Installation & Technical Support User's Guide

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OrCAD®

Electronic Design Automation Tools

Installation & Technical Support User's Guide

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OrCAD®

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THANK YOU for buying OrCAD software.

Please take a moment to read this booklet. It tells you how to install the software, register your purchase with OrCAD, and contact our Technical Support and Customer Service specialists. We want you to get the most out of your software.

Installation

Getting ready to install OrCAD software

This is a guide to installing OrCAD software on your computer's hard disk.

To install and run OrCAD software, your system needs to meet certain minimum requirements. Depending on the product and product family, these specific requirements vary. To determine the requirements for the software you are about to install, please consult the accompanying *User's Guide* or *Reference Guide*. The general requirements are:

- Sufficient system memory. Release IV family products typically require at least 640K of system memory and support additional memory (EMS). Products from the 386+ family typically require at least 2 MB of system memory and prefer more.
- An IBM compatible personal computer with a hard disk and either a high density 3½ inch or a high density 5¼ inch floppy disk drive. Release IV family products can run on PC/XT, PC/AT, and PS/2 computers and later. Products from the 386+ family require computers using the Intel 80386 microprocessor or later.
- DOS version 3.3 or later.
- Free hard disk space sufficient for the applications you want to install. Disk space requirements are listed in READ.ME files.

Your computer system may include optional cards and devices. Setup instructions for these are provided in the manuals that came with them.

Before installing the software, you need to know what type of display adapter your system uses: EGA, VGA, or monochrome. In addition to these basic types, OrCAD software supports many other display adapters. After installing the software, see *Chapter 3: Display drivers* for more information.

Read the READ.ME file

It's sad but true: important information sometimes doesn't make it into the manual. Before installing the software, be sure to read the file called READ.ME found on the first disk in each set of master disks. The READ.ME file includes information about how much disk space each application requires.

To read the file, use the DOS TYPE command. Once you have the ESP design environment installed, you can use the **View Reference Material** editor to review the READ.ME file for each application.

Make backup copies

Before you install the software, protect your investment by making a backup copy of each disk in the set. You may make backup copies as detailed in the License, which is found in *Chapter 4: License* of this booklet. Opening the sealed software package and using the program constitutes acceptance of the terms of the license.

To make backup copies of your disks, use the DOS COPY or DISKCOPY commands. Refer to your DOS manual for instructions.

Installing the software

To install the software, follow these steps:

1. Place the first disk of the set in the floppy drive of your computer.
2. At the DOS prompt, enter the name of the drive the disk is in. For example, if you placed the master disk in drive A, type the command **A:** and press <Enter>.
3. Type the command **INSTALL** and press <Enter>.

   From this point on, the installation software prompts you to enter the information it needs to install the software on your system. When the installation process is complete, the DOS prompt displays.

△ *NOTES: The installation program prompts you for product disks, and it may ask for some disks twice. To ensure correct installation of the software, be sure to insert the correct disks.*

The installation program copies itself to your hard disk during the installation process. You will need the installation program to install future releases and updates.

Where to go next

After installation, your software is ready to use. While you accustom yourself to the design environment and the tool sets, it is a good idea to read through the *OrCAD/ESP Design Environment User's Guide* and the *User's Guides* for the tool sets you installed.

Each OrCAD tool set has a *User's Guide* and a *Reference Guide*. The *User's Guides* contain basic information about the tools and tutorials. The *Reference Guides* contain more in-depth information and cover advanced topics.

Getting started on the right foot—*fast*

When you first use the OrCAD design environment, it is almost impossible to resist the temptation to wade right in and start copying files from old directories to new ones to see what's what. After all, one of the benefits of the graphical interface is that it is sleek and intuitive. Before you do, though, there's one unassuming but very powerful feature you should know about.

It's the *template*. You'll see it for the first time when you start ESP after installation. The title "TEMPLATE Design" displays in the top center of your screen.

The template design is a set of patterns ESP uses to create new designs. Anything added to or taken away from the template will be added to or withheld from designs you make in the future using ESP's **Create Design** tool. Changes you make to configurations in the template become part of all new designs, too.

When you install **Schematic Design Tools**, eight files are placed in the template. To see the list, select **Edit file** from the **Schematic Design Tools** screen. Other files are added when you install other OrCAD products. To find out more about these files and how ESP uses them, see *Chapter 5: Design environment technical information* in your *OrCAD/ESP Design Environment User's Guide.*

Here are some tips for making the best use of the template.

- Remember the TEMPLATE design is just that—a template for new designs. To save disk space, only files that you want to include in *every* design you create should be copied into TEMPLATE. If hard disk space is at a premium on your system, keep the number of files in TEMPLATE to a minimum.
- If you use certain configurations routinely, make these settings in TEMPLATE. They will automatically become part of every new design, eliminating the need to configure tools again and again. For example, if you always want **Create Netlist** to produce one particular netlist format, set this up in the TEMPLATE.
- INSTALL automatically places the macro files MACRO1.MAC and MACRO2.MAC in TEMPLATE. You may remove these files or replace them with your own custom macro files, if you like. *Do not remove* any of the other files INSTALL places in TEMPLATE.

Messages from DOS

Here are some messages from DOS you might encounter during installation.

Not enough disk space

This message means there is not enough free space on your hard disk to install the OrCAD software. Remove some of the files on your hard disk after backing them up on a floppy disk and try again. The READ.ME file for each application includes information about how much free disk space the application requires.

Serious disk I/O error

This message means that the installation program detected a serious error as it was reading or writing files during installation. This message may mean that the disk you received was damaged in some way. Contact OrCAD Customer Service for replacements.

Not enough environment space

This message might appear after you install the software and then reboot your computer.

The design environment uses four environment variables in conjunction with DOS. They are defined in the AUTOEXEC.BAT file for your computer using DOS's SET (Set Environment) command and are loaded every time you turn on your computer. The installation program can add the following definitions to AUTOEXEC.BAT automatically as it installs the software.

```
SET ORCADEXE=C:\ORCADEXE\
SET ORCADPROJ=C:\ORCAD\
SET ORCADESP=C:\ORCADESP\
SET ORCADUSER=C:\ORCADESP\
```

NOTE: The C drive is shown above as an example. During installation, you specify the drive on which to install the environment and other OrCAD software. The installation program places the appropriate drive designator in AUTOEXEC.BAT when it adds the environment variables.

By default, DOS reserves a fixed amount of memory for environment variables. Occasionally, adding variables to your AUTOEXEC.BAT file means DOS needs more than the default amount of memory in order to load the variables. When that happens, DOS displays this message:

```
Out of environment space
```

When DOS reports insufficient environment space, you need to increase the number of bytes DOS reserves for environment variables by using the DOS SHELL command. Using an editor, add this statement to your CONFIG.SYS file:

```
SHELL=COMMAND.COM /P /E:###
```

where:

`/P` makes the change to the environment permanent.

`/E:###` specifies a base 10 integer and indicates the number of bytes to set the environment size. This number must be in the range of 160 to 32768. Non-numeric characters are not allowed. A number between 512 and 768 is usually plenty.

For more information about the SHELL command, see your DOS documentation.

△ *NOTE: If your CONFIG.SYS file already has a SHELL statement and the "out of environment space" message appears, try adding 150 to the value specified after /E:.*

More troubleshooting

Although the installation program places SET commands in your AUTOEXEC.BAT file and modifies your PATH statement, you may need to make these changes to the file:

- If your AUTOEXEC.BAT file runs another program before it reaches the SET commands, the OrCAD tools do not operate properly. To correct this, move the SET commands up in your AUTOEXEC.BAT file so that they are run before AUTOEXEC.BAT runs anything else. The SET commands you need are listed in the section *Not enough environment space* on the previous page.
- If you used older versions of OrCAD software, you should remove paths to the old executable software from the PATH statement in AUTOEXEC.BAT. The path you specify in the PATH statement for Release IV software is `C:\ORCADEXE;`. For example:

```
PATH=C:\;C:\DOS;C:\TOOLS;C:\EDITOR;C:\ORCADEXE;
```

Technical support

This chapter lists the OrCAD resources and services you can take advantage of as a registered customer.

Registration

To help us support your new product, please register your software by filling out the registration card and mailing it to us within 90 days of purchase. Your registration card is inside the sealed packet containing your program disks.

Benefits of registration

We want you to get the most out of your software. As a registered customer, you have a staff of trained Technical Support and Customer Service specialists waiting to help you. By registering your software you receive these benefits for one year from the date of purchase:

- ❖ Free technical telephone support
- ❖ Free product updates
- ❖ Access to OrCAD's twenty-four hour Bulletin Board System, including OrCAD's technical support database
- ❖ Free subscription to the *OrCAD Pointer*, OrCAD's technical newsletter

Technical Support (503) 690-9722

OrCAD is committed to providing you with the best support in the industry. As a registered customer, you are entitled to free technical support for one year on our Technical Support hot line. For help with technical questions, call (503) 690-9722 between 8:00 A.M. and 4:00 P.M. Pacific Time. Please have your registration number ready for the operator.

A specialist will help you solve the problem. You can expedite your call by having this information ready:

- Product name, version number, and configuration settings
- Computer type or model
- DOS version number
- The amount of memory installed
- Display type

Depending on the specific nature of your problem, the Technical Support specialist may also need to know:

- How much free memory remains in your computer after loading OrCAD software
- Name and version number of any Terminate-and-Stay-Resident, or TSR, programs
- Mouse and mouse driver version number
- Type of printer and plotter
- Types of expansion boards

Before calling Technical Support

1. Check to see if your hardware meets the minimum system requirements for the software you are using.
2. Check the documentation that accompanies your software. It should answer most questions.
3. Check to make sure your hardware and peripherals are set up according to the manufacturers' instructions.
4. Make sure all cable connections are secure.

Customer Service (503) 690-9881

OrCAD has a staff of Customer Service experts trained to help you with answers to non-technical questions or problems. Call (503) 690-9881 between 8:00 A.M. and 5:00 P.M. Pacific Time for:

- ❖ Help with registering your product
- ❖ Extending your registration by purchasing a Product Support Agreement
- ❖ Status of your order or update
- ❖ Defective or damaged product disk replacements
- ❖ Device-support lists and technical notes

Customer Service is responsible for maintaining our registered customer database. If you have any questions about your registration status, call Customer Service. If you have moved to a new address, call or write to Customer Service to notify them. By keeping your address current, you will always receive the updates and technical newsletters to which you are entitled, as well as notification of new products.

Sales and Administration (503) 690-9881

Call (503) 690-9881 between 8:00 A.M. and 5:00 P.M. Pacific Time for:

- ❖ Location and phone number of your nearest sales distributor
- ❖ General information about OrCAD products such as features and system requirements
- ❖ Products or Product Support Agreement (PSA)
- ❖ Demonstration disks

OrCAD Pointer

The *OrCAD Pointer* is a technical newsletter about OrCAD personal engineering tools. Its purpose is to:

- Provide up-to-date technical information
- Supplement published manuals and technical notes
- Tell about updates and current development efforts
- Allow users to exchange information about how OrCAD software can be used to maximize productivity

The *OrCAD Pointer* is free to all registered users of OrCAD products with mailing addresses in the United States and Canada. Registered users outside the US and Canada can receive the *OrCAD Pointer* via first class mail for a $5 postage fee. The subscription rate for non-registered users with addresses in the United States is $10 per year. Non-registered users with mailing addresses outside the United States may subscribe for $10 per year plus postage.

Send subscription inquiries, address changes, and all correspondence regarding the *OrCAD Pointer* to:

OrCAD, Inc.
Publications Department
3175 NW Aloclek Drive
Hillsboro, OR 97124-7135

Bulletin Board System (503) 690-9791

For twenty-four hour access to the Bulletin Board System, call (503) 690-9791. The services provided by the Bulletin Board System are:

- New releases of software updates for printers, plotters, graphic cards, and libraries
- Technical notes and a database answering the most frequently asked questions
- Replies to technical support questions you post to the bulletin board
- General information about OrCAD, mail from other OrCAD users, and custom libraries, drivers, and utilities contributed by our customers

System requirements

To access the OrCAD bulletin board you need:

- A 300, 1200, or 2400 baud modem set for eight data bits, one stop bit, and no parity.
- Any communications software. You may wish to use software which supports ANSI graphics.

Configuration

Set your communications software to send and receive data using an error-correcting protocol such as XMODEM, YMODEM, SEAlink, KERMIT, or SuperKERMIT. These protocols send or receive binary information or data containing control characters. You can also send plain ASCII files to and receive from the bulletin board.

Bulletin Board System maintenance

The bulletin board operates twenty-four hours a day, except when it is shut down for maintenance. If you are not able to establish communications after a few rings, the bulletin board may be down for maintenance, and you should call back later.

Logon instructions

The first time you log on to the bulletin board, you can use many, but not all, bulletin board features. First, you must register by entering your password and registration number.

The bulletin board prompts you to enter all the necessary information. Allow two to three working days for OrCAD to upgrade your access level.

Once OrCAD changes your access level to "registered user," you can access all of the bulletin board features. We encourage you to explore what is available.

Product Support Agreement (PSA)

The first year of OrCAD support is free when you buy any OrCAD product. If you live in the U.S. or Canada, after the first twelve months, you can purchase an OrCAD Product Support Agreement (PSA). Your PSA extends the same benefits you receive when you register your new product with OrCAD for another year:

- Free technical telephone support
- Free product updates
- Access to OrCAD's twenty-four hour Bulletin Board System, including OrCAD's technical support database
- Free subscription to the *OrCAD Pointer*, OrCAD's technical newsletter

To get a PSA, contact OrCAD Sales and Administration.

If you live outside the U.S. and Canada, contact your OrCAD distributor or OrCAD international sales representative for information about update support.

Display drivers

IBM PC compatible systems can be equipped with any of a wide array of display adapters. The information in this chapter is arranged so that the most common adapters are discussed first. If you have one of the more common adapters, skim the rest of the chapter. If you have a more complex adapter and have it working with the manufacturer-supplied software, you should be able to easily understand the technical notes in this chapter.

About display drivers

A display driver is a program which processes a graphic drawing request from an OrCAD program so that it works on a specific display adapter. That is, a driver lets you see what the program wants you to see on your monitor.

OrCAD supplies a large set of display drivers that support a wide variety of display adapters. Each driver is optimized either to give the best possible performance or to give very good performance with some flexibility.

You specify the display driver you need on the **Configure ESP** screen and on the configuration screens for each of the OrCAD design tools. Depending on the flexibility of your display adapter and monitor, you may wish to use different drivers for different applications.

OrCAD display drivers can be grouped into these categories, each of which is discussed in more detail in this chapter:

- Drivers that support standard display modes including EGA, VGA, and Hercules Monochrome Graphics.
- Drivers that support Super VGA adapters that can display 1024x768 or greater.
- Drivers for EGA and VGA displays up to 800x600 that you create with a program called **Gendrive**.
- Drivers for "standard" interfaces that take advantage of on-board graphics co-processors. These include support for the TIGA and DGIS standards.
- Drivers for specific manufacturers' boards.

Drivers for standard display modes

Most users purchase display adapters and monitors that work with standard display modes. OrCAD supplies the following drivers to support these modes:

VGA640.DRV	Supports 640x480x16 colors and should work for most cards with "VGA" in their names. This card may also work with EGA cards that support 640x480, but if it doesn't, you can use **Gendrive** to create one that works.
EGA16E.DRV	Supports 640x350x16 colors and should work with most cards with "EGA" in their names.
HGC2.DRV	Supports 720x348x2 colors and should work with Hercules Monochrome Graphics Adapter or any card claiming to be Hercules compatible.
VESA800.DRV	Supports 800x600x16 colors and should work with VGA cards that claim to support the Video Electronics Standards Association extension to 800x600. If this driver doesn't work, you can use **Gendrive** to create one that does.

Drivers for displays up to 1024x768

OrCAD supports VGA extension cards which provide 1024 x 768 resolution. However, each vendor uses different software interfaces for their cards. OrCAD provides separate drivers for each of these cards. The cards currently supported are:

8514A.DRV	Supports cards that are 8514 "register level" compatible (1024 x 768).
AHEAD1K.DRV	Ahead Systems Wizard Video Graphics Adapter.
ATI1K.DRV	ATI VGA WONDER, version 4 and later of the chip.
ATI1024.DRV	Supports cards using the ATI MACH 8 or MACH 32 chips.
CHIPS1M.DRV CHIPS512.DRV	Supports cards using Chips and Technology Super VGA chips. The CHIPS1M driver requires 1 MB of RAM on the display card; CHIPS512 uses 512K of RAM on the display card.
CIRRUS1K.DRV	Supports cards using the Cirrus Logic CL-GD5410 chip.
GEN641K.DRV	Genoa SuperVGA 6400 cards. Use GENOA1K.DRV with Genoa 5400 cards.
GENOA1K.DRV	Supports Genoa SuperVGA cards in 1024x768 mode. The card is based on the Tseng Labs EV3000 chip. OrCAD supports mode 37H because many cards with the Tseng Labs chip have BIOS's that use this mode. Verify if your board uses a Tseng Labs chip or your manual mentions a mode 37H which supports 1024x768 and 16 colors. Use GEN641K.DRV with Genoa 6400 cards. The following companies use the Tseng Labs chip set: Sigma Designs VGA/H, NANAO, EIZO, SOTA VGA/16, and Orchid ProDesigner.

OAK1K.DRV	Supports cards using Oak Technologies OTI-067 chip.
S31024.DRV	Supports cards using the S3 chips: 86C911, 924, 928, 801, or 805.
TECMAR1K.DRV	Supports TECMAR VGA/AD in 1024x768 mode.
TRI1K.DRV	Supports cards that use the Zymos Poach Set and the Trident TVGA8900c chip.
TSENG1K.DRV	Tseng Labs ET4000 Graphic chip sets. Originally developed with an Orchid ProDesigner II card.
VEGA1K.DRV	Supports Video 7 VRAM cards with 512KB of memory. Also supports Headlands 1024i cards.
WD1K.DRV	Western Digital WD90C00 Chip set. Supports Paradise cards capable of doing 1024x768.

△ ***NOTE:*** *1024x768 in 16 colors requires more than 256K of display memory. Some display adapters that can do 1024x768 are sold with only 256K. You have to add memory to get the higher resolution.*

Most EGA/VGA cards start the display buffer at `A000:0`. ***Gendrive*** *can handle up to 800 x 600 (60,000 bytes) in one 64K segment.*

Most OrCAD VGA drivers issue INT 10H to invoke a BIOS mode which supports 1024x768. OrCAD does not support special timing values required for the cards to work with different multi-frequency monitors. In some cases, the cards come with software which supports multi-frequency monitors.

▲ *CAUTION: Some cards which implement 1024x768 display modes use a technique called interlacing. These cards are often described as IBM 8514-like cards, since that IBM display adapter uses interlaced output.*

Interlaced means the display is drawn in two passes. The even lines draw on one pass, the odd lines draw on the next. This approach is implemented with slower and less expensive parts. Unfortunately, it often results in poor picture quality.

OrCAD provides drivers for cards running in interlaced modes. However, you should purchase such cards and monitors with great care. Verify that the card and monitor work well in your environment before losing the option to return them for a refund or upgrade.

Drivers for displays up to 800x600

OrCAD uses **Gendrive** to support various display drivers with enhanced resolution modes up to 800x600. **Gendrive** is a utility for creating a custom display driver to support your system's video graphics card.

About Gendrive

To create a driver with the proper functionality and performance, **Gendrive** modifies the internal configuration of a generic driver. **Gendrive** can create drivers for most display adapters claiming to be EGA- or VGA-compatible with resolutions up to 800 horizontal x 600 vertical.

EGA and VGA cards have the hardware capability to map a logical color to an actual color on the display screen. This mapping is done via a color palette table. In addition, a border around the drawing area is usually supported and the palette is initialized to draw the border in black. **Gendrive** allows you to re-define the color palette, and lets you change the color assignments.

How to use Gendrive

Follow these steps to create a display driver:

1. At the DOS prompt, type **cd \orcadesp\drv** and press <Enter>. If you chose a different directory structure than the one OrCAD recommends, substitute the path to the directory containing GENDRIVE.EXE.
2. To run **Gendrive**, type **Gendrive** and press <Enter>.

   Gendrive initializes itself and reads in the OrCAD-supported set of configurations from GENDRIVE.DAT. Then it displays the driver description part of the file as a set of menu options. The four options are:

   - Entering the number associated with your display adapter. You can use the ↑ and ↓ keys to scroll through the menu to see the available options.
   - Pressing **<M>** to see more menu options.
   - Pressing **<Q>** to quit **Gendrive.** No updates occur.
   - Pressing **<S>** to define a special set of parameters. For more information, see the *Defining a Special Display Driver* section of this chapter.
3. If you do not see an appropriate menu option, select **<S>** and skip ahead to the section *Defining a special display driver.*
4. Select an option.

   Gendrive reads the file **GENDRIVE.DRV** and updates it with the set of parameters associated with the menu item you selected. Then **Gendrive** displays the current assignments of the color palette and allows you to assign new color values.
5. If you decide to change the palette, refer to the *Color Palette Assignments* section later in this chapter for detailed instructions.

   Otherwise, select **<Q>** to quit this part of the process without saving selections. Use **<U>** to save the changes. Once you have exited the palette definition menu, **Gendrive** asks you to enter a name for the new driver.
6. Enter a filename for the new driver. **Gendrive** writes the new driver to the disk and exits.

The new driver is ready to use. Configure your OrCAD software to load this new driver in the **Configure ESP** screen and all of the OrCAD tools' configuration screens. Refer to the *OrCAD/ESP Design Environment User's Guide* and the OrCAD Reference Guides for the tools you need to configure.

△ ***NOTE:*** *Display drivers have limited ability when it comes to checking for adapter compatibility. If the video adaptor and the new driver are not compatible, you may see either a blank screen or a screen that displays random patterns. If you select one of the predefined driver configurations, this shouldn't happen to you, but if it does, you may need to re-boot your computer to get back to the system prompt.*

Defining a special display driver

To define a special display driver, you need to know some technical information about your display. Refer to the technical reference or programmer's reference section in your display adapter's manual as you complete step 1.

1. If you have not already done so, follow steps 1 through 3 in the *How to use Gendrive* section preceding this section. After you press <S>, **Gendrive** asks you to define these parameters:

   - The number of columns of pixels your display adapter supports. Typical values are 640 or 800.
   - The number of rows of pixels your display adapter supports. Typical values are 350, 480, or 600.
   - A value to be assigned to AX to set up for an interrupt 10H. The value entered must be a hexadecimal number. This is often referred to in the adapter user's manual as a display mode. Make sure the number specified in the manual is expressed in hexadecimal. If the standard VGA mode (640x480x16) is listed as 12, then the table is probably in hex.

The AX and BX values must be consistent with the numbers of columns and rows you enter. Standard EGA/VGA values normally have AH (most significant byte of the word AX) equal to 0 and AL (least significant byte of AX) equal to either 10 (EGA 640x350) or 12 (VGA 640x480). Hence, AX = 0010H or 0012H for these. Extended EGA cards often use AL=12H for 640x480 mode. The register values for sizes above 640x480 vary considerably. In addition, certain cards want to see a value for AH that is not 0.

- A value to be assigned to BX to set up for an interrupt 10H. The value entered must be hexadecimal.

  Interrupt 10H is the BIOS video interrupt. Many technical references for the PC discuss this interrupt in detail.

2. If you want special information to display while the driver is initializing, enter the text at the "Identification displayed during driver initialization: Driver Name:" prompt. The color palette displays.
3. Make any desired changes to the color palette as described in the next section, and then press **<U>**.
4. Enter a filename for the new driver. **Gendrive** writes the new driver to the disk and exits.

Color palette assignments

Using the EGA/VGA Palette Definition menu, you can change color options for the driver you are creating. As shown in the figure below, the menu at the bottom of the screen tells you what commands are available.

△ *NOTE: Although the color palette is easy to change, you probably only should change it to compensate for poor lighting. To skip to the next screen, press <Q>.*

```
GENDRIVE - EGA/VGA Palette Definition
-------------------------------------
Index       Normal Color      Current Color
    0       Black             Black
    1       Blue              Blue
    2       Green             Green
    3       Cyan              Cyan
    4       Red               Red
    5       Magenta           Magenta
    6       Brown             Brown
    7       Dark Gray         Dark Gray
    8       Light Gray        Light Gray
    9       Light Blue        Light Blue
   10       Light Green       Light Green
   11       Light Cyan        Light Cyan
   12       Light Red         Light Red
   13       Light Magenta     Light Magenta
   14       Yellow            Yellow
   15       Black             Black
   16       White             White                          (16=Border)
   H - Help
0-16 - Change that Index Q - Abandon Redefinition    U - Use Settings Above
   R - Reverse/Color     M - Reverse/Mono (1-15-->0) N - Reset to Normal
Selection ->
```

Gendrive's EGA/VGA Palette Definition menu.

These three commands let you change the color palette:

- **<0 - 16> Change that Index.** Lets you re-assign a color according to your preference. You can re-assign any of the sixteen colors plus background. In addition to letting you tailor the appearance of the display to match your personal preferences, this command also lets you map red or other dim colors to brighter colors when using a projection device for presentations or review meetings.

- **<R> Reverse Color.** Changes black and white, but leaves other color assignments alone. The background and border are white; the text and the cursor are black. This mode is useful in environments with lots of glare or if you find switching between black characters on white paper to a normal mode video screen disorienting. You may need to experiment with other color assignments. In particular, colors 7, 8, and 14 (Dark Gray, Light Gray and Yellow) are often difficult to see against the white background.

- **<M> Reverse Video Monochrome.** Maps black to white and *all* other colors to black. This gives you a reverse video monochrome screen. Depending on the quality of your display, this display mode may have a fairly crisp "black type on white paper" look. This may be useful in a high glare environment.

To help you keep track of changes made to the color palette, **Gendrive** displays the message "CHANGED" on the screen next to a newly assigned color when you change an index. If you make a mistake, you can either reassign the mis-specified color or press <N> (for Normal) to reset all colors to their default assignments.

The other four color palette commands are:

- **<H> Help.** Displays additional information on the screen about the color assignment options.
- **<Q> Abandon Redefinition.** Exits the color palette definition screen without making any assignments. **Gendrive** builds a driver that does not access any of the color palette routines.
- **<N> Set to Normal.** Returns all color assignments to their default settings.
- **<U> Use Settings above.** Tells **Gendrive** to build a driver using the settings displayed.

△ *NOTES: The display adapter does color mapping without the rest of OrCAD software being aware of it. The Color Table options in the Configuration screen for your OrCAD product assume the default table is active, and the menu options presented remain those that are standard, ignoring the possibility of re-mapping using* ***Gendrive.***

For EGA cards, ***Gendrive*** *makes an educated guess about the proper way to redefine colors. This works for most EGA cards. If it does not yield satisfactory results on your system, contact Technical Support.*

Adapter technical requirements

Gendrive is designed to handle display adapters that follow the general conventions of native mode EGA and VGA displays. These conventions are:

- The display buffer starts at address `A000:0`.
- Less than 64K bytes of addressable display memory is required.
- To calculate the size of memory required by a display, use this formula:

  ```
  rows * columns / 8
  ```

  For example:

  ```
  640 * 480 / 8 = 38400 bytes
  800 * 600 / 8 = 60000 bytes   (just less than 64K bytes)
  1024 * 768 / 8 = 98304 bytes  (too large)
  ```

- OrCAD software normally uses sixteen colors. This implies the display buffer is really composed of 4 bit planes of 64K bytes each.
- Pixels are stored eight pixels per apparent byte. The high order bit of byte `A000:0` represents the upper left most bit on the screen. Each one of these bytes is mapped to four bytes by the EGA or VGA hardware.
- The number of columns must be a multiple of eight. That is, no byte contains bits from both the right end of a line and the left end of the next line. We know of no graphic adapters that violate this rule.
- The mapping from bits on screen and in memory must be continuous. For example, if byte `n` contains the last 8 bits on line `m`, then byte `(n+1)` contains the first 8 bits on line `(m+1)`. Various non-EGA/VGA adapters and modes violate this rule. For example, CGA and Hercules Graphics modes.

Editing the Gendrive control file

Gendrive is controlled by an editable ASCII file called GENDRIVE.DAT. You can change this file to make a special definition process into a menu option. You might want to do this if you have a large number of users and a small number of adapters for which OrCAD does not currently provide ready-made drivers. If you choose to edit the file, make sure your text editor can output ASCII-only files with carriage return/line feed sequences as line separators.

Any line that starts with a semicolon is a comment. Any line that is not a comment must be a mode specification.

A mode specification consists of five fields separated by commas:

```
Driver Description, Columns, Rows, AX value, BX value
```

where:

- `Driver Description` is text that displays during application initialization. It normally contains "`Columns x Rows`" and a display adapter description. If this field contains an embedded comma, the usual field delimiter, you must enclose the field in either single or double quotes.

  Examples:

`EGA 640x350 16 color`	No quotes needed
`"EGA 640x350, 16 color"`	Quotes required
`"EGA 640x350 16 color"`	Quotes optional
`'EGA 640x350 16 color'`	Quotes optional

- `Columns` is the number of columns of pixels the display supports. Enter this number in decimal.

  Examples:

  ```
  640
  752
  800
  ```

- `Rows` is the number of rows of pixels that the display supports. Enter this number in decimal.

  Examples:

  ```
  350
  480
  600
  ```

- `AX value` is the value to be MOVed into AX before doing an INT 10H to initialize the card. Enter this number in hexadecimal. Hexadecimal is used here because most manuals show the numbers in hex.

  Examples:

  ```
  0010H
  0012H
  ```

- `BX value` is the value to be MOVed into BX before doing an INT 10H to initialize the card. Enter this number in hexadecimal. Again, hexadecimal is used here because most manuals show the numbers in hex.

  Examples:

  ```
  0H
  0012H
  ```

  The latter value causes 640x480 modes for some extended EGA cards.

Example Here is a mode specification for a Genoa SuperEGA EGA 640x480 graphics adapter card:

```
'GENOA SuperEGA EGA 640x480 16 color', 640, 480, 73H, 0H
```

To see the most current listing of graphics display drivers supported by **Gendrive,** use the DOS TYPE command to display the file GENDRIVE.DAT.

Drivers for DGIS and TIGA displays

DGIS is a graphics interface defined and supported by Graphics Software Systems of Beaverton, OR. It runs on many high resolution cards. Refer to your manufacturer's user's manual for instructions for how to start DGIS.

TIGA (Texas Instruments Graphics Architecture) is a graphics interface defined by Texas Instruments to use with their 34010 and 34020 graphics chips and is supported by many companies. Using this protocol, OrCAD supports a wide range of display drivers with one piece of software. See the user's manual for your graphics adapter card for specific instructions about TIGA. OrCAD-specific notes are included in this section.

About the TIGA display driver

The TIGA protocol allows communication between three pieces of software to produce high performance graphics for PC-compatible computers.

The three pieces of software are:

- TI 34010 or 34020 software running on a display adapter card. The 34010 and 34020 are specialized computer chips that handle graphics processing five or more times faster than a 80386 processor.
- The TIGA System Driver. This driver is PC-based software loaded either by **CONFIG.SYS**, a Terminate-and-Stay-Resident program, or a combination of both.
- The OrCAD TIGA driver, which lets OrCAD software communicate with the TIGA System Driver to request services of the adapter resident code.

Over 20 display card manufacturers use the TI 34010 or 34020 graphics chips. Most have announced their intention to provide TIGA support. OrCAD supplies the TIGA driver directly, but the other required software (the TI software and the TIGA System Driver) is supplied by the manufacturer of your display adapter. You may have to specially request this software from the display adapter's manufacturer or dealer.

Why TIGA?

TIGA lets OrCAD support a wide range of display resolutions with one piece of software. To support these display adapters with standard drivers would mean creating drivers that are much slower than our current drivers. Running "flexible" code on a processor faster than the host processor lets OrCAD offer flexibility without performance degradation.

With the current version of TIGA and a TI 34010 board, most OrCAD software runs at about as fast as with the best VGA and Super VGA cards. Future versions of TIGA could improve on this. Future versions of TIGA (or TIGA with a TI 34020) could be perceptibly faster than VGA.

On higher resolution displays, OrCAD software normally does not draw bigger objects on the screen, but instead draws more objects. Given the same technology, each object takes the same time to draw. Higher resolution therefore usually means a longer redraw time, but with fewer redraws. OrCAD software minimizes redraw time since it is an important first-order determiner of user productivity. OrCAD supports a large set of VGA, Super VGA and 1024x768 VGA cards of varying cost and performance. The more expensive, faster cards at any resolution level reduce redraw time. Now, by buying the TIGA compatible cards, you can continue up from 1024x768 and still trade-off price and performance options.

OrCAD's TIGA driver

The TIGA driver works with most cards implementing TIGA. Because of the complexity and recentness of TIGA implementations, the driver is not guaranteed to work with every TIGA implementation.

Manufacturers of 34010/34020 boards with TIGA support

The following manufacturers produce 34010 or 34020 boards with TIGA support. In many cases, these manufacturers have local distributors and retailers. Many more manufacturers have announced intent to support TIGA.

Artist Graphics
2675 Patton Road
St. Paul, MN 55113

Dell Computer Corporation
9505 Arboretum Blvd
Austin, TX 78759

Hewlett-Packard, GTD
3404 East Harmony Road
Fort Collins, CO 80525

Micro Display Systems
755 East 31st Street
Hastings, MN 55033

National Design, Inc.
1515 Capital of Texas Hwy.
South, 5th Floor
Austin, TX 78746

Number Nine Computer Corp.
725 Concord Avenue
Cambridge, MA 02138

RenaissanceGRX
2265 116th Avenue, NE
Bellevue, WA 98004

Installing TIGA

Follow these steps to install TIGA.

1. Install the TIGA hardware and run whatever setup is needed for your system. See the manufacturer's instructions.
2. Run the OrCAD INSTALL program and install both TIGA1.DRV and TIGA2.DRV. TIGA1.DRV runs with TIGA release 1.1 system drivers. TIGA2.DRV runs with release 2.0 system drivers.
3. Install the TIGA software following the manufacturer's instructions. See comments below on the TIGA system driver, number of bits per picture element, and adapter memory requirements.
4. Run ESP and configure your OrCAD products to run with one of the TIGA display drivers by entering either `TIGA1.DRV` or `TIGA2.DRV` in the **Configure Display Driver** entry box of each product. Refer to the Reference Guide for each product for help with configuration.
5. Before trying to do productive work, run the application for a while to see if TIGA error messages show up or the system hangs. See the test sequence suggested near the end of this chapter in the section *Instability after a failure.*

TIGA system driver

Install the TIGA System Driver according to the instructions supplied by your display adapter manufacturer. This may require any or all of these steps:

- Add a **DEVICE=** statement to **CONFIG.SYS**. If required, this software often sets up a base environment that supports the manufacturer's own software protocols, the DGIS protocol and TIGA.
- Invoke a Terminate-and-Stay-Resident program that sets up the final environment for TIGA. This program is usually called **TIGACD**.

- Run a program that allows you to set up the screen resolution and the number of bits per pixel. The *Pixel sizes: 1, 4, and 8 bits* section later in this chapter tells how. In some cases, this set-up is accomplished by setting parameters in the **DEVICE=** statement. In other cases, the final adjustment can only be made with the **MODE** adjustment program. The name of this program varies with the manufacturer.
- Add a line to the AUTOEXEC.BAT file to set an environment variable to point to the directory where the TIGA files are placed. Add this line:

  ```
  SET TIGA=-m<directory>-l<directory>
  ```

  where:

  `m` Specifies the path for TIGA system files. All TIGA system files are placed in the TIGA directory of the destination drive.

  `l` Specifies the path for TIGA dynamic user modules.

  Replace `<directory>` with the directory name. An example is:

  ```
  SET TIGA=-mC:\TIGA-lC:\TIGA
  ```

Pixel sizes: 1, 4, and 8 bits

OrCAD software runs best with 16 colors. This requires four bits per picture element (4-bit pixels). OrCAD's TIGA driver determines the pixel size during initialization. If the pixel size is four or eight, OrCAD's TIGA Driver assumes colors 0 through 15 display the same as colors 0 through 15 display on an EGA or VGA display adapter.

If the pixel size is less than four, OrCAD's TIGA driver resets an internal table to map colors 1 through 15 to all-bits (1, 2 or 3) on. Color 0 is Black (all-bits off) for all pixel sizes. If your adapter is attached to a monochrome display, this results in proper display of all OrCAD objects in the Color Table set to colors other than black. On a color display, this normally results in objects displaying with one color only: blue for a one-bit pixel, or cyan (blue+green) for a two-bit pixel.

It is a good idea to run color monitors with four-bit pixels, monochrome monitors with one-bit pixels, and gray-scale monochrome monitors with four-bit pixels. Running other combinations either wastes memory (eight-bit pixels) or visibly degrades image quality (blue or cyan with one or two-bit pixels).

Adapter memory requirements

OrCAD's TIGA driver needs some non-display memory, approximately 50K in this release, on the adapter card, to handle a down-loaded character font and to speed up certain operations.

Although unlikely, it is possible your card may not have enough memory or not have it available when the card is set for its maximum resolution and pixel size mode. For example, if your card can display 1024x768 with eight-bit pixels, it might not have spare memory when in full mode. If you reduce pixel size to four bits, half of display memory is freed and becomes available.

On some cards, you also specify how many "pages" of display are available. In the above example, the mode program might step you from 1024x768x8 with one page to 1024x768x4 with two pages. This does not free up any memory. You need to specify a mode with one page of memory.

OrCAD's TIGA driver requests this memory through a series of GSP_Malloc calls (Graphics System Processor Memory Allocation). If the card does not have enough memory, you will see a message that includes the phrase: "GSP_MALLOC Failure." If this message appears, you must adjust your mode down.

PC memory requirements

The manufacturer's TIGA software may use up a lot of PC memory, thereby interfering with some OrCAD software running requirements.

High resolution—high zoom mismatches

OrCAD software uses the fastest possible arithmetic for calculating screen coordinates. This normally involves using 16-bit values less than 32767. When the product of the resolution and the **ZOOM** factor is greater than 32767, the result unexpectedly becomes a negative number. With **Schematic Design Tools**, this is normally not a problem since its maximum zoom is 20 and the maximum resolution is 1600 (product = 32000).

If the problem occurs, you see a mathematical inversion of your board display on the screen. To recover, just zoom in one level. Normally, no harm is done. You should be able to see all or most of your board at the lower level.

Messages

Occasionally you may see one of the following messages display.

Incorrect version of TIGA

OrCAD's TIGA1.DRV driver is designed to work with TIGA Version 1.1 from TI. It does not run properly with a TIGA 1.0 System Driver. (OrCAD is not aware of any manufacturers that released a 1.0 driver, but they may use them internally.) TIGA2.DRV is designed to work with TIGA Version 2.0 or later.

GSP_Malloc Failure

See the previous sections concerning adapter and PC memory requirements.

Mixing VGA and EGA, dual and single monitors

Some manufacturers' display cards work with VGA and EGA adapters and some do not. Most adapters that plug into the PS/2 Micro Channel Architecture will work. Some monitors are manufactured with the ability to alternate between VGA and TIGA modes under software control. This is more complex on AT-Bus systems. Some manufacturers produce VGA cards that interface via special cables to the TIGA card. These allow one monitor to handle both modes. Unless you buy one of these, the chances for running VGA and TIGA in one system is lower. The probability of running from one monitor is zero.

Monochrome display and Hercules-compatible adapters seem to work with the TIGA cards. This implies separate displays, which is not necessarily bad. A good monochrome screen is inexpensive compared to a color screen and is better for text work. Hence, a dual display system with monochrome for text work and color for graphics may be a desirable, if forced, condition.

Upon exiting from an OrCAD application or during a **Suspend to System** process, the application invokes TIGA function **Set_VideoMode** with a mode of MDA (monochrome). This invokes a **BIOS Set Videomode** via an Interrupt 10H. In most cases, this activates your default video controller. It usually works with monochrome, Hercules, EGA and VGA controllers.

If it doesn't work, there are two problems, one you can fix, and one you cannot. You can invoke the OrCAD application via a batch file that invokes another program upon exit from the application. This program does whatever is necessary to restore screen function. The problem with **Suspend to System**, however, is you can't automatically invoke such a fix-it program. You might have to type the program name and enter it while the screen is unreadable.

If you do have a problem with exiting or **Suspend to System**, please contact OrCAD Technical Support. If possible, OrCAD will modify the driver to handle your specific situation more smoothly.

Instability after a failure

TIGA is complex. Sometimes, it fails and cannot be restarted with normal software processes. If this happens, it may be necessary to re-boot your computer by pressing `<Ctrl><Alt><Del>`.

Fortunately, most problems occur during initialization for TIGA or when setting up to return to the system. Except for **Suspend to System**, this usually means your data is safe because you either have not accessed the application yet (during initialization), or you saved it (before quitting). In most cases, these problems are intermittent, and therefore, hard to identify and fix. Their frequency has gone down with each release from the card's manufacturer. Although most of the problems are ultimately not OrCAD's fault, if you experience a failure, please contact OrCAD Technical Support so we can be aware of the problems for other OrCAD customers and coordinate solutions with the card's manufacturer.

Before beginning production work, test your TIGA environment by following these steps:

1. Set your system up, installing or checking the TIGA hardware and software and running diagnostics supplied by the adapter manufacturer.
2. At the DOS prompt, enter **CHKDSK**. Make a note of the "bytes free" value.
3. Configure your OrCAD application to use either the TIGA1.DRV or TIGA2.DRV display driver.
4. Run your OrCAD application.
5. Exit the OrCAD application.
6. Enter **CHKDSK** again. The "bytes free" value should be unchanged.
7. Run the OrCAD application.
8. Select **Suspend to System**. Is the screen readable?
9. Enter **EXIT** to get back to the application. Is the application readable?
10. Repeat steps 7 and 8 several times, checking that the screen is readable after each command.
11. Exit the application.

12. Enter **CHKDSK** again, and note the "bytes free" value.

    If CHKDSK reports the same value for bytes free each time, and the screen is readable after each operation, then the probability of the system hanging is low.

    If the system hangs, or you get a message such as "Time Out waiting for Command Buffer," please report the last task you performed to OrCAD Technical Support.

Drivers for specific displays

Other drivers for specific display adapters display when you install OrCAD software. You can also obtain a list of available drivers and the drivers themselves from OrCAD. If you are buying a relatively new graphics card, call Technical Support. We may have your new driver in development.

Applied Data Systems (ADS) was among the first to develop a driver for OrCAD. This driver, ADS.DRV, runs with a RISC processor on their board. Check the READ.ME file on your ADS software disks for more information about the ADS driver.

Changing display drivers from DOS

If the display driver you select when you install ESP is incompatible with your monitor, or the display driver is unspecified, your display may not be function correctly. You need to change display drivers from DOS. To change display drivers from DOS, follow these steps:

1. Change to the DOS directory C:\ORCAD\TEMPLATE
2. Use a text editor to edit the text file: ESP.CFG
3. Change the line that starts with `DD` to:

   ```
   DD = 'DisplayDriver'
   ```

   Where `DisplayDriver` is the name of the appropriate display driver.

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Memory considerations for Release IV programs

What is EMS?

EMS is an acronym for Expanded Memory Specification. A full acronym is LIM-EMS (Lotus-Intel-Microsoft Expanded Memory Specification).

LIM-EMS specifies how software works with special hardware to swap 16K pages of memory into and out of the one megabyte address space typically available in IBM PCs and compatibles.

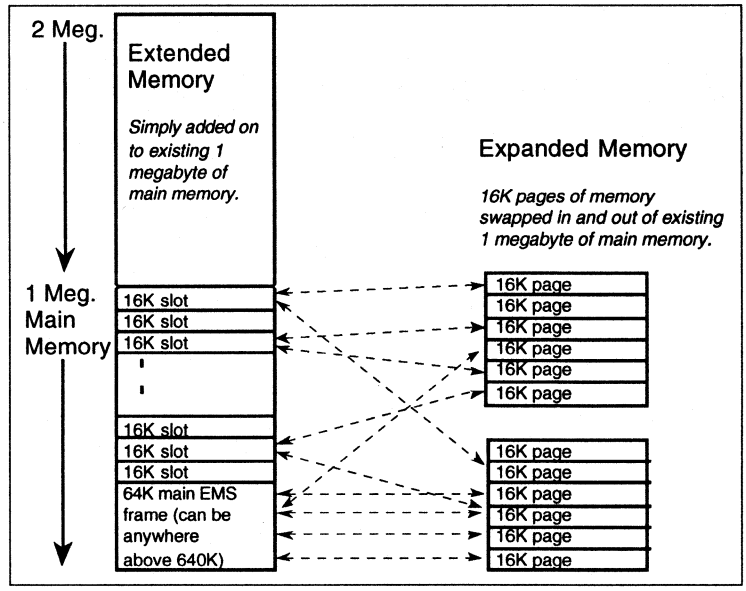
Using memory management software, an application can read and write data on one page, swap in another page, and then swap back to the first page, with all data intact. Using this method, an application can use a small number of 16K main memory slots to access much more than 1 MB of memory.

EMS in the ESP design environment

When the design environment is run, it checks to see if at least two 16K pages of EMS are available. If they are, it loads its display driver into EMS. If the design environment and an OrCAD tool set use the same display driver, it only needs to be loaded once. This removes the display driver from the lower 640K of memory, providing more lower memory for the OrCAD tool set.

When you exit ESP and return to the DOS operating system, all EMS used by the design environment and OrCAD tool sets are released. The EMS then becomes available for other applications.

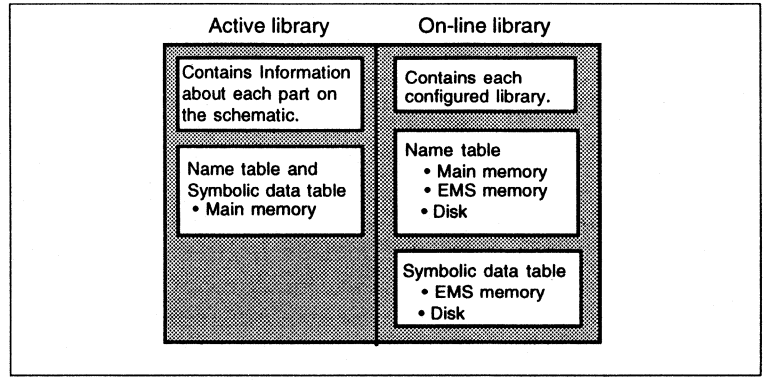
△ ***NOTE:*** *Expanded memory is sometimes confused with extended memory. Extended memory is memory above the 1 MB of main memory, while expanded memory is memory that is swapped into and out of the 1 MB of main memory. Release IV software does not use extended memory.*



PC memory allocation.

EMS in Schematic Design Tools Release IV

Schematic Design Tools Release IV uses two types of libraries: the active library and the on-line library. Both libraries contain a *name table* and a *symbolic data table.* The name table is a list of parts. The symbolic data table contains symbolic information about each part. The figure at the bottom of this page shows the active library, the symbolic library, and what they contain.



Two types of libraries in ***Schematic Design Tools Release IV.***

The active library

The active library contains information about each part on the schematic. It always resides in main memory. It can be configured to be 64–152K (this is done on the **Configure Schematic Design Tools** screen).

- The name table contains a list of the parts found on the schematic.
- The symbolic data table contains all of the symbol information for each part on the schematic.

On-line library

The on-line library contains information about each configured library.

- The name table contains a list of all the parts in each configured library. It can be stored in main memory, EMS memory, or on disk.
- The symbolic data table contains all of the symbol information for each part in each configured library. It can be stored in EMS memory or on disk.

Configuring Schematic Design Tools Release IV to use EMS

Follow these steps to configure **Schematic Design Tools Release IV** to use EMS:

1. Select **Draft** and **Configure Schematic Tools** from the **Schematic Design Tools** screen. The **Configure Schematic Design Tools** screen displays.
2. Move to the **Library Options** area.

   Notice the headings **Name Table Location** and **Symbolic Data Location** at the bottom of the **Library Options** area.
3. Select the desired location for each of these tables.

The next section discusses the performance impacts of the different configurations.

Performance impacts

Depending on the location of the on-line library's name and symbolic data tables, you can expect the performance impacts listed below. This list is given in order of efficiency. The most efficient configuration is given first, the least efficient is given last.

- **Name table in main memory and symbolic data table in EMS. Draft's GET** and **LIBRARY Browse** commands execute fastest under this configuration.
- **Name table in EMS memory and symbolic data table in EMS.** The **GET** and **LIBRARY Browse** commands may be slightly slower than in the first configuration. However, you can add additional EMS memory to get as many parts on line as possible.
- **Name table in main memory and symbolic data table on disk.** The **GET** and **LIBRARY Browse** commands are even slower, but are still tolerable. This is the best option for PCs without EMS.
- **Name table in EMS memory and symbolic data table on disk.** This configuration should only be used for the following special cases:
  - Very large designs (E size drawings with a large number of parts).
  - PCs with a small amount of EMS memory.
  - PCs with a small amount of available main memory. This can be caused by running multi-tasking software or a large network driver.

  Performance in this configuration is degraded compared to the above configurations, but is still acceptable.
- **Name table on disk and symbolic data table on disk.** This is the slowest configuration. It should only be used with portable computers that have only 512K main memory. It is tolerable for long use only if the hard disk is fast.

See pages 17 and 18 in the *Schematic Design Tools Reference Guide,* fifth edition, for more information about the performance impacts of the different configurations.

Viewing EMS memory allocation in Draft

The CONDITIONS command in **Draft** displays the amount of EMS and main memory used by the active library and the on-line library. To view this data, simply select **CONDITIONS** from **Draft's** main menu. When you are done viewing this information, press any key to return to **Draft's** main menu.

△ *NOTE: The CONDITIONS command displays information about the active library and the "reference" library. The reference library is the same as the on-line library.*

EMS in Digital Simulation Tools Release IV

Simulate looks for EMS in the 384K portion of main memory between 640K and 1 megabyte. If a 64K block is available, **Simulate** uses it. Any additional 16K slots between 640K and 1 megabyte are also used. The number of available slots is dependent upon your EMS hardware and software, and the other hardware installed on your PC. Memory can be increased between 64K and 256K.

Configuring EMS for use with Digital Simulation Tools

EMS software—such as Quarterdeck Expanded Memory Manager-386™ (QEMM-386) and Qualitas' 386^{MAX}—set up only the 64K main EMS frame. In order to enable extra 16K slots above 640K, you must specify extra parameters on the "DEVICE=" line of your CONFIG.SYS file. Refer to your EMS documentation for more information. Some EMS software packages include software that will help you determine which 16K slots are available.

QEMM-386, 386^{MAX}, and other EMS products allow you to load Terminate and Stay Resident (TSR) programs and device drivers into memory above 640K. This is done with commands or "DEVICE=" statements with the phrase LOADHI or LOADHIGH in your CONFIG.SYS file. Doing this reduces the amount of high memory that **Simulate** finds. However, if you need the TSRs, it is still advantageous to load them above 640K. **Simulate**—and other programs—run better with the memory below 640K free.

Memory considerations for 386+ programs

Schematic Design Tools 386+ versions 1.00 and 1.01

Schematic Design Tools 386+ versions 1.00 and 1.01 use the Rational Systems DOS/4GW memory extender to access memory above 640K. This memory extender is included in the **Schematic Design Tools 386+** installation. You don't need to configure anything to use it.

Whenever you run a version 1.00 or 1.01 tool from the **Schematic Design Tools 386+** tool set, the tool loads the DOS/4GW memory extender into low memory. The memory extender then grabs any available memory above 640K (up to the amount you specify on the **Configure Schematic Design Tools** screen). When the tool is done running, the memory extender releases the high memory and unloads DOS/4GW, thus releasing low memory.

If you have any Terminate and Stay Resident (TSR) programs and device drivers, you may want to us an EMS memory manager to load these items into memory above 640K. By moving the OrCAD device drivers into high memory, you can release up to 32K low memory.

Schematic Design Tools 866+ versions 1.10 and greater

Schematic Design Tools 386+ version 1.10 and greater use the Phar Lap memory extender to access memory above 640K. The memory extender is contained in the program SDTXTEND. This program, along with the program HANDLER_, must be in the PATH statement for your system or else the Schematic Design Tools 386+ programs will not run. The INSTALL program takes care of this automatically when it installs the software, so there is nothing for you to configure.

Digital Simulation Tools 386+ and memory

Digital Simulation Tools 386+ also uses the Phar Lap memory extender to access memory above 640K. It is recommended that you have at least 2 MB of free (available) extended memory when you run **Digital Simulation Tools 386+**. The memory extender is contained by the program SIMULATE.

PC Board Layout Tools 386+

Like **Schematic Design Tools 386+** and **Digital Simulation Tools 386+**, **PC Board Layout Tools 386+** uses the Phar Lap memory extender. It is contained in the program PCB386.

Phar Lap memory extender technical information

This section provides detailed information about the Phar Lap memory extender and its associated utility programs.

About the CFIG386 utility

All Phar Lap programs support the use of command line switches to override the default operation of the program. The CFIG386 utility allows you to customize a Phar Lap program by specifying command line switches to be automatically processed every time the program is run. Judicious use of the CFIG386 utility will allow you to avoid having to type commonly used switches every time you run a program.

When a Phar Lap program is run, the program defaults are first set up. Then, any switches configured into the program are processed from left to right. If any conflicting switches are given, the last switch processed takes precedence. Thus, switches configured into a program can be overridden with command line switches.

How to run CFIG386

The command line format for CFIG386 is the following:

```
CFIG386 PCB386.EXE [switches]
```

The first command operand is the name of the .EXE file that you want to configure, in this case, PCB386.EXE. The file must be a Phar Lap program. The operand must follow the standard DOS filename conventions. For example:

```
\MYLI99B\386ASM

Run386

A:386LINK.EXE
```

If a filename extension is not specified, then ".EXE" is assumed.

Following the filename, you list one or more command switches. The switches are shown in the same format they are given on the command line for the program being configured. CFIG386 determines which Phar Lap program is being configured from a program signature in the program's configuration block. The specified switches are added to the configuration block of the program, after any switches that are already there from any previous configurations. For example:

```
CFIG386  386ASM -NOLIST -8086

CFIG386  RUN386  -MINREAL 100h -MAXREAL 400h

CFIG386  386DEBUG -BO
```

CFIG386 recognizes one switch that alters its own processing: the -CLEAR switch. The -CLEAR switch causes CFIG386 to erase the current contents of the program's configuration block. Any switches specified after the clear switch are added to the just-cleared configuration block. For example:

```
CFIG386 386LINK   -CLEAR

CFIG386 MINIBUG  -CLEAR -CEMM
```

If CFIG386 is run with no switches on the command line, it displays the current contents of the program's configuration block. For example:

```
CFIG386  386ASM
CFIG386: 1.1s--Copyright (c) 1986,1987 PharLap
Software, Inc.

Phar Lap program type: 386|ASM Version 1.1s
Configured switch values:
    -INCLUDE \INCLUDES\
    -TWOCASE
    -386p
```

△ ***NOTE:*** *CFIG386 does NOT check the values of any of the switches or switch parameters which it stores in the program's configuration block. Thus, it is possible to configure invalid switch values into a Phar Lap program. You should ALWAYS run the program after configuring it to make sure that the configured switch values have the desired effect.*

Error messages

Several errors can be reported by the CFIG386 utility.The error messages and their causes are listed below.

```
Filename too long:  filename
```

The filename specified is too long for an internal CFIG386 buffer.

```
System Error
```

An internal error in the CFIG386 utility has been detected. Save a copy of the program which causes the error and contact Phar Lap.

```
Unable to open:  filename: reason
```

An error of some sort prevented filename from being opened. The reason gives more detail as to why the error occurred.

```
Unable to read configuration for:  filename
```

The .EXE file being configured has a valid Phar Lap signature but an invalid switch block of some sort. This error should never occur with a Phar Lap program. Save a copy of the program and contact Phar Lap.

```
Out of configured space on switch:  switchname
```

The internal switch buffer in the program being configured has overflowed. Switch `switchname` and all following switches aren't added to the default switch table.

```
Unable to save new configured switch values in
executable file
```

The program file is either write-locked or has been corrupted between the time the switch block was read from the file and when it was written back.

```
Unable to read config block from:  filename
```

The .EXE file being configured has a valid Phar Lap signature but an invalid switch block of some sort. This error should never occur with a Phar Lap program. Save a copy of the program and contact Phar Lap.

```
Not a Phar Lap program:  filename
```

The specified .EXE file does not have one of the Phar Lap program signatures that the CFIG386 utility expects to find in the program's configuration block.

386 | DOS-Extender command line switches

Command line switches change the default operation of 386 | DOS-Extender. By default, 386 | DOS-Extender:

- Uses all memory below 640K for your application and leaves no free real mode memory for other applications.
- Allocates 4K for the data buffer used on DOS and BIOS function calls.
- Allocates four buffers of 1K each to be used for stack memory when switching from protected mode to real mode.

Command line switches begin with a minus sign ("-") character, followed by the name of the switch. There are two forms of each switch name: a long form and a short form. Any argument to the switch must immediately follow the switch name, with a space as a separator. If conflicting switches are given on a command line, the last (right-most) switch takes precedence.

Some of the command line switches take a number as an argument. By default, the number is considered to be a decimal (base 10) number.

Hexadecimal (base 16) numbers may be specified by appending the character "h" or "H" to the number. The following two examples both give the same number as an argument to the switch -MAXREAL:

```
run386 -maxreal 200h hello

run386 -maxreal 512 hello
```

386 | DOS-Extender switches may be specified in three different ways:

- Some switches may be given when the program is linked.
- Switches may be configured into the 386 | DOS-Extender task image (RUN386.EXE) using the CFIG386 utility.
- Switches may be entered on the command line, when the program is actually run. The link time switch settings are processed first, then configured in switches, and, last, the command line switches. If conflicting switch settings are given, the last switch processed takes precedence.

Conventional memory switches

The -MINREAL and -MAXREAL switches control how much conventional memory (memory below 640K) is left free by 386 | DOS-Extender. By default, 386 | DOS-Extender allocates all the available conventional memory for use by the application program.

If the application program you are executing ever makes a system call to execute another program, you must make sure that 386 | DOS-Extender leave sufficient conventional memory free for the second program's needs.

The -MINREAL switch specifies the minimum amount of conventional memory to leave free; 386 | DOS-Extender refuses to run the program if it cannot leave at least this amount of memory free.

The -MAXREAL switch specifies the maximum amount of conventional memory to leave free. 386 | DOS-Extender guarantees that at least MINREAL memory is left free and that as much as possible, up to MAXREAL memory, is left free.

The -MINREAL and -MAXREAL switches both take a number as an argument. The number specifies memory size in units of 16-byte paragraphs (the standard unit of memory allocation under MS-DOS).

The number must be less than or equal to 65535 (FFFFh). By default, 386 | DOS-Extender sets both -MINREAL and -MAXREAL to zero. These switches may also be specified at program link time.

Syntax

```
-MINREAL nparagraphs
-MAXREAL nparagraphs
```

Short form

```
-MINR nparagraphs
-MAXR nparagraphs
```

Examples

```
run386 -minreal 100h hello
run386 -minr 128 -maxr 512 hello
```

Systems Call Data Buffer Switches

The -MINIBUF and -MAXIBUF switches control how much memory is allocated to the data buffer used for DOS and BIOS function calls. This buffer is most important for file I\O; if your program reads or writes large amounts of data at a time, you should allocate a large buffer for efficiency.

The -MINIBUF and -MAXIBUF switches both take a number as an argument. The number specifies the buffer size in units of 1K and must be between one and 64, inclusive. By default, 386 | DOS-Extender sets MINIBUF to 1K, and MAXIBUF to 4K. If 386 | DOS-Extender cannot allocate at least MINIBUF kilobytes for the interrupt buffer, it refuses to run the program. If possible, MAXIBUF kilobytes are allocated. If there is not enough memory available to satisfy both the MAXREAL and MAXIBUF parameters, MAXIBUF takes precedence. These switches may also be specified at program link time.

Syntax

```
-MINIBUF nK
-MAXIBUF nK
```

Short form

```
-MINI nK
-MAXI nK
```

Examples

```
run386 -maxibuf 2 hello
run386 -mini 64 filecopy
```

Mixed mode program switches

The -REALBREAK and -CALLBUFS switches control program loading of programs that contain both real mode and protected mode code.

The -REALBREAK switch controls how much of the program must be loaded into conventional memory, so that it can be accessed or executed in real mode. It takes an argument specifying the number of bytes at the beginning of the program, which must be loaded in conventional memory. This switch may also be specified at link time. It is usually more convenient to specify this switch at link time, when the argument can be the name of a public symbol appearing at the end of the real mode code and data. If this switch is used at run time, the argument must be an absolute number which has been calculated from the information in the link map.

The -CALLBUFS switch controls the size of the intermode call buffer, which is allocated in conventional memory for use by the application program as a data buffer on intermode procedure calls. The buffer address is obtained at run time with a 386 | DOS-Extender system call. The argument is the size of the buffer in kilobytes and must be less than or equal to 64. The default buffer size is zero. This switch may also be specified at link time.

Syntax

```
-REALBREAK nbytes

-CALLBUFS nkilobytes
```

Short form

```
-REALB nbytes

-CALLB nkilobytes
```

Examples

```
run386 -realbreak 200h -callb 2 switch

386link switch -realb END_REAL -callbufs 2
```

Stack allocation switches

The -NISTACK and -ISTKSIZE switches control how much memory is allocated to the buffers used to provide stack space when switching the 80386 from protected mode to real mode. For the vast majority of application programs, the default settings of these parameters are sufficient.

Both switches take a number as an argument. The -NISTACK switch specifies the number of stack buffers to allocate and must be four or greater. The-ISTKSIZE switch specifies the size of each stack buffer in kilobytes and must be between one and 64, inclusive. By default, 386 | DOS-Extender allocates four stack buffers of 1K each. These switches may also be specified at program link time.

Syntax

```
-NISTACK nbuffers
-ISTKSIZE nkilobytes
```

Short form

```
-NI nbuffers
-ISTK nkilobytes
```

Examples

```
run386 -ni 6 -istk 2 switch.exp
```

Extended memory switches

The -EXTLOW and -EXTHIGH switches limit the amount of extended memory (memory above 1 MB) that 386 | DOS-Extender allows the application program to use. By default, all extended memory that is not allocated to other programs is available for use by the application. Other programs which may have allocated extended memory include RAM disk programs, disk cache programs, and EMS simulators.

Both the -EXTLOW and -EXTHIGH switches take a number as an argument. The number specifies a physical memory address in extended memory. By default, 386 | DOS-Extender sets EXTLOW to 100000h (1 MB) and EXTHIGH to FFFFFFFFh (four gigabytes).

386 | DOS-Extender uses only extended memory above the address specified with the -EXTLOW switch, or memory used by other programs, whichever is higher. Similarly, it uses only extended memory below the address specified with the -EXTHIGH switch, or memory used by other programs, whichever is lower.

Normally, it is not necessary to use these switches. If your system has a program installed that uses extended memory, however, and does not use either (1) the VDISK or RAMDRIVE standards for allocating memory from 1 MB up, or (2) the INT 15th function 88h BIOS call for allocating extended memory from the top of memory down, it may be necessary to use one or both of these switches to prevent 386 | DOS-Extender from allocating extended memory used by the installed program.

Syntax

```
-EXTLOW address

-EXTHIGH address
```

Short form

```
-EXTL address

-EXTH address
```

Examples

```
run386 -extlow 200000h hello

run386 -extl 180000h -exth 400000h hello
```

Weitek 1167 switch

The -1167 switch is used to select how to detect the Weitek 1167 floating point coprocessor. If 386 | DOS-Extender detects the presence of the 1167, it initializes segment selector 003Ch to map the memory space used by the 1167 and segment register FS to contain selector 003Ch. A program can, therefore, test for the presence of the 1167 at run time by examining the contents of the FS register.

The -1167 switch has three settings.

- -1167 AUTO. Tells 386 | DOS-Extender to use the Weitek-approved BIOS presence detection call. This may not work correctly on all machines, if the appropriate BIOS is not installed.
- -1167 ON. Tells 386 | DOS-Extender to assume the 1167 is present.
- -1167 OFF. Assumes the 1167 is not present. This is the default setting.

Syntax

```
-1167 AUTO
-1167 ON
-1167 OFF
```

Short form

```
-1167 AUTO
-1167 ON
-1167 OFF
```

Example

```
run386 -1167 on float.exp
```

Interrupt relocation switches

The -HWIVEC and -PRIVEC switches select the interrupt vectors to use for interrupts, which 386 | DOS-Extender must relocate due to compatibility problems between the 80386 processor exceptions and PC/AT-compatible interrupts.

The -HWIVEC switch selects a block of eight interrupt vectors to use for hardware interrupts IRQ0 through IRQ7. These interrupts must be relocated, because they are vectored through interrupts 08h–0Fh, which are also used for processor exceptions. The switch argument is the interrupt vector number to use for hardware interrupt IRQ0. The default, if no command line switch is used, is interrupt vector 78h. This switch is not available when executing under the DESQview 386 environment, since DESQview also relocates hardware interrupts.

The -PRIVEC switch selects the interrupt vector to use for the BIOS print screen function call. This interrupt must be relocated, because it normally uses vector 05h, which is also used for the processor bounds exception. The default setting for this switch is interrupt vector 80h.

Syntax

```
-HWIVEC vector

-PRIVEC vector
```

Short form

```
-HWI vector

-PRI vector
```

Example

```
run386 -hwivec 50h -pri 78h hello
```

Interrupt mapping switches

The -INTMAP and -PRIMAP switches prevent 386 | DOS-Extender from relocating any interrupt vectors, and specify where the relevant interrupt vectors are already mapped. The purpose of these switches is:

- To allow protected mode memory-resident (TSR) programs to be installed.
- To provide compatibility with other programs which relocate interrupts.

The -INTMAP switch disables remapping of hardware interrupts, and specifies the block of eight interrupt vectors to which hardware interrupts IRQ0 through IRQ7 are already mapped. DOS normally maps interrupts to vectors 08h–0Fh, but it is possible for other programs to relocate them. When the -INTMAP 8 switch is used, 386 | DOS-Extender (and a debugger, if one is being used) does not take over processor exceptions 08h–0Fh. The -INTMAP 8 switch should ONLY be used with programs that have already been debugged, since a processor exception in a buggy program run with this switch would be interpreted as a hardware interrupt, causing the machine to crash.

The -PRIMAP switch disables remapping of the BIOS print screen function call, and specifies the interrupt vector to which this call is already mapped. The print screen function is normally invoked through INT 5. When the -PRIMAP 5 switch is used, 386 | DOS-Extender (and a debugger, if one is being used) does not take over processor exception 5, the BOUND exception. If a buggy program which causes this exception is run with the -PRIMAP 5 switch, a print screen occurs instead of an abnormal program termination.

Syntax

```
-INTMAP vector
-PRIMAP vector
```

Short form

```
-INTM vector
-PRIM vector
```

Examples

```
run386 -intm 8 -primap 5 kbdtrap
run386 -intmap 78h -prim 80h program2
```

Paging disable switch

The -NOPAGE switch is used to prevent 386 | DOS-Extender from using the 80386's hardware paging functionality to perform memory management. This switch is used to avoid a bug in early versions of the 80386 chip. Chip steps B1 and earlier have the bug. Chip step D0, which does not have the problem, was released by Intel in Q2 1988.

The problem only appears in programs which use the 80387 numeric coprocessor, and manifests itself as the machine halting, with not even the DOS system reboot command, <Ctrl><Alt><Del>, available. This problem does not occur on all 80386 machines (e.g., the Compaq DESKPRO 386/20), because it can be affected by the design of the system motherboard.

When this problem occurs in a program which uses floating point arithmetic, the only workarounds available are:

- To simulate floating point operations in software to avoid using the 80387 coprocessor
- To install a step D0 or later 80386 chip in the machine
- To disable paging, which removes one of the hardware conditions necessary for the problem to occur. The -NOPAGE switch disables paging.

There are disadvantages to using the -NOPAGE switch. Programs run with this switch cannot be linked with the -OFFSET switch. Programs run with -NOPAGE are loaded entirely in extended memory, with conventional DOS memory (below 640K) not available. In addition, the dynamic memory allocation system services provided by 386 | DOS-Extender are disabled when this switch is used. This means that the program must specify at link time (using the -MINDATA and -MAXDATA linker switches) how much memory it needs at run time. Heap memory allocation performed by compiler run-time libraries is normally done out of memory allocated under the control of the linker -MAXDATA switch, and is not affected by the use of -NOPAGE. The system memory allocation calls which are disabled by the use of this switch are INT 21h functions 48h, 49h, 4Ah, and 250Ah.

Syntax

```
-NOPAGE
```

Short form

```
-NOP
```

Example

```
run386 -nopage numcrunch
```

Compaq built-in memory switch

The -NOBIM switch is used to disable the automatic use of Compaq built-in memory. By default, 386 | DOS-Extender attempts to use built-in memory mapped above 14 MB on Compaq 386 machines, if the memory is not allocated to another program. This switch instructs 386 | DOS-Extender not to check for Compaq built-in memory. Normally, it is not necessary to use this switch.

Syntax

```
-NOBIM
```

Short form

```
-NOB
```

Example

```
run386 -nobim hello
```

VDISK compatibility switch

The -VDISK switch is a workaround for compatibility problems with other programs which do not correctly follow the VDISK standard for allocating extended memory.

If 386 | DOS-Extender refuses to run an application program because of inconsistent VDISK allocation signatures, this switch can be used to force 386 | DOS-Extender to run the program. The larger of the two allocation marks present will be used. Before using this switch, you should check the allocation sizes printed out with the error message when 386 | DOS-Extender refuses to run the program. If the larger of the two numbers printed out does not seem reasonable, it is necessary to calculate how much extended memory is in use by other programs and to use the -EXTLOW switch to inform 386 | DOS-Extender of the correct value.

Syntax

```
-VDISK
```

Short form

```
-VDISK
```

Example

```
run386 -vdisk hello
```

80386 step B0 switch

The -B0 switch is used to enable operation of 386 | DOS-Extender on a system that has a step B0 80386 chip. 386 | DOS-Extender is able to run only on 80386 chips that are step B0 or later because of a bug in earlier chips that did not permit the processor to be switched from protected mode back to real mode.

386 | DOS-Extender can only check at run time whether the 80386 chip is step B1 or later. By default, it refuses to run the application program if the chip is earlier than step B1. The -B0 switch can be used to force 386 | DOS-Extender to run. Note that if the -B0 switch is used with a chip that is earlier than step B0, the system will crash.

Syntax

```
-B0
```

Short form

```
-B0
```

Example

```
run386 -B0 hello.exp
```

EMS simulator switch

The -CEMM switch is used to turn off the COMPAQ CEMM or compatible EMS (Lotus/Intel/Microsoft Expanded Memory Specification) simulator programs. These EMS simulators operate in the 80386's Virtual 8086 Mode.

386 | DOS-Extender normally cannot run in Virtual 8086 Mode and, by default, refuses to run the application program if the 80386 is in virtual mode and if the VCPI interface provided by the Quarterdeck QEMM and some other programs is not present. The -CEMM switch can be used to have 386 | DOS-Extender automatically disable the EMS simulator program and switch the 8086 back to real mode. Note that the same thing can be accomplished by manually disabling the EMS simulator before running 386 | DOS-Extender. If the -CEMM switch is used when some program other than a Compaq-compatible EMS simulator has switched the 80386 into virtual mode, 386 | DOS-Extender prints an error message and refuses to run the program.

Syntax

```
-CEMM
```

Short form

```
-CEMM
```

Example

```
run386 -CEMM hello
```

Address line 20 switch

The -A20 switch is used to control how address line 20 is enabled or disabled. 80386 systems that conform to the IBM PC/AT standard have hardware either to allow full 32-bit addressing ("enable A20") or to truncate addresses to 20 bits ("disable A20"). When executing in real mode, A20 is normally disabled for compatibility with programs that take advantage of the address space wrap-around occurring at 1 MB on 8088/8086 systems. Very few programs rely on this behavior; the most common example is copy protection programs.

By default, 386 | DOS-Extender enables A20 before starting the application running, and restores the original A20 setting when the program terminates. The -A20 switch can be used to force 386 | DOS-Extender to disable A20 each time the 80386 is switched to real mode, and to re-enable A20 each time the 80386 is switched to protected mode. This can be important if, for example, a software diver, which can gain control at any time via a hardware interrupt, and which relies on 1 MB addressing wrap-around, is installed on your machine.

There is a penalty associated with the -A20 switch. Depending on the hardware in your system, it can take several milliseconds to enable or disable A20. Thus, using the -A20 switch slows down the switch to 80386 real mode, then back to protected mode, that occurs whenever there is a hardware interrupt or DOS or BIOS function call.

Syntax

```
-A20
```

Short form

```
-A20
```

Example

```
run386 -A20 hello
```

PC and PC/XT detection switch

The -XT switch is used to inform 386 | DOS-Extender that it is executing on a IBM-Compatible PC or PC/XT with a 386 board, such as the Intel Inboard/PC, installed. 386 | DOS-Extender normally detects such configurations automatically, but it may not be able to detect systems which do not have the IBM standard system ID byte in the BIOS. If 386 | DOS Extender does not correctly detect a PC environment, this switch can be used to allow the program to execute successfully.

Syntax

```
-XT
```

Short form

```
-XT
```

Example

```
run386 -xt hello
```

386 | VMM command line switches

Command line switches change the default operation of 386 | DOS-Extender, and of 386 | VMM. This section describes the 386 | DOS-Extender command line switches that apply specifically to operation with virtual memory. These switches can be used with 386 | DOS-Extender even if 386 | VMM is not used. Except where noted, the 386 | VMM-specific switches are ignored by 386 | DOS-Extender when used without virtual memory. By default, 386 | VMM:

- Places the swap file used for paging in the root directory of the device from which the application program was loaded.
- Always increases the swap file size when the program allocates additional virtual memory.
- Uses a least-frequently-used algorithm for selecting the page to be replaced (written to the swap file), when bringing another page into memory.
- Updates the virtual page aging information (used by the page replacement algorithm) every four seconds.

Command line switches begin with a minus sign ("-") character, followed by the name of the switch (e.g., -LFU). There are two forms of each switch name: a long form and a short form. Any argument to the switch must immediately follow the switch name, with a space as a separator (such as, -VSCAN 4000). If conflicting switches are given on a command line, the last (right-most) switch takes precedence.

Some of the command line switches take a number as an argument. By default, the number is considered to be a decimal number. Hexadecimal numbers may be specified by appending the character "h" or "H" to the number. The following two examples both give the same number as an argument to the switch "-VSCAN":

```
run386 -vscan 2048 -vmfile vmmdrv bigsort
run386 -vscan 800h -vmfile vmmdrv bigsort
```

Virtual memory driver switches

The -VMFILE switch is used to specify the name and location of the development version of 388 | VMM to be loaded by 386 | DOS-Extender during initialization. Using this switch causes the application program to run in a virtual memory environment.

The -VMFILE switch is normally not used with bound applications (programs which have the redistribution versions of 386 | DOS-Extender and 386 | VMM bound to them in a single .EXE file). If the -VMFILE switch *is* used with a bound application, the virtual memory driver specified with the switch will be loaded, instead of the virtual memory driver that is bound to the application. This can be useful for testing a bound application with a later release of 386 | VMM.

The -NOVM switch instructs 386 | DOS-Extender not to load a virtual memory driver, regardless of whether the -VMFILE switch was used, or whether 386 | VMM is bound to the application program. It causes the program to run in a non-virtual environment.

Syntax

```
-VMFILE filename
-NOVM
```

Short form

```
-VM filename
-NOVM
```

Examples

```
run386 -vmfile vmmdrv hello
386debug -vm \pharlap\vmmdrv.exp hello
cfig386 hello.exe -novm
```

Swap file location switch

The -SWAPDIR switch specifies the device and directory in which to place the page swap file. The default location for the swap file is the root directory of the device from which the application program was loaded. This switch is useful for placing the swap file on a device which has sufficient free space to allow the swap file to grow as needed.

The directory name specified with this switch must not end with a "\" character, as 386|VMM appends a "\" before adding the name of the swap file. The swap file is created with a unique filename (using the DOS Create Temporary File system call).

Syntax

```
-SWAPDIR filename
-SWD dirname
```

Short form

```
-VM filename
-NOVM
```

Examples

```
run386 -swapdir d: -vm vmmdrv hello
minibug -swd e:\tmp -vm vmmdrv hello
```

Page replacement policy switches

386 | VMM supports two switch-selectable page replacement policies. The page replacement policy defines the algorithm used to select a page to be swapped to disk when a page already on disk needs to be brought into memory. The performance of a program in a virtual memory environment depends to some extent on whether the system usually replaces pages that are not needed for a long time; ideally, the page selected for replacement is the page not referenced by the program for the longest time into the future. Depending on the memory referencing patterns of an application, one of the page replacement algorithms supported by 386 | VMM may yield better performance than the other.

The -LFU switch selects the Least-Frequently-Used replacement policy. A reference frequency count is kept with each page. Periodically, the page tables are scanned, and the count is either incremented or decremented, depending whether the page was referenced since the last scan. The page with the lowest count (the least-frequently-used page) is the page selected for replacement. This is the default page replacement policy if no switches are used.

The -NUR switch selects the Not-Used-Recently replacement policy. This algorithm chooses a page for replacement based on whether the page has been accessed by the program, and whether it is dirty (its contents have been modified). Periodically, the page tables are scanned to mark all pages not accessed. The page accessed information thus identifies pages which have been referenced recently (since the last page table scan).

The -VSCAN switch selects how frequently the page tables are scanned in order to update the page aging information used by the page replacement policy. Changing the scan period affects which pages are selected for replacement, and therefore, affects program performance. The -VSCAN switch takes as an argument a time expressed in milliseconds (ms). The minimum value which may be given is 1000 ms (1 second). The default scan period is 4000 ms. (Note that 386 | VMM assumes the timer tick interrupt occurs 18.2 times per second; application programs which change this standard timer operation must adjust the value specified with the -VSCAN switch appropriately).

Syntax

```
-LFU
-NUR
-VSCAN nmilliseconds
```

Short form

```
-LFU
-NUR
-VS nmilliseconds
```

Examples

```
run386 -lfu -vm vmmdrv hello
minibug -nur -vm vmmdrv hello
386debug -nur -vscan 2000 -vm vmmdrv hello
```

Swap file growing policy switches

The page swap file can potentially grow very large, if the virtual address space required by the program is large. Under these circumstances, it is possible to run out of disk space. The tradeoff is using up more disk space than is actually needed versus taking the risk of running out of swap space during a page fault, in which case 386 | VMM is forced to abort the program.

The -SWAPCHK switch is used to select when the size of the swap file is increased by 386 | VMM. The -SWAPCHK MAX setting causes the swap file to grow whenever the virtual address space of the program is increased. The size of the swap file is always set to the size of the program's virtual address space, which is the largest size that could possibly be needed. If the swap file cannot be grown when a memory allocate system call is made, the memory allocate call returns failure, so the program can deal with the condition gracefully. This is the safest setting, because it guarantees that 386 | VMM will always have swap space available when a page fault occurs. It does, however, result in the largest swap file. (Remember that disk space problems can sometimes be solved by placing the swap file on a different disk drive with the -SWAPDIR switch.)

The default setting is -SWAPCHK FORCE, which still causes the swap file to grow whenever additional virtual memory is allocated. However, the size to which it is increased is smaller than the virtual address space for the program, while still large enough to guarantee that sufficient swap space is available when a page fault occurs. This setting is a good compromise. It results in a smaller swap file, but ensures that no unexpected program aborts will occur. However, if this setting is used and too large a value is specified by the -CODESIZE switch, it can result in an out of swap space condition during a page fault.

The -SWAPCHK ON setting does not grow the swap file when virtual memory is allocated; instead, the swap file size is increased by the page fault handler as it needs new swap space. When additional virtual memory is allocated, the amount of free space on the disk is checked to make sure there is sufficient free space, using the same swap space requirements as those imposed by the -SWAPCHK FORCE setting. However, the swap file is not actually grown until the space is needed. This setting minimizes the size of the swap file; but if the program uses up disk space for another purpose between the time the memory allocate is performed and the swap file needs to be grown, a fatal out-of-swap-space error may occur in the page fault handler. In addition, there will be some performance degradation, because it is more expensive to grow the swap file one page at a time than to grow it in large chunks when additional virtual memory is allocated. For these reasons, it is normally better to use the -SWAPCHK FORCE setting.

The -SWAPCHK OFF setting disables all swap space checking when virtual memory is allocated. The swap file is grown as needed when a page fault occurs. As with -SWAPCHK ON, this minimizes swap file size, but leaves the program vulnerable to out-of-swap-space fatal errors when a page fault occurs. If this setting is used, the program should install an out-of-swap-space handler that attempts either to create more swap space, or clean up and exit, when this condition occurs.

The -CODESIZE switch specifies the number of bytes of code which can be paged to disk without seriously affecting program performance. It is equal to the total size of the program's code, in bytes, minus the program's code "working set," that is, the amount of code that needs to be in memory at any given time to avoid excessive paging. This information is used with the -SWAPCHK FORCE and -SWAPCHK ON settings to calculate the minimum swap space required. Increasing the value reduces the swap file size. Specifying too large a value with this switch may result in unacceptable program performance, or even in fatal out-of-swap-space errors.

The -SWFGROW1ST and -NOSWFGROW1ST switches specify what the page fault handler should do when it needs a page in the swap file and one is not available. -SWFGROW1ST is the default, and causes the page fault handler, first, to attempt to grow the swap file, and then if that fails, to attempt to take a swap file page away from a virtual page currently in memory (this can be done because a page in memory does not need space in the swap file). The -NOSWFGROW1ST setting reverses the order; it causes a swap page to be taken away from an in-memory page first, and the swap file to be grown only if no in-memory page owns a page in the swap file. The tradeoff is performance versus disk space. Disk space requirements are reduced if the -NOSWFGROW1ST switch is used, but program performance suffers.

The -MAXSWFIZE switch is used to limit the maximum disk space that is allocated to the swap file. It specifies a size, in bytes, beyond which the swap file is never increased. If this switch is not used, the only upper bound on swap file size is the amount of free space available on the disk.

Syntax

```
-SWAPCHK OFF

-SWAPCHK ON

-SWAPCHK FORCE

-SWAPCHK MAX

-SWFGROW1ST

-NOSWFGROW1ST

-CODESIZE nbytes

-MAXSWFSIZE nbytes
```

Short form

```
-SWC OFF
-SWC ON
-SWC FORCE
-SWC MAX
-SWFG
-NOSWFG
-CODES nbytes
-MAXS nbytes
```

Examples

```
run386 -swapchk force -vm vmmdrv hello
run386 -swc off -noswfg -vm vmmdrv hello
minibug -swc on -codes 900 -vm vmmdrv hello
run386 -maxs A00000h -vm vmmdrv hello
```

CGA ■ An acronym for *Color Graphics Adapter.*

Design ■ A collection of files for a project that reside in a subdirectory apart from files for other projects. The files include source, object, configuration, and data files.

Design environment ■ The OrCAD ESP design environment within which you use OrCAD tools and organize files by project.

DGIS ■ A graphics interface defined and supported by Graphics Software Systems of Beaverton, OR. It runs on many high resolution cards.

EGA ■ An acronym for *Enhanced Graphics Adapter.*

EMS ■ An acronym for *Expanded Memory Standard.*

Gendrive ■ An OrCAD utility for creating a custom display driver to support your system's video graphics card.

Hercules ■ A standard for monochrome display adapters. May also be referred to as HGA (*Hercules Graphics Adapter*) or MGA (*Monochrome Graphics Adapter*).

Install ■ An OrCAD utility for placing OrCAD software on your hard disk. The software creates directories, copies files, and may add commands to your AUTOEXEC.BAT and CONFIG.SYS files.

Product Support Agreement ■ A service offered by OrCAD which extends technical support, update, and other benefits.

PSA ■ An acronym for *Product Support Agreement.* See *Product Support Agreement.*

RISC ■ An acronym for *Reduced Instruction Set Computer.*

Terminate-and-stay-resident ■ A program that loads itself into memory and returns control to DOS, remaining in the background. For example, a mouse driver is a terminate-and-stay-resident program.

TIGA ■ An acronym for *Texas Instruments Graphics Architecture.* TIGA is a graphics interface defined by Texas Instruments to use with their 34010 and 34020 graphics chips and is supported by many graphics adapters. OrCAD uses TIGA to support a wide range of display drivers.

TSR ■ An acronym for *Terminate-and-Stay-Resident.* See *Terminate-and-stay-resident.*

VGA ■ An acronym for *Video Graphics Array.*

VRAM ■ An acronym for *Virtual Random Access Memory.*

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Installatie OrCAD/SDT & PCB

Helaas vonden wij een foutje in het huidige OrCAD Installatie programma (versie 4.42). Daarom hebben wij in dit document een aantal opmerkingen geplaatst. Wij raden u aan om voordat u begint met de installatie dit document aandachtig te lezen.

Tijdens het installeren

Fout

Tijdens het installeren dient u aan te geven welke tool sets u wilt installeren: *Select the tool sets to install on your system.* Aangezien het installatie programma na het installeren van OrCAD Schematic Design Tools 386+ niet verder gaat met het installeren van OrCAD PC Board Layout Tools 386+ hoeft u nu alleen de volgende tool sets te selecteren:
OrCAD ESP Design Enviroment
OrCAD Schematic Design Tools

Voor het installeren van OrCAD PC Board Layout Tools 386+ dient u namelijk het OrCAD installatie programma opnieuw te starten en dan uiteraard alleen de tool set **OrCAD PC Board Layout Tools** te selecteren.

BELANGRIJK

Tijdens het installeren van OrCAD Schematic Design Tools 386+ dient u aan te geven welke Netlist formaten u wilt installeren: *Select one of more of the following netlist formats to install on your system.* Aangezien OrCAD PC Board Layout Tools 386+ het EDIF netlist formaat nodig heeft dient u het volgende netlist formaat te selecteren:

EDIF Flat/Hier. EDIF 200