

Instructions:

1. Copy the driver program **DSVGA.EXE** contained on the Utility Diskette to the disk which has the AutoCAD program files.

2. The driver program **DSVGA.EXE** needs to be loaded before you can use the 1024x768, 800x600 and 640x480 modes with AutoCAD. Once loaded, the driver remains memory resident until you power off or restart your system. Remember that you need to load the driver only once each time you power on or restart the system.

To load the driver program via one lines of entry type

DSVGA-r{123456}-v{nn}

where-r selects the desired resolution listed below.
1 = 640x480 (8x8 Font, 16 color)
2 = 1024x768 (8x16, Font, 16 color)
3 = 640x480 (8x16 Font, 2 color)
4 = 800x600 (8x16 Font, 16 color)
5 = 640x480 (8x16 Font, 16 color)

where -v selects the interrupt vector for driver used (7A is the default interrupt used by both AutoCAD and this driver).

Example: **DSVGA -r2-v7D**

selects 1024x768 resolution, using interrupt 7D.

Note: DSVGA, and attached parameters may be invoked via a batch file.

DSVGA may also be invoked using the following method, type

DSVGA

The driver program will display the following:

— AutoCAD ADI Driver V2.23 —
VGA Adapter AutoCAD Driver

If you are changing resolutions please respond with original INT number

Enter ADI INT number in HEX (Default=7A)==>

Please Enter Resolution
1 = 640x480 (8x8 Font, 16 color)
2 = 1024x768 (8x16 Font, 16 color)
3 = 640x480 (8x16 Font, 2 color)
4 = 800x600 (8x16 font, 16 color
5 = 640x480 (8x16 Font, 16 color)
Choice ==>

The driver is now all set to be used at the resolution you selected. If later you wish to change driver resolution just type DSVGA again.

3. Using the AutoCAD documentation configure AutoCAD. Simplified instructions are included below.

- Type ACAD
- Select Main Menu item 5 (Configure AutoCAD)
- Select Configuration Menu item 3 (Configure video display)
- Select ADI display
- Select the hexadecimal interrupt, this must match your -v parameter selection when loading DSVGA. The default is 7A.
- Continue through the configuration menu. After you complete the configuration you can begin using AutoCAD.

4.3 AutoCAD Release 9/10, and AutoShade by Autodesk, Inc.

The following instructions are applicable to users of Autodesk Inc's AutoCAD Release 9/10 and AutoShade Please be sure that your monitor is capable of displaying 800x600 and/or 1024x768 resolutions in order to utilize this driver. Choosing a higher resolution than your monitor is capable of displaying will bring unsatisfactory results.

The enclosed ADI Drivercontains an AutoCAD driver program called **VAD140EXE** which in turn is configured by a file called **VINST. EXE.** The **VAD140EXE,** program makes full use of the 640x480, 800x600 and 1024x768 graphics mode of the Display Card.

To configure **VAD** 14Ø.EXE you must first run the **VINST. EXE** program. In running this, you must answer several questions dealing with Resolution, Configuration, and Screen Colors by entering a new value or pressing RETURN to accept the default value displayed by each question.

After all questions are answered in **VINST. EXE,** the program will display a message declaring the AutoCAD ADI driver successfully modified.

Note that there is an extensive list for determining the colors of the various entities comprising the graphic screen. the setting of these colors requires entering a color code number. The following is a listing of color code numbers.

0 Background
1 Red
2 Yellow
3 Green
4 Cyan
5 Blue
6 Magenta
7 White
8-15 intensified versions of codes 0-7

After setting colors for all of the screen elements, your ADI driver configuration is complete.

At this time, you should run **VAD14Ø.EXE** to load the configured driver, before loading AutoCAD. If you wish to change any of the screen element attributes, simply run **VINST.EXE** again to make changes and run **VAD14Ø.EXE** again before loading AutoCAD. **VAD14Ø.EXE** should always be run before loading AutoCAD in order to display in the resolution, and with the screen attributes of your choice.

Running AutoCAD

After the ADI driver has been configured to your requirements and **VAD14Ø.EXE** has been run, AutoCAD can then be loaded.

Using the AutoCAD documenation configure AutoCAD. Simplified instructions are included below.

- Type ACAD
- Select Main Menu item 5 (Configure AutoCAD)
- Select configuration Menu item 3 (Configure video display)
- Select ADI DISPLAY
- Select the hexadecimal interrupt, the default is 7A.
- Continue through the configuration menu

After you complete the configuration you can begin using AutoCAD.

4.4 Windows 2.XX and Windows/386 V.2.1 by Microsoft

The instructions which follow are applicable to users of Microsoft Windows version 2 and Windows/386 version 2.1. Please be sure that your monitor is capable of displaying these resolution in order to utilize this driver. Choosing a higher resolution than your monitor is capable of displaying will bring unsatisfactory results.

Driver installation for Windows Version 2.XX

The Utility Diskette contains new driver files under **WINDOWS2** sub-directory. These drivers will replace the driver file contained on the Windows Screen Driver Diskette.

Instructions:

1. Run the Windows **SETUP** program as usual, when the choose the display adapter menu is displayed, select "Other Display Driver Supplied by Manufacturer" option.

2. when prompted by Windows program "Insert disk for your display driver in the following drive", insert the Utility Diskette into drive "A:" and type **A:\WINDOWS2** and press RETURN

3. Windows will locate the supplied drivers and display:

   VGA Adapter 800x600 16 colors
   VGA Adapter 1024x768 16 colors

4. Select the option you wish to use.

5. When prompted by Windows, select "VGA Fonts".

6. Continue with the rest of the Windows setup process.

After you complete the above steps you can begin using Windows.

Driver installation for Windows/386 version 2.1

The Utility diskette contains the high-resolution drivers, as well as a file called SETUP.INF that replaces the files of the same name on the Windows/386 Setup, Build, and Display 1 diskette. Follow the instructions listed below carefully to install a high-resolution driver.

Instructions:

1. Make a DISKCOPY of the Setup, Build, and Display 1 diskette. Example (for systems with one diskette driver and hard drive):

   C:>DISKCOPY A: A:

   The system will use drive A: for both the original and the copy as the source and target diskettes are inserted alternately for the copy.

2. After the copy is made, return the original to its jacket and store safely.

3. Copy the file **SETUP.INF** from Utility diskette to the newly-created copy of the Setup, Build, and Display 1 diskette. Example (for systems with a single floppy and hard drive):

   C:>COPY A:SETUP.INF B:

   The system will use drive A: as drive B: also. After the copy is finished, type A: [ENTER].

4. Type SETUP [ENTER] to begin installation of Windows/386.

5. When asked if the configuration list is correct, move the cursor to the VGA selection and press [ENTER] to select from the following.

   VGA Adapter 800x600 Mode
   VGA Adapter 1024x768 Mode

6. The program will ask you to insert the VGA Driver Diskette 1 in order to install the driver information. Please insert your Utility diskette in drive A: and type **A:\WIN386** [ENTER]. After this is done, the installation program will continue normally.

4.5 Ventura Publisher Version 1.1-2.0

The following instructions are applicable to users of Ventura Publisher Version 1.1-2.0.

The enclosed Ventura 800x600 and 1024x768 driver files are installed **AFTER** Ventura Publisher has been installed on your system. Please be sure that your monitor is capable of displaying these resolutions in order to utilize the drivers. Choosing a higher resolution than your monitor is capable of displaying will bring unsatisfactory results.

To install your VGA driver, perform the following steps:

1. Follow the Ventura installation instructions.

2. When you are asked to select a video adapter, choose

   E IBM Personal System/2 (640x480) two colors (Version 1.1) or
   E IBM VGA or Compatible (640x480) 2 colors (Version 2.0)

3. Complete Ventura Publisher installation and see that it is working properly using the installed IBM driver.

4. Exit Ventura Publisher and insert the Driver Diskette in your A: drive.

5. Log on to your A: drive, for example

   C:>A: [ENTER]
   A:>

   and type **VPDRV2_0** [ENTER]

6. The program will ask you some questions about your Ventura configuration. Answer them appropriately.

7. When the program asks you what display device and resolution you want to install for, make a selection,

   VGA Adapter (800x600) 16 colors or greys or
   VGA Adapter (1024x768) 16 colors or greys

Whichever is appropriate or desirable for your hardware configuration.

8. The program then asks for the type of mouse you have. Respond as you did during your initial installation.

9. Finally, the program displays the choices you have made and provides you the opportunity to change. If no change is necessary, press [ENTER] or "Y" (the default response is "Y") and the driver will be installed.

10. If you desire a change, press "N" [ENTER] and make your changes.

The driver will then be installed and you can log back on to the hard disk drive and begin using Ventura.

4.6 GEM Version 2.2-3.1

IMPORTANT

The GEM drivers on your Utility Diskette are used for GEM versions 2.2 and 3.0-3.1. The drivers whose file extensions end in. VGA are for GEM Versions 3.0-3.1, while those ending in .SYS are for GEM Version 2.2. This is transparent to the individual GEM programs as they will seek out the appropriate driver files during loading.

Please note that the Utility Diskette supplied to you is created specifically for the drivers contained therein. The original has a volume label called **GEM DRIVRPK** that GEM must see in order to load the drivers. If you need additional back up copy of your driver diskette, it must be indentically copied using the DOS DISKCOPY command in order to preserve the integrity of the order and content of the original.

Driver Installation for GEM 2.2

The following instructions are applicable to users of GEM2.2.

Please be sure that your monitor is capable of displaying these resolutions in order the utilize the drivers. Choosing a higher resolution than your monitor is capable of displaying will bring unsatisfactory results.

The enclosed GEM driver files require a new **GEMSETUP.TXT** file to be installed in place of that which is on **GEM Device Driver Diskette #1.** The driver makes full use of the 800x600 and 1024x768 graphics mode of the Display Card.

Before installing GEM, perform the following steps:

1. Make a DISKCOPY of **GEM Device Driver Disk #1.** This copy will be used in place of the original during installation.

2. Copy **GEMSETUP.V22** from your Utility Diskette to the newly-created copy of the GEM Device Driver Disk #1, as **GEMSETUP.TXT.**

Example: **C:>COPY A:GEMSETUP.V22 B:GEMSETUP.TXT**

Please note that you are copying the GEMSETUP.V22 file from your Utility Diskette to your GEM Device Driver Disk #1 diskette while simultaneously renaming it to GEMSETUP.TXT.

After the GEM Device Driver Disk #1 is copied with the new GEMSETUP.TXT file, you can proceed with the installation.

3. Install GEM as per instructions. When the program asks, "Which graphics card and display do you have?", respond with choice:

   VGA Adapter (800x600) 16-color Mode; VGA 800 or
   VGA Adapter (1024x768) 16-color Mode; VGA 1024

   as your video adapter, whichever is appropriate for your hardware configuration.

   The GEM installation program will ask you to insert the Utility Diskette into drive A and the installation will continue. Complete the GEM installation as instructed.

4. You can now begin using GEM 2.2.

Driver Installation for GEM 3.0-3.1

The following instructions are applicable to users of GEM 3.0-3.1.

Please be sure that your monitor is capable of displaying these resolutions in order to utilize the drivers. Choosing a higher resolution than your monitor is capable of displaying will bring unsatisfactory results.

The enclosed GEM driver files require a new **GEMSETUP.TXT** file to be installed in place of that which is on **GEM System Master Disk.** The drivers make full use of the extended graphics modes of the Display Card.

Before installing GEM, perform the following steps:

1. Make a DISKCOPY of **GEM System Master Disk.** This copy will be used in place of the original during installation.

2. Copy the appropriate Setup file, GEMSETUP.V31 for Version 3.1 or GEMSETUP.V30 for Version 3.0, from your Utility Diskette to the newly-created copy of the GEM System Master Disk, as GEMSETUP.TXT.

   Example:

   For Version 3.0, **C:>COPY A: GEMSETUP.V30 B: GEMSETUP.TXT**

   For Version 3.1, **C:>COPY A: GEMSETUP.V31 B: GEMSETUP.TXT**

   Please note that you are copying the GEMSETUP file from your Utility Diskette to your GEM System Master Disk while simultaneously renaming it to GEMSETUP.TXT.

3. After the GEM System Master Disk is copied and prepared with the new GEMSETUP.TXT file, you can proceed with the installation.

4. The installation of VGA extended mode drivers is a 2-step process.

   a. Install GEM as per instructions, selecting

      IBM 16-Color VGA for PS/2 (640x480) or Compatible

      as your video driver. Complete the GEM installation instructions normally. After completing installation, it is a good idea to start GEM to ensure that it operates properly before doing the next step.

   b. Assuming the GEM worked properly with the IBM VGA driver loaded, reinsert your **System Master Disk** and run GEMPREP again. This time, choose to change your configuration. You want to change the video adapter part of the configuration in order to load the driver. Select from the followings:

      VGA Adapter (800x600) 16-Color Mode or
      VGA Adapter (1024x768) 16-Color Mode

   The program will ask you to insert the GEM DRIVER PACK diskette. This is your Display Card's Utility Diskette. The driver will load and the program will conclude.

5. You can now begin using GEM 3.

4.7 Word Pefect 5.0

The following instructions are applicable to users of WordPerfect 5.0 at 800x600 or 1024x768 resolution. Please be sure that your monitor is capable of displaying these resolutions in order to utilize the drivers. Choosing a higher resolution than your monitor is capable of displaying will bring unsatisfactory results.

The enclosed drivers, **WP800.WPD** and **WP1024.WPD**, are used to enable WordPerfect 5.0 to be displayed at 800x600 and 1024x768 resolution respectively. The drivers need only to be copied onto the disk directory where WordPerfect 5.0 resides. Upon loading the program the following steps should be taken to choose the resolution desired:

1. Form the document screen displayed after entering WordPerfect, press SHIFT/F1 to get to the Setup menu.

2. From Setup, choose option 3-Display. This brings up the Get Setup: Display menu.

3. From the Get Setup: Display menu, choose option 5-Graphics Screen Type.

4. From the Get Setup: Graphics Screen Type menu, choose either;

   VGA Adapter 800x600 16 color
   or
   VGA Adapter 1024x768 16 color

5. Exit from the menus and begin using WordPerfect.

4.8 Lotus 1-2-3 V2.XX, Symphony 1.XX

Introduction

Six drivers for Lotus 1-2-3 Release 2 or later and Symphony Release 1.1 or later are provided on your Utility Diskette under subdirectory name Lotus. These drivers support all the text modes of the Display Card: 80x25, 132x25, 132x28, 132x44 and 80x60. There is one driver dedicated to each of these five modes; each of these drivers, when selected as the active text display for a Lotus product, will automatically cause individual Lotus programs and utilities (1-2-3, Translate, Symphony, Printgraph, etc.) to display in the selected format. For example, if the 132x28 driver has been selected in the installation procedure, as described below, then when 1-2-3 is run, the spreadsheet will display 132 columns by 28 rows of text.

There is also the **'All Color Text Modes'** driver which supports all five text display modes of the Display Card. When this driver is selected, each time you enter an individual Lotus program or utility, you are offered the choice of any of the five display modes. This allows you to switch between 80-column and 132-column displays without exiting to DOS.

We have provided six drivers to give you complete flexibility in configuring Lotus products to meet you needs. If you always want a 132x28 display, install the 132x28 driver and you will automatically get that display every time you start a program from the Lotus or Access menu. If you want the 80x25 display most of the time for speed and reading ease, but want to be able to switch to the 132x44 display quickly to get an overall view of your spreadsheets, install the 'All Modes' driver and select the desired display each time you start 1-2-3 or Symphony. We've left you the freedom to pick the drivers that are right for you.

ONE NOTE: when you are using the **'All Color Text Modes'** driver, whenever you enter Translate utility from the Lotus or Access menu, you should have 80x25 mode selected. The Translate utility operates differently from the other programs and utilities, and often does not show 132-column displays properly from the 'All Modes' driver. Also, the Install utility always comes up in 80-column mode, no matter what driver is used.

Installation Instructions

Before installing the text drivers, be sure that you have read GETTING STARTED in the Lotus 1-2-3 or the Lotus Symphony documentation. This documentation assumes that you are familiar with the Install program and procedures outlined in the Lotus documentation. The Lotus Install program permits new drivers to be added to the driver library via the **Add New Drivers to Library** option of the **Advanced Options Menu.** Once the text drivers are added to the library you may select them via the Modify Current Driver Set option of the Advanced Options Menu.

Please note that the following instruction assumes that you have a Hard Disk system.

1. Insert the Utility Diskette into drive A. Text drivers are in Utility Diskette under LOTUS subdirectory.

2. Copy all text drivers from Utility Diskette onto the hard disk that has Lotus program files.

   COPY A: \LOTUS*.DRV

3. Perform the First-Time Installation of your Lotus product. Refer to the Lotus GETTING STARTED documentation for instructions on running the Install program. Select the **First-Time Installation** option from the main menu. The Install program will guide you through the procedure of selecting the drivers you want. Remember that supports the IBM Enhanced Graphics format, so you should select the EGA card for the initial text and graphics screen display device.

   When you have completed the driver selection, press **F10** function key to display the current driver selections. Please note that the Text Display and Graph Display selections **must** match the samples below in order to use the text drivers. You may want to create several driver sets, and experiment to see which suits your needs.

   When you have completed your selections, the Install program saves the drivers you select in a file, or driver set, called 123.SET for Lotus 1-2-3 or LOTUS.SET for Lotus Symphony. When prompted, respond that you do not want to leave the Install program at this time. Continue with step 5; you are now ready to install the text drivers.

When installing Lotus 1-2-3 your selections should look like:

Text Display	**IBM Enhanced Graphics**
Graph Display	**IBM Enhanced Graphics**
Keyboard	IBM Keyboard
Printer Int.	IBM Printer Interface
File Trans.	IBM PC or compatible
Collating	Numbers first or other choice
Math Unit	Coprocessor Floating Point Driver
	Software Floating Point Driver
Text Printer	None or the printer you selected
Graph Printer	None or the printer you selected

When installing Lotus Symphony your selections should look like:

Text Display	**Universal Text Display-Separate**
Graph Display	**IBM Enhanced Graphics-Separate**
Keyboard	IBM Keyboard
Printer Int.	IBM Printer Interface
Comm Port	None or the comm port you selected
Modem	None or the modem you selected
Comm Protocol	None or the protocol you selected
File Trans.	IBM PC or compatible
Collating	Numbers first or other choice
Math Unit	Coprocessor Floating Point Driver
	Software Floating Point Driver
Text Printer	None or the printer you selected
Graph Printer	None or the printer you selected

4. You should be in the Main Menu of the Install program at this point. Select **Advanced Options** from the Install Main Menu and press RETURN.

5. The Advanced Options Menu will appear on your screen. Select **Add New Drivers to Library** and press RETURN. Note that this step only needs to be performed once.

6. The Install program will ask you to press RETURN. This step creates a file named SINGLE.LBR which contains the drivers we are adding. (Step 3 above copied the drivers from the Utility Diskette to your hard disk, so you are all set to go).

7. The Advanced Options Menu will appear on your screen. Select **Modify Current Driver Set** and press RETURN.

8. The current drivers selected will appear on your screen. Select Text Display and press RETURN.

9. The text display drivers will appear on your screen. Select the VGA Adapter driver you want to use and press RETURN. As discussed earlier, the available drivers are:
   VGA Adapter (All Color Text Modes)
   VGA Adapter (80x25 Color Text Only)
   VGA Adapter (132x25 Color Text Only)
   VGA Adapter (132x28 Color Text Only)
   VGA Adapter (132x44 Color Text Only)
   VGA Adapter (80x60 Color Text Only)

10. The currently selected drivers will appear on your screen. Verify that the driver you selected appears in the Text Display field. Select **Return to Menu** and press RETURN.

11. The Advanced Options Menu will appear on your screen. Select **Save Changes** and press RETURN.

12. At this time the Install program prompts you for the name of your driver set. Lotus 1-2-3 and Lotus Symphony permit selection of the driver set to use when you start the program. If you want to name the driver set, type the name and then press RETURN. For example, if you selected the VGA Display (132x28) driver you may wish to name it VGA28. To save the current driver set using the default name of 123 for Lotus 1-2-3 or LOTUS for Lotus Symphony simply press RETURN. These default driver sets will be used automatically if you don't explicitly select another driver set when you run Lotus or Access.

13. The Install program will inform you that the driver set has been saved. Press RETURN. The Exit menu will appear on your screen. You can create additional driver sets at any time by selecting the **Advanced Options Menu, Modify Current Driver Set**, and **Save Changes** procedures of the Install program (step 8 through 13 above). If you want to create additional driver sets now, press RETURN to go to the Main

Menu. Don't forget to use a different name for each driver you save. When you are finished select Yes and press RETURN to exit the Install program.

14. Refer to the Starting and Ending chapter of the Lotus Getting Started documentation to learn how to start Lotus or Symphony. Below are some examples of how to select a different driver set when starting the program.

If you are starting Lotus 1-2-3

Type **LOTUS** and press RETURN to use the default driver set named **123.**

Type **LOTUS VGA28** and press RETURN, where **VGA28** is the name of the driver set you created used for 132 column by 28 row display on your Display Card.

Type **LOTUS VGA44** and press RETURN, where **VGA44** is the name of the driver set you created used for 132 column by 44 row display on your Display Card.

etc.

If you are starting Lotus Symphony:

Type **ACCESS** and press RETURN to use the default driver set named **LOTUS.**

Type **ACESS VGA28** and press RETURN, where **VGA28** is the name of the driver set you created used for 132 column by 28 row display on your Display Card.

Type **ACCESS VGA44** and press RETURN, where **VGA44** is the name of the driver set you created used for 132 column by 44 row display on your Display Card.

etc.

Using 'All Color Text Modes' text display for Lotus 1-2-3 and Symphony

If you select '**All Color Text Modes**' text driver, after entering 1-2-3, a pop-up menu is activated by issuing a **CTR-A** key input sequence, at which time the text display mode selection menu appears. After selecting the desired mode, the RETURN or ENTER key is depressed causing a beep to emit from the system. This indicated that the desired mode has been set. You must then EXIT to the Lotus Access menu if the program was entered through the LOTUS command, or back to DOS if program was entered with the 1-2-3 command, in order to invoke the desired mode selection.

4.9 Windows 3.0 by Microsoft

The instructions which follow are applicable to users of Microsoft Windows 3.0 and Your Display Card based on Tseng ET4000 VGA chip. Please note that, to use 800x600 and 1024x768 modes, an ANALOG Color display capable of these high resolutions is required.

Your "Tseng ET4000-Windows 3.0 Driver Disk" contains 256 color and high-resolution drivers, as well as a file called SETUP.INF that replaces the files of the same name on the Microsoft Windows 3.0 Setup "Disk 1" diskette. Follow the instructions listed below carefully to install the drivers.

Instruction: -First Time Windows 3.0 Installation.

1. Made a DISKCOPY of the Setup "Disk 1" diskette.
   Example (for systems with a single floppy and hard drive):

   C:>DISKCOPY A: A:

   The system will use drive A: for both the original and the copy as the source and target diskettes are inserted alternately for the copy.

2. After the copy is made, return the original to its jacket and store safely.

3. Copy the file SETUP.INF from your Tseng ET4000-Windows 3.0 Driver Disk to the newly-created copy of the Setup "Disk 1" diskette. Example (for systems with a single floppy and hard drive):

   C:>COPY A:SETUP.INF B:

   The system will use drive A: as drive B: also. After the copy is finished, type A: [ENTER].

4. Type **SETUP** [ENTER] to begin installation of Windows 3.0.

5. Review the configuration list when it is shown. If you wish to change Display type, move the cursor (highlighted line) to the "Display:" line and press [ENTER] to select from the available list.

6. The program will ask you to insert the Tseng ET4000-Windows 3.0 Driver Disk in order to install the drivers as required. After this is done, the installation program will continue normally.

Note:

If you wish to change the display type after completing the installation, click on the Windows Setup icon found in the Main desktop window.

Instructions: -Windows 3.0 Already Installed

To use the Tseng ET4000 Windows 3.0 drivers you need to copy the following files into the \WINDOWS\SYSTEM subdirectory.

VGA443.DRV
VGA448.DRV
VGA463.DRV
VGA464.DRV
VGA468.DRV
VGA474.DRV
VGA478.DRV
VGAMONOX.GR2
VGACOLRX.GR2
VDDTLI4.386
SETUP.INF

If you have ALREADY installed Windows 3.0, you can copy the above list of files into the \WINDOWS\SYSTEM subdirectory. After you copy the files, change the display configuration from within Windows itself to one of the extended drivers. See the Windows documentation for further information.

When you run the Windows Setup to change to a different driver, Windows may prompt you for some of the Windows Installation diskettes. The drivers use display fonts which are contained on the standard Windows 3.0 distribution diskettes.

The enclosed drivers are generic and should work with most ET4000 based boards. The drivers have various display memory requirements and of course your display monitor must be able to support the resolution you select.

The drivers support the following :

Resolution	Mode (HEX)	Minimum display memory required	Driver name
640x480x2	11h	256KB	VGAMONO.DRV**
640x480x16	12h	256KB	VGA.DRV **
800x600x16	29h	256KB	VGA464.DRV
1024x768x16	37h	512KB	VGA474.DRV
640x480x256	2Eh	512KB	VGA448.DRV
640x480x32K	2Eh ***	1MB	VGA443.DRV
800x600x256	30h	1MB	VGA468.DRV
800x600x32K	30h ***	1MB	VGA463.DRV
1024x768x256	38h	1MB	VGA478.DRV

** Uses Windows 3.0 supplied VGA driver

*** Requires a RAMDAC which support the sierra HICOLOR mode. (e.g.SC11486CN)

IMPORTANT

It is important that the drivers be installed properly , replacement grabbers (GP2 extension and Virtual-Display-Device handler 386 extension) are included to properly the extended feature set of the ET4000 VGA chip.

APPENDIX A: Application Note: Using the Extended Color TEXT MODES.

This application note describes how to select the Display Card's 132-column text modes from application programs and how the 132-column text modes memory map is organized.

Selecting 132- and 80-Column Color or Monochrome Text Modes

The Display Card BIOS supports the following 132- and 80-column text modes. These modes are not used by IBM VGA. The numbers are in decimal except as noted.

Mode	Columns	Rows	Length of Memory Map
22 hex	132	44	132x44x2 = 11616 = 2D60 hex
23 hex	132	25	132x25x2 = 6600 = 19C8 hex
24 hex	132	28	132x28x2 = 7392 = 1CEO hex
26 hex	80	60	80x60x2 = 9600 = 2580 hex

The 132-column modes are selected exactly as the standard modes 0-7 and D-13 are selected:

- Place a 0 in register AH to indicate "select mode" function
- Place the mode number in register AL
- Execute an INT 10H instruction, generating software interrupt 10 hex, which invokes the Display Card BIOS to set the mode

The above calling sequence should be familiar to anyone who has ever called the BIOS from assembly language or from a machine-language driver, and is the standard BIOS interface mode select.

132-Column Color Text Memory map

The 132-column color text memory map begins at B800:0000 (monochrome at B000:0000), just like other text modes. Memory is organized with even bytes as character codes and odd bytes as attributes, again just like normal text. The row offset register (CRTC register 13 hex) is normally set to 66 (42 hex) to compensate for the greater width of the screen, and so the start of each row is 264 bytes after the start of the row above it, as opposed to the 80-column row offset register of 40 (28 hex) and 160 bytes from the start of one row to the start of the next.

As indicated in the table above, the lengths of the 132-column memory maps are longer than the nomal 80x25 length of 4000 bytes.

APPENDIX B: Connector Pinouts

Connector Pinouts and video Signals

VIDEO PORT CONNECTOR PINOUT

Pin No.	Function
1.	Red Video
2	Green Video
3	Blue video
4	Monitor ID Bit 2 (not used)
5	Ground
6	Red Return (ground)
7	Green Return (ground)
8	Blue Return (ground)
9	Key (no pin)
10	Sync Return (ground)
11	Monitor ID Bit 0 (not used)
12	Monitor ID Bit 1 (not used)
13	Horizontal Sync
14	Vertical Sync
15	not used

Monochrome type monitors use Green Video for all video input and ignore Red Video and Blue Video.

Monitor ID Bits are not used by the VGA adapter. Monitor type is determined on power up by an automatic monitor detection circuit.

Video Signals
Black level=0V
Full intensity level=+0.7V

Video Feature Connector Pinouts (Optional)

Pin	Function	Pin	Function
1	PD0(DAC pixel data bit 0)	14	ground
2	PD1(DAC pixel data bit 1)	15	ground
3	PD2(DAC pixel data bit 2)	16	ground
4	PD3(DAC pixel data bit 3)	17	Select Internal Video
5	PD4(DAC pixel data bit 4)	18	Select Internal Syncs
6	PD5(DAC pixel data bit 5)	19	Select Internal Dot Clock
7	PD6(DAC pixel data bit 6)	20	not used
8	PD7(DAC pixel data bit 7)	21	ground
9	DAC Clock	22	ground
10	DAC Blanking	23	ground
11	Ext. Horizontal Sync	24	ground
12	Ext. Vertical Sync	25	not used
13	ground	26	not used

APPENDIX C: Hardware Reference

The Memory

a) Memory Size

The size of memory on your Display Card determines the graphics resolutions and number of colors the card provides. Please avoid removing the memory from your Display Card as field downgrade of memory may not be possible.

The following resolutions/colors require 256KByte memory
- 320x200 in 256 colors
- 640x350 in 16 colors
- 640x480 in 16 colors
- 800x600 in 16 colors

The following resolution/colors require 512KByte memory
- 640x480 in 256 colors
- 800x600 in 256 colors
- 1024x768 in 16 colors

The following resolutions/colors require 1MByte memory
- 1024x768 in 256 colors

b) Memory Type and Speed

Your Display Card uses 265Kx4 (44256) DRAM. 8 pieces of 256Kx4 DRAM will comprise 1MByte memory. DRAM speed of 100 nanosecond is recommended.

The Digital-to-Analog Converter Chip

Your Display Card basically functions in digital mode. However, the VGA and new-generation monitors operate in analog mode. The digital-to-analog chip converts the digital signals into analog signals before they are transmitted to the analog monitor.

Video BIOS

This is the video Basic Input-Output System. It is the software interface for programmer to program the Display Card. It simplifies and unifies programming of the Display Card.

The video BIOS is being constantly revised to improve compatibility with PC system BIOS, system software, application software, device driver software. Information of BIOS functions are available in ET4000 Data Book.

VGA-Sync ROM

Some Hercules, CGA, EGA software (eg. Microsoft Windows) by-pass the BIOS and generate their respective frequencies which are different/incompatible to the VGA monitor frequency. The VGA-Sync converts these frequencies to the VGA monitor's frequency, therefore, allowing you to run all pre-VGA software standards on a VGA monitor. VGA-Sync is a transparent, fast and reliable method to assure full backward software compatibility.

PC Bus Connector

Your Display Card may come with either 16-bit bus or 8-bit bus. The 16-bit Display Card provides faster operation. However, an 8-bit Display Card may obtain equivalent performance to the 16-bit Display Card by loading its Video BIOS into PC/AT or PC/386's system RAM (ideally the Shadow RAM). A Utility for this purpose called FASTBIOS.SYS is included in the Utility Diskette.

The 16-bit Display Card is also compatible with the PC's 8-bit bus. The BIOS automatically switches to 8-bit operation when the Display Card is inserted into an 8-bit slot.

Oscillators

Oscillators are the sources of various timing frequencies required to generate various resolutions of the Display Card. However, some Display Card may come with a **clock chip** with one or two oscillators/crystals. The clock chip is able to generate various frequencies from a reference oscillator therefore eliminating the use of many oscillators on the Display Card.

Following is an example of Display Card's oscillators, their resolutions and frequencies. A clock chip will also generate the same resolutions and frequencies as listed below.

Please consult this table to determine suitable display monitors that may be attached to your Display Card for maximum displayable resolutions.

Oscillator speed (MHz)	Resolution	Horizontal Frequency (KHz)	Vertical Frequency (Hz)
25.175	320x200 (VGA&CGA	31.5	70
	640x400 double scanned)	31.5	70
	640x350 (EGA in VGA mode)	31.5	70
	640x480 (VGA graphics)	31.5	60
28.322	720x400 (80x25 text)	31.5	70
36.000	800x600 (extended VGA graphics, 16/256 colors)	35.5	56
40.000	800x600 (extended VGA graphics, 16/256 colors)	38.0	60
	1056x352 (132x44 text display)	31.5	70
	1056x350 (132x25 text display)	31.5	70
	1056x364 (132x28 text display)	31.5	70
44.900	1024x768 (extended VGA graphics, 16/256 colors, interlaced)	35.5	43.5
65.000	1024x768 (extended VGA graphics, 16/256 colors, non-interlaced)	48.0	60
72.000	1024x768 (extended VGA graphics, 16/256 colors, non-interlaced)	56.3	70