FUTURE DOMAIN®

PowerSCSI!™
The Universal Application Interface
User's Manual

for DOS/Windows

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Future Domain Corporation
2801 McGaw Avenue
Irvine, California 92714
(714) 253-0400
Fax (714) 253-0913

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1. Introduction

PowerSCSI!™ bridges the gap between the DOS and Windows operating environments and SCSI peripherals. To get the most from this manual, please read the next section.

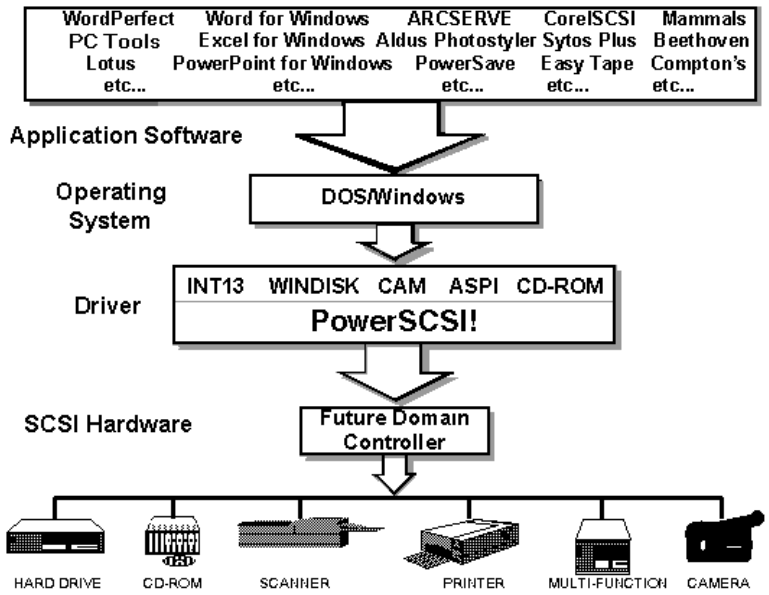
1.1 How to Use this Manual

For your convenience, the PowerSCSI! User's Manual is divided into four main sections. Although it is recommended that you read each Chapter, you may skip ahead to the section that interests you:

- For an overview of PowerSCSI! and how you will benefit from having PowerSCSI! installed on your PC, refer to Chapter 1.
- For a fast Automatic installation of PowerSCSI!, refer to Chapter 2.
- For a Custom installation of PowerSCSI!, refer to Chapter 3.
- For answers to frequently asked questions, refer to Appendix A. You may want to read this section first.
- For a Technical overview of PowerSCSI!, refer to Appendix B.
- For help Troubleshooting your SCSI hardware/software, refer to Appendix C.
- For help using the CD-ROM Utilities, refer to Appendix D.

1.2 PowerSCSI! Overview

PowerSCSI! is the Universal Application Interface developed by Future Domain that allows your Application software to work seamlessly with most SCSI peripherals. PowerSCSI! can be thought of as middleware between the Application software calling your SCSI peripheral through the Operating System, and the actual SCSI hardware consisting of the SCSI Controller and cables. Once PowerSCSI! is installed, it will operate in the background managing input/output (I/O) calls from your favorite Application software to any number of SCSI peripherals including CD-ROMs, Magnetic Optical Drives, Digital Cameras and Scanners. PowerSCSI! includes support for Applications written to one of five popular interfaces: INT13, WINDISK (FastDisk®), CAM, ASPI and CD-ROM. At first these names might seem a bit strange, but trust PowerSCSI! to make them work with your SCSI peripherals. Refer to the following figure to better understand this concept.



PowerSCSI! will then convert the five software interfaces into Future/CAM™, Future Domain's implementation of Common Access Method (CAM), a powerful ANSI standard SCSI interface. If you are interested, the five Application software interfaces and CAM are explained in Appendix A: Questions and Answers.

In addition to converting your application calls to CAM, PowerSCSI! provides two other functions: WINDISK and I/O Management. WINDISK is a SCSI version of the popular FastDisk virtual device driver included in Windows v3.1. WINDISK improves system performance and manages multiple requests to the SCSI Controller. Because PowerSCSI! is based on CAM, it can manage multiple I/O requests from your Application software and SCSI devices simultaneously!

1.3 System Requirements

PowerSCSI! is designed to run on almost any PC system. Please review the following guidelines:

System Compatibility:	ISA, EISA or MicroChannel (MCA) PC's with at least 1MB RAM for DOS, 2MB for Windows; 20MB Hard Drive; 1.4MB 3.5" or 1.2MB 5.25" Floppy Disk
Operating Environment:	MS or PC-DOS v4.X-5.0, Windows v3.1, DR DOS 6.0
DOS	Memory required - 7KB minimum, 42KB maximum Location - upper (640KB to 1MB) or conventional (0-640KB)
Windows	WINDISK/CAM module - approximately 30KB per SCSI Controller using extended memory
SCSI Controller:	Future Domain SCSI Controller with a BIOS version shown in the following table.

SCSI Controller Type and Model	*BIOS version*		
	v 3 . 2	*v 8 . 2*	*v 2 . 2*
8-bit ISA			
TMC-850M		X	
TMC-860M		X	
TMC-885M		X	
16-bit ISA			
TMC-1650	X		
TMC-1660	X		
TMC-1670	X		
TMC-1680	X		
16-bit MCA			
MCS-600	X		
MCS-700	X		
32-bit EISA			
TMC-7000EX			X

NOTE: If your Future Domain SCSI Controller has an older version BIOS, we recommend you upgrade to the latest version by calling 1-800-879-7599. Future Domain does not claim support of SCSI Controllers from other manufacturers. For ROM-less SCSI Controllers, a BIOS is required to support fixed drives.

SCSI Peripherals:

More than 50 manufacturers of SCSI peripherals are supported directly in DOS/Windows by using PowerSCSI!. There are SCSI peripherals that are not supported by DOS/Windows that require Application software to access them. PowerSCSI! provides the support needed by these programs. The table on the adjacent page will help you determine if Application software is required to use your SCSI peripheral.

SCSI Peripheral	*DOS/Windows Support*	*Notes*
Fixed Disk	DOS v4.0/5.0 - 9 drives total (2 IDE + 7 SCSI)	7 SCSI drive support requires the latest BIOS v. x.2
CD-ROM	DOS - 7 drives Windows - 7 drives	CD-ROM driver and MSCDEX included, see footnote
Read - Write Optical Removable Drives Tape Drives Multifunction Drives Jukeboxes WORM Scanner Digital Camera Others	No DOS/Windows support	Use third-party software to support these SCSI peripherals (ASPI or CAM compliant)

NOTE: The total number of drives supported is for each Controller installed. PowerSCSI! includes Future Domain's CD-ROM device driver with Microsoft's MSCDEX required to run CD-ROM drives.

Software Compatibility:	PowerSCSI! has been tested to work with virtually every program written for the DOS/Windows environment. If you are experiencing problems with your Application software, read Appendix C: Troubleshooting.
Customer Service:	Available by calling (714) 253-0440 during normal business hours PST.

2. Automatic Installation

This Chapter explains how to perform an **Automatic** installation of PowerSCSI! by letting PowerSCSI! scan the SCSI bus and install the appropriate drivers for the SCSI peripherals it finds. Although PowerSCSI! does a fine job of installing only the drivers it needs, you can still select the **Custom** option to modify and install only the drivers you want; see Chapter 3.

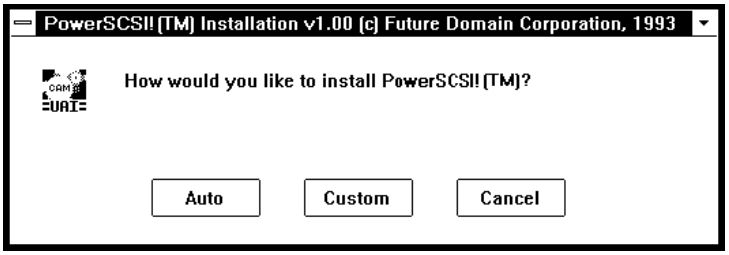
2.1 Before You Begin

PowerSCSI! requires that you have properly installed your SCSI Controller, cables and SCSI peripherals and that you are able to boot DOS. PowerSCSI! for Windows requires that you have Windows v3.1 running. If you are having difficulty installing your SCSI hardware refer to the user's manual that came with your SCSI Controller or peripheral for help, or refer to Appendix C: Troubleshooting.

2.2 PowerSCSI! for Windows

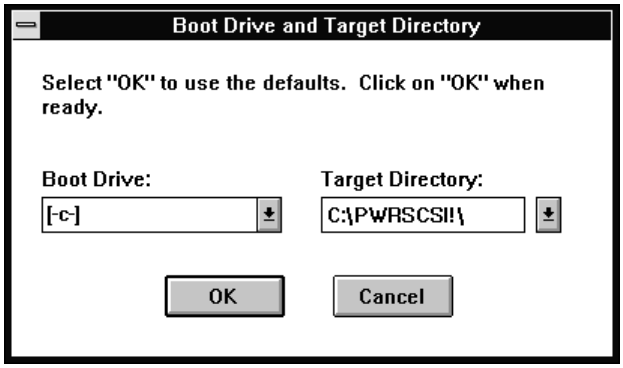
Installing PowerSCSI! for Windows is easy, just follow these few simple steps. Insert your PowerSCSI! diskette into drive A: or B:, click on **File** ,**Run...**, type **A:\INSTALL** or **B:\INSTALL** on the command line, then click on the **OK** button or press **<ENTER>**.

The following PowerSCSI! installation screen will appear:



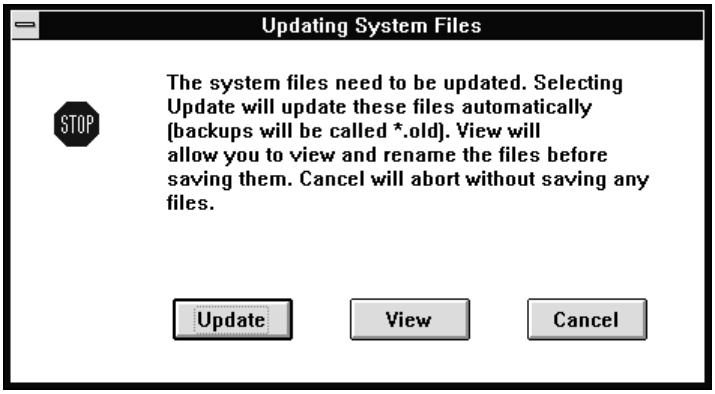
Click on the **Auto** button to begin **Automatic** installation of PowerSCSI! for Windows. You may click on the **Cancel** button to cancel the installation.

The following screen will ask for your boot drive and a target directory to install the PowerSCSI! files:



PowerSCSI! will select drive **C:** as the default boot drive and **C:\PWRSCSI!** as the target directory. Click on the down arrows to change settings. Click on the **OK** button or press **<ENTER>** to use the defaults. PowerSCSI! will now scan the SCSI bus and select the appropriate drivers for the SCSI peripherals it finds.

The following screen indicates PowerSCSI! is ready to update your DOS/Windows configuration files:



Click on the **View** button to give you the option of viewing and renaming the configuration files before saving them or simply click on the **Update** button or press **<ENTER>** to begin. PowerSCSI! will now prompt you as the configuration files are updated, click on the **OK** button to continue the installation process.

The following screen indicates PowerSCSI! for Windows has installed successfully:

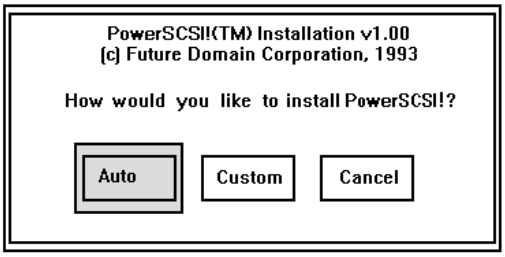
You must now exit Windows and reboot your computer to enable the changes PowerSCSI! made to your DOS/Windows configuration files. Click on the **Exit** button or press **<ENTER>** to finish the installation. That's all there is to it!

NOTE: If you Add or Remove any SCSI peripherals from your system you must re-install PowerSCSI!

2.3 PowerSCSI! for DOS

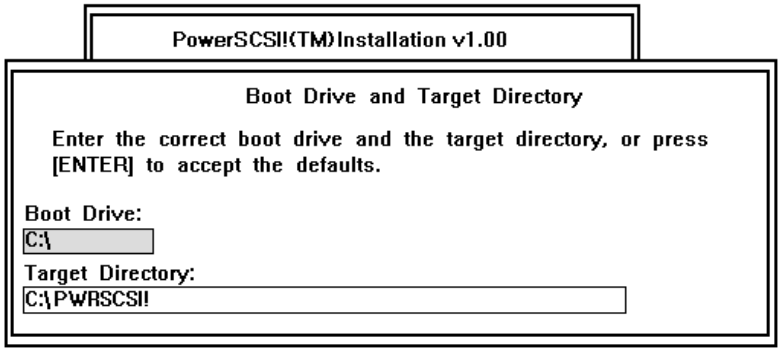
Installing PowerSCSI! for DOS is easy, just follow these few simple steps. From the DOS prompt type **A:** or **B:** and press **<ENTER>** to log on to the drive which contains the PowerSCSI! diskette. Type **DINSTALL** and press **<ENTER>** to begin the PowerSCSI! for DOS installation.

The following screen will appear:



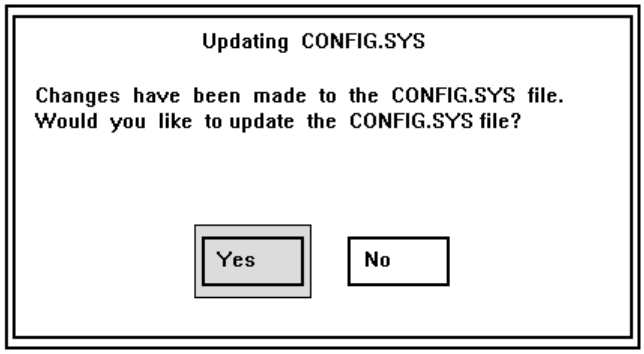
Press **<ENTER>** to begin **Automatic** installation of PowerSCSI! for DOS. You may use the **<TAB>** or arrow keys to move the cursor to the **Cancel** button to cancel the installation.

The following screen will ask for your boot drive and a target directory to install the PowerSCSI! files:



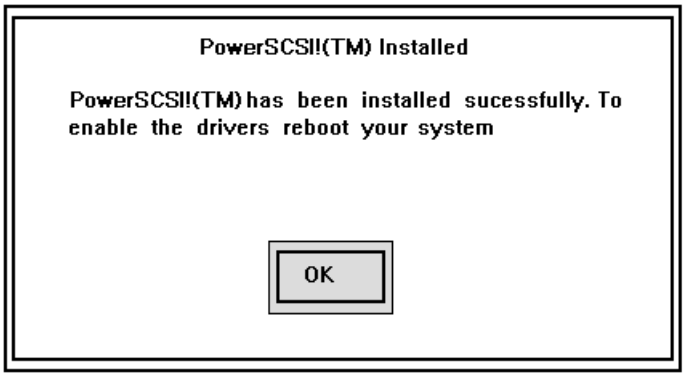
PowerSCSI! will select drive **C:** as the default boot drive and **C:\PWRSCSI!** as the target directory. To change settings begin typing or press **<ENTER>** to use the defaults. PowerSCSI! will now scan the SCSI bus and select the appropriate drivers for the SCSI peripherals it finds.

The following screen indicates PowerSCSI! is ready to update your DOS configuration files:



PowerSCSI! will now prompt you as the configuration files are updated, press **<ENTER>** to continue the installation process.

The following screen indicates PowerSCSI! for DOS has installed successfully:



Reboot your computer to enable the changes PowerSCSI! made to your DOS configuration files. If you later upgrade to Windows you must install PowerSCSI! for Windows to update the SYSTEM.INI file. Press **<ENTER>** to finish the installation. That's all there is to it!

NOTE: If you Add or Remove any SCSI peripherals from your system you must re-install PowerSCSI!

3. Custom Installation

This Chapter explains how to perform a **Custom** installation of PowerSCSI! by allowing you to manually select, modify and install drivers for the SCSI peripherals it finds. If you are a first-time user, it is highly recommended that you perform an **Automatic** installation of PowerSCSI!; see Chapter 2.

3.1 Before You Begin

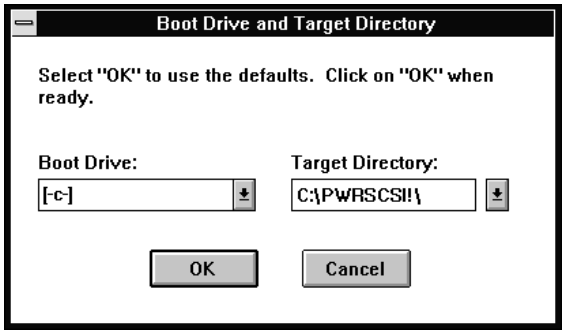
PowerSCSI! requires that you have properly installed your SCSI Controller, cables and SCSI peripherals and that you are able to boot DOS. PowerSCSI! for Windows requires that you have Windows v3.1 running. If you are having difficulty installing your SCSI hardware refer to the user's manual that came with your SCSI Controller or peripheral for help, or refer to Appendix C: Troubleshooting. If you are not familiar with editing the DOS/Windows system configuration files do not attempt the **Custom** installation. Instead, choose the **Automatic** installation!

3.2 PowerSCSI! for Windows

Custom installation requires an understanding of PowerSCSI! for Windows drivers and where to install them into your CONFIG.SYS, AUTOEXEC.BAT and SYSTEM.INI system configuration files. Refer to Appendix B: Technical Overview for an explanation of PowerSCSI! internal operation before attempting any changes to your system files.

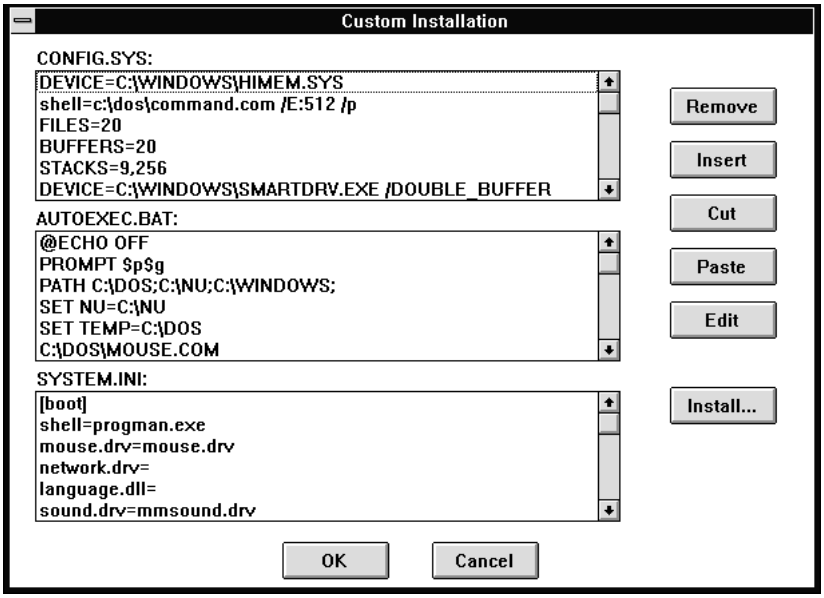
Follow the steps in Chapter 2: Automatic Installation, Section 2.2 PowerSCSI! for Windows to get to the opening installation screen. Click on the **Custom** button to begin Custom installation of PowerSCSI! You may click on the **Cancel** button to cancel the installation.

The following screen will ask for your boot drive and a target directory to install the PowerSCSI! files:



PowerSCSI! will select drive **C:** as the default boot drive and **C:\PWRSCSI!** as the target directory. Click on the down arrows to change settings. Click on the **OK** button or press **<ENTER>** to use the defaults.

The following screen will indicate PowerSCSI! is ready to begin edit of your DOS/Windows configuration files:



The contents of your current system CONFIG.SYS, AUTOEXEC.BAT and SYSTEM.INI files are conveniently displayed. PowerSCSI! features a powerful command line editor that allows you to change the system file contents. You must exit Windows and reboot to enable any changes to the CONFIG.SYS system file. Standard Windows elevator bars are available to scroll through to see the entire file contents.

The following paragraphs describe the functions of the six buttons that appear to the right.

Remove Deletes the selected line. Select the line you want to delete by clicking on it, then click on the **Remove** button.

Insert Inserts blank line and allows you to enter text into your system files. Select the line where you want to insert a blank line above by clicking on it, then click on the **Insert** button.

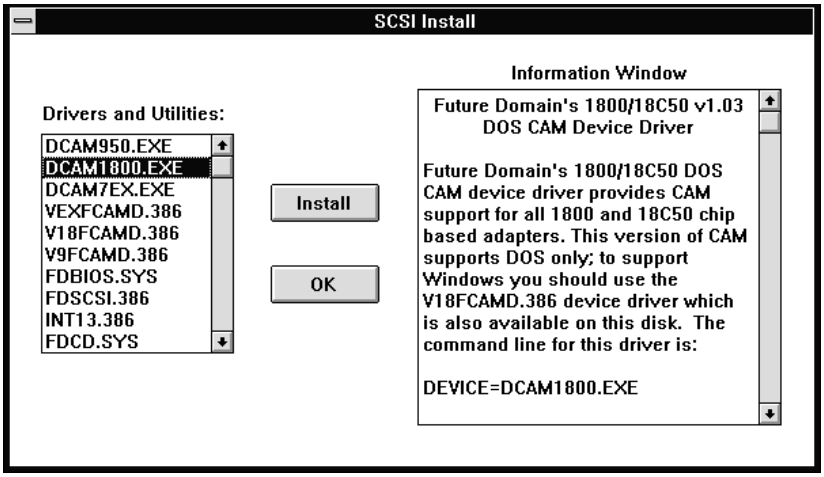
Cut Copies line to the editor clip board. Select the line you want to cut and place into the editor clip board, then click on the **Cut** button.

Paste Pastes line from editor clip board. Select the line you want to paste the contents of to the editor clip board above by clicking on it, then click on the **Paste** button.

Edit Select line and begin editing. PowerSCSI! features a command line editor that allows you to insert and delete text. Select the line you want to edit by clicking on it, then click on the **Edit** button. Click on the **OK** button when you are finished.

Install... Important information on the files included on your PowerSCSI! distribution disk. For example, to find out more about the DCAM1800 driver and any command line parameters click on DCAM1800.EXE in the Drivers and Utilities menu.

The following help screen will appear:



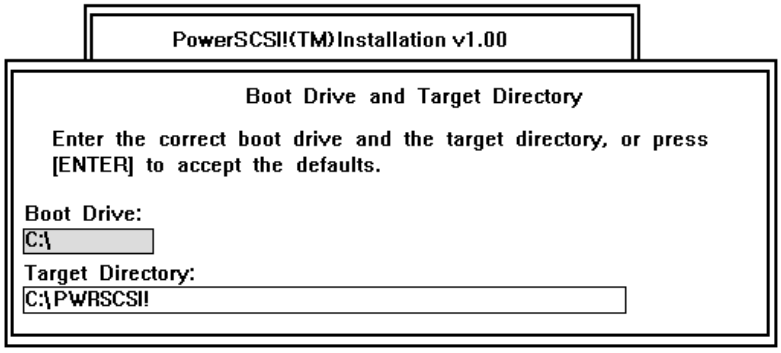
When you are finished editing your CONFIG.SYS, AUTOEXEC.BAT and SYSTEM.INI system configuration files click on the **OK** button. PowerSCSI! will now prompt you as the configuration files are updated, click on the **OK** button to continue the installation process. You may click on the **Cancel** button or press **<ESC>** at any time to terminate the **Custom** installation process. PowerSCSI! will save your original system files as CONFIG.OLD, AUTOEXEC.OLD and SYSTEM.OLD after a successful installation.

3.3 PowerSCSI! for DOS

Custom installation requires an understanding of PowerSCSI! for DOS drivers and where to install them into your CONFIG.SYS, AUTOEXEC.BAT system configuration files. Refer to Appendix B: Technical Overview for an explanation of PowerSCSI! internal operation before attempting any changes to your system files.

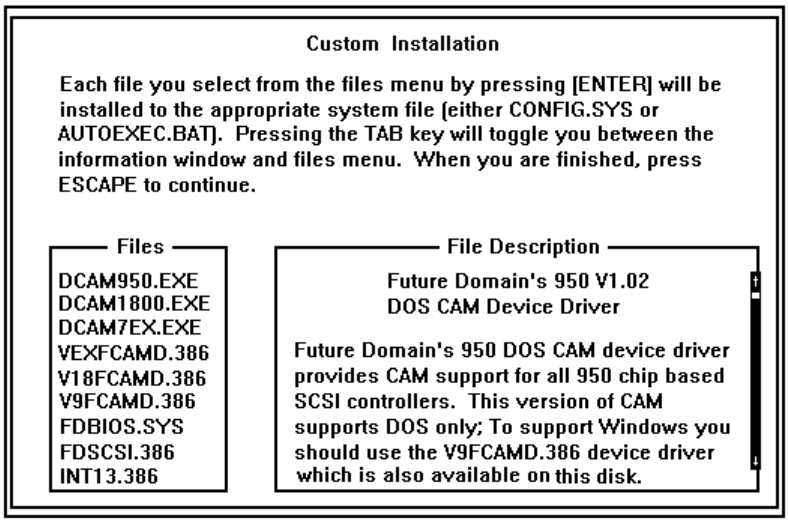
Follow the steps in Chapter 2: Automatic Installation, Section 2.3 PowerSCSI! for DOS to get to the opening installation screen. Using the **<TAB>** or Arrow keys, move the cursor to the **Custom** button and press **<ENTER>** to begin Custom installation of PowerSCSI! for DOS. You may use the **<TAB>** or Arrow keys to move the cursor to the **Cancel** button to cancel the installation.

The following screen will ask for your boot drive and a target directory to install the PowerSCSI! files:



PowerSCSI! will select drive **C:** as the default boot drive and **C:\PWRSCSI!** as the target directory. To change settings begin typing or press **<ENTER>** to use the defaults.

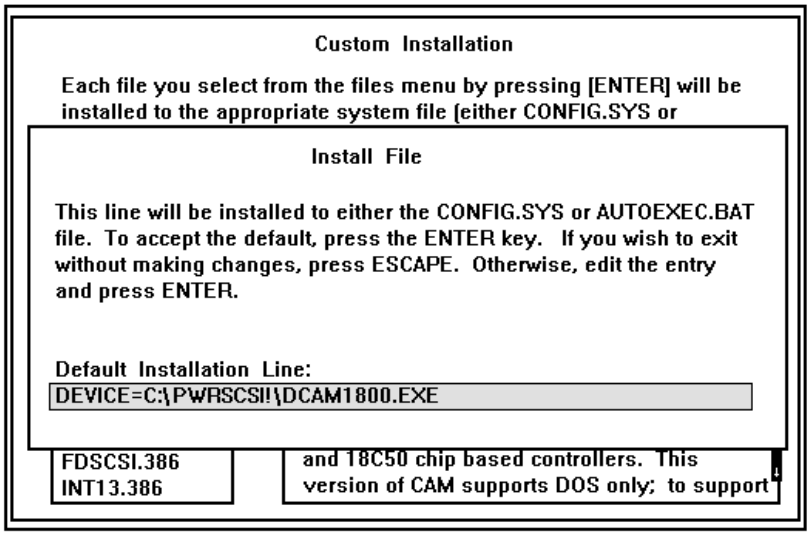
The following screen indicates PowerSCSI! is ready to begin edit of your DOS configuration files:



You can find out more about each PowerSCSI! file by selecting the file name using the Arrow keys, then press the **<TAB>** key. Pressing the **<TAB>** key again will switch you between the Files and File Description windows.

To install a driver you must be in the Files window, then press **<ENTER>**.

The following install screen will appear:



To change settings begin typing or press **<ENTER>** to use the defaults. You may use the **<ESC>** key to exit without making any changes. When you are finished editing your CONFIG.SYS, AUTOEXEC.BAT and SYSTEM.INI system configuration files press the **<ESC>** key. PowerSCSI! will now prompt you as the configuration files are updated, press **<ENTER>** on the **Yes** button to continue the installation process. You may press **<ENTER>** on the **No** button or press **<ESC>** at any time to terminate the Custom installation process. PowerSCSI! will save your original system files as CONFIG.OLD, AUTOEXEC.OLD and SYSTEM.OLD after a successful installation.

Appendix A. Questions and Answers

The following paragraphs list the most frequently asked questions and answers:

Q1. What is SCSI?

A1. Small Computer Systems Interface or SCSI (pronounced Scuzzy) is a multi-tasking peripheral input/output (I/O) bus endorsed by the American National Standards Institute (ANSI). The SCSI bus supports up to 56 device addresses on one SCSI Controller with data transfer rates up to 10MB/sec. To learn more about SCSI see Appendix C: Troubleshooting.

Q2. How does PowerSCSI! work?

A2. PowerSCSI! converts input/output (I/O) calls from your Application software written to one of five popular interfaces: INT13, WINDISK (FastDisk), CAM, ASPI and CD-ROM, into Future/CAM. Future/CAM is Future Domain's implementation of Common Access Method (CAM), an ANSI standard SCSI interface.

Q3. What are INT13, WINDISK (FastDisk), CAM, ASPI and CD-ROM interface support?

A3. Disk Operating System (DOS) communicates to a standard fixed drive through a BIOS interrupt 13 function call. PowerSCSI! intercepts this call, adds Microsoft extensions and allows you to communicate with SCSI devices. WINDISK and CAM are explained below. Advanced SCSI Programming Interface (ASPI) is an interface developed by Adaptec Corp. Compact Disk Read Only Memory (CD-ROM) peripherals communicate through the DOS Microsoft extensions, then they are converted to CAM.

Q4. What are FastDisk and WINDISK?

A4. WINDISK is Future Domain's implementation of Microsoft's FastDisk, a virtual SCSI device driver (VXD) that increases the performance of fixed disks under Windows by taking advantage of the 386 enhanced mode and bypassing DOS and the PC system BIOS.

Q5. What is CAM?

A5. Common Access Method or CAM defines the SCSI interface that isolates the SCSI Controller from the Operating System. CAM was defined by the American National Standards Institute (ANSI). CAM committee members include companies such as Future Domain, IBM and NCR. CAM is a multi-tasking input/output (I/O) management standard which provides portability across many PC platforms and Operating Systems.

Q6. What is THE DISK MAESTRO® and when do I need it?

A6. THE DISK MAESTRO® is a disk management program from Future Domain that contains several utilities that allow you to perform a low-level format and surface analysis, partitioning, hi-level format and a system file editor to help you install a new SCSI peripheral on your PC. THE DISK MAESTRO also features a SCSI diagnostic and image copy utility. Your Future Domain SCSI Controller BIOS v3.1/8.1/2.1 or LESS will only provide support for up to two SCSI fixed drives. You will need THE DISK MAESTRO if you are going to use both Integrated Drive Electronics (IDE) and SCSI fixed drives together, drives with removable media, or connect more than two physical fixed drives to your PC. See Chapter 1: Section 1.3 System Requirements to determine which SCSI peripherals are supported by DOS/Windows.

THE DISK MAESTRO is not required with BIOS v3.2/8.2/2.2!

Q7. What is multi-tasking I/O under Windows?

A7. Multi-tasking is the ability to open and have running several applications at the same time. PowerSCSI! gives you the ability to Multi-task to the SCSI peripherals in virtual memory so it is a logical match for the power of Windows.

Q8. What are the ISA, EISA and MCA PC buses?

A8. **Industry Standard Architecture or ISA** is the most popular Personal Computer (PC) bus in the market. Originally developed by IBM for the PC/AT, the ISA bus has a 8/16-bit Data and 24-bit Address path. **Extended Industry Standard or EISA** is an enhanced version of the ISA bus which has a 8/16/32-bit Data and 32-bit Address path. EISA was jointly developed by Intel, Microsoft, Compaq, AST, Epson, H-P, NEC, Olivetti, Tandy, WYSE and Zenith. It is possible to plug an 8-bit or 16-bit ISA card into a 32-bit EISA slot. **MicroChannel Architecture or MCA** was developed by IBM. MCA has a 8/16/32-bit Data and 24/32-bit Address path.

Q9. Can I install PowerSCSI! for DOS from a Windows DOS box by using DINSTALL?

A9. No, Installing PowerSCSI! from within a Windows DOS box is NOT the same as exiting Windows and installing PowerSCSI! for DOS from the DOS prompt. The PowerSCSI! distribution disk has two installation programs. PowerSCSI! for Windows will use **INSTALL** and PowerSCSI! for DOS will use **DINSTALL**. Although the two programs are similar, the **INSTALL** program will update the SYSTEM.INI configuration file to take advantage of multi-tasking I/O under Windows.

Q10. I can't get PowerSCSI! to work with my CD-ROM. What should I do?

A10. The default **Automatic** installation will provide CD-ROM support including adding the Microsoft CD-ROM Extensions (MSCDEX) to your Disk Operating System (DOS). First check to see that your CD-ROM was powered on when PowerSCSI! was first installed. PowerSCSI! will NOT install the drivers if no CD-ROM is detected. Try re-installing PowerSCSI! then refer to Appendix C: Troubleshooting or call Future Domain's customer service at (714) 253-0440 7AM-5PM PST for assistance.

Q11. I just installed PowerSCSI!. When I try to boot my system, my PC hangs.

A11. Check your hardware configuration and then refer to Appendix C: Troubleshooting. If you think the problem may be related to the installation process, PowerSCSI! saved your original CONFIG.SYS, AUTOEXEC.BAT and SYSTEM.INI system configuration files with a *.OLD extension so you can always go back and rename them.

Q12. Can I use PowerSCSI! along with an Adaptec Controller?

A12. Yes, you can use a Future Domain and Adaptec SCSI Controller together in the same PC provided there are no hardware conflicts caused by jumper settings. However, to ensure the optimum system performance use the PowerSCSI! ASPI to CAM program and install only the Future Domain SCSI Controller.

Q13. I'm a computer programmer and I would like to write my own device driver to work with PowerSCSI! What development tools are available?

A13. To communicate with PowerSCSI! your device driver must be written to CAM by using the Future/CAM for DOS/Windows software development tool available from Future Domain. If you have already written a driver using Future Domain's OEM Toolkit you must re-link with the new OEM Toolkit v4.0 to make your driver CAM-aware.

Q14. Tell me more about Future Domain, where are they located?

A14. Founded in 1982, Future Domain is a leading manufacturer of complete SCSI solutions located in Irvine, CA. With over 1.5 Million SCSI Controllers installed worldwide supported by over 150 manufacturers of SCSI peripherals, Future Domain is the logical choice for major OEM customers like IBM, SONY and Toshiba.

Appendix B. Technical Overview

To successfully install PowerSCSI! on your PC using the **Custom** installation requires an understanding of the internal structure of PowerSCSI! and where to install the various drivers into your CONFIG.SYS, AUTOEXEC.BAT and SYSTEM.INI system configuration files. It is beyond the scope of this User's Manual to provide information on writing CAM drivers, refer to Appendix A: Questions and Answers to find out more about software development tools available.

The following paragraph describes the files on the PowerSCSI! distribution disk directory:

READ.ME	Latest updates and changes
DINSTALL.EXE	Installation program for DOS
DINSTALL.DAT	Data file for DOS installation
INSTALL.EXE	Installation program for Windows
INSTALL.INI	Data file for Windows installation
DOS	
ASPIFCAM.SYS	ASPI to CAM driver
DCAM950.EXE	CAM driver for the 950 SCSI chip
DCAM1800.EXE	CAM driver for the 1800/18C50 SCSI chip
DCAM7EX.EXE	CAM driver for the 7000EX Controller
FDBIOS.SYS	INT13 to CAM driver
WINDOWS	
FDSCSI.386	WINDISK virtual device driver manager
INT13.386	Virtual device driver for INT13
V9FCAMD.386	CAM virtual device driver for the 950 SCSI chip
V18FCAMD.386	CAM virtual device driver for the 1800/18C50 SCSI chip
WINDOWS (cont.)	
VEXFCAMD.386	CAM virtual device driver for the 7000EX Controller
CDROM	
FDAUDIO.COM	CD-ROM Audio player
FDCD.SYS	CD-ROM driver
FDCDTEST.COM	CD-ROM diagnostic Utility
FDEJECT.COM	Ejects CD-ROM
FDLOCK.COM	Locks CD-ROM
FDUNLOCK.COM	Unlocks CD-ROM
MSCDEX.EXE	DOS driver for CD-ROM support

The root directory contains the installation programs DINSTALL and INSTALL, plus help files for DOS and Windows respectively. Notice there are separate sub-directories for DOS and Windows with similar files. All CD-ROM drivers are located in the CDROM sub-directory and are explained in Appendix D: CD-ROM Utilities.

PowerSCSI! for Windows takes advantage of WINDISK, Future Domain's implementation of Microsoft's FastDisk for SCSI peripherals that increases system performance by bypassing the INT13 BIOS and running applications in Windows 386 Enhanced Mode. WINDISK will support up to seven SCSI hard drives. WINDISK is installed when you select the **Automatic** installation option. Another benefit from using WINDISK is the ability to run more DOS applications simultaneously under Windows.

To **Custom** install a virtual device driver requires you to load the device driver in the correct place in the Windows SYSTEM.INI file. All virtual device drivers (*.386) must be loaded under the [386Enh] section. WINDISK (FDSCSI.386) must also be loaded in the [386Enh] section and will require (INT13.386) to handle Windows INT13 calls. In addition, each device driver has command line parameters to recognize the SCSI Controller Interrupt, I/O address and in some cases Memory address.

Please refer to the help screens that appear when you select the file names during the **Custom** installation (or from the DOS prompt COPY the DINSTALL.DAT or INSTALL.INI files to your printer). PowerSCSI! will save your original system files as CONFIG.OLD, AUTOEXEC.OLD and SYSTEM.OLD after a successful installation. You can always go back to your original CONFIG.SYS, AUTOEXEC.BAT and SYSTEM.INI files.

Refer to the table below to determine which drivers are required for your **Custom** installation:

	PowerSCSI! for DOS	*PowerSCSI! for Windows*
FDC 950 SCSI chip	DCAM950.EXE	V9FCAMD.386
FDC 1800/18C50 chip	DCAM1800.EXE	V18FCAMD.386
7000EX SCSI Controller	DCAM7EX.EXE	VEXFCAMD.386
INT13 hard disk	FDBIOS.SYS	INT13.386
WINDISK (FastDisk)	N/A	FDSCSI.386
CD-ROM *	FDCD.SYS	FDCD.SYS
ASPI	ASPIFCAM.SYS	ASPIFCAM.SYS

*CD-ROM requires Microsoft CD-ROM Extensions (MSCDEX) for DOS

PowerSCSI! essentially has two layers; a top layer where Application software I/O calls are converted to CAM and a bottom layer where CAM communicates directly to the SCSI hardware. The top layer is typically called the Application Program Interface (API) and the bottom layer is called the SCSI Interface Module (SIM) for the SCSI Controller chip supported. Many Operating Systems including OS/2 and UNIX have a CAM-like API embedded requiring only the selection of a SIM to connect SCSI peripherals. All application calls are converted to CAM in the API Layer. For example, if you are running an ASPI application the ASPIFCAM.SYS driver will convert ASPI calls into CAM.

In the SIM layer there are separate DCAM files for each Future Domain SCSI Controller chip. For example, if your system has a TMC-850M SCSI Controller based on the 950 SCSI Controller chip you will use the DCAM950.EXE driver.

It's OK to have more than one driver installed but you will use more system memory. Choose only the API and SIM layer driver(s) you need to optimize for system memory.

Appendix C. Troubleshooting

This section will help you determine the cause and possible solution to problems that may occur with your system.

If you are having trouble getting your SCSI peripheral to work properly with PowerSCSI! it is important to carefully observe all error messages during installation as well as messages that appear briefly after you reboot your computer: The following messages will appear when all PowerSCSI! drivers have installed:

1. Future Domain 950 SCSI ROM BIOS v8.xx
or **Future Domain 1800/18C50 SCSI ROM BIOS v3.xx**
or **Future Domain 7000EX SCSI ROM BIOS v2.xx**

This message is generated by the BIOS on your Future Domain SCSI Controller. If this message fails to appear, it may be caused by jumper settings conflicting with some other cards plugged into your system. It is also possible your SCSI Controller does not have a ROM BIOS installed. The ROM BIOS is necessary in order to boot DOS from your SCSI hard drive.

2. **ID 4 LUN 0 TOSHIBA XME-3301TA Firmware Rev. xx**
ID 5 LUN 0 IBM KZ-P 146 Firmware Rev. xx
512 bytes per sector (FS)

This message is generated by each SCSI peripheral attached to your SCSI Controller. The example shown is for two SCSI peripherals: a Toshiba CD-ROM set for ID 4, and an IBM hard disk set for ID 5 that is capable of Fast Sync data transfers. (The message your drive sends may vary from the examples above.)

If you do not have any message displayed it is possible your SCSI peripheral is not responding due to a failure on the SCSI bus caused by improper termination. Refer to the section below on SCSI Troubleshooting Tips. All SCSI peripherals should respond, If one or more are missing, make sure the SCSI IDs for each peripheral are different. The primary boot SCSI drive should always be set to ID 0.

3) Future/CAM (TM) for DOS (950 Series VLSI) ver 1.xx
or **Future/CAM (TM) for DOS (1800 Series VLSI) ver 1.xx**
or **Future/CAM (TM) for DOS (TMC-7000EX) ver 1.xx**

Adapter 0 found with 2 SCSI device(s) attached:
I/O Port Base Address is 140
Memory Base Address is CA000
IRQ Level is 5

This message is displayed when Future/CAM for DOS is loaded. In order to work, PowerSCSI! must have a CAM driver loaded. Future/CAM is Future Domain's implementation of Common Access Method (CAM), a powerful ANSI standard SCSI interface. Notice the configuration information about your SCSI Controller that follows; Your information may vary.

4. (c) 1986-1992 FUTURE DOMAIN CORP. CD-ROM
Loadable driver version 2.xx.x

This message is displayed when PowerSCSI! has detected a CD-ROM and the CD-ROM driver is loaded. The CD-ROM driver requires MSCDEX; See below.

5. MSCDEX Version 2.xx
Copyright (c) Microsoft Corp. 1986-1990. All rights reserved

This message is displayed when the Microsoft CD-ROM Extensions to DOS are loaded. DOS versions 3.x to 5.0 do not support CD-ROM drives, MSCDEX is required.

6. PowerSCSI! ASPI Interface v1.xx

This message indicates the ASPI to CAM driver is loaded.

7. PowerSCSI! Int 13h Interface v2.x

This message indicates the FDBIOS driver is loaded.

If you have installed PowerSCSI! for Windows the following additional messages will appear:

8. Future/CAM™ for Windows (950 Series VLSI) ver 1.xx
or **Future/CAM™ for Windows (1800 Series VLSI) ver1.xx**
or **Future/CAM™ for Windows (TMC-7000EX) ver 1.xx**

Adapter 0 found with 2 SCSI device(s) attached:
I/O Port Base Address is 140
Memory Base Address is CA000
IRQ Level is 5

This message is displayed when Future/CAM for Windows is loaded. In order to work, PowerSCSI! must have a CAM driver loaded. Future/CAM is Future Domain's implementation of Common Access Method (CAM), a powerful ANSI standard SCSI interface. Notice the configuration information about your SCSI Controller that follows. Your information may vary.

9. Future Domain WINDISK (FastDisk for SCSI) ver 1.xx

This message is displayed when WINDISK (FastDisk for SCSI) is loaded.

SCSI Troubleshooting Tips

If your are able to determine the problem is caused by the SCSI hardware, try following these Seven SCSI Rules:

1. Every SCSI device requires a unique ID (including the controller).
2. Every SCSI bus requires a termination on each end and at least one term power source.
3. External cables must be a minimum of 1 foot (0.3m) and a maximum of 20 feet (6m).
4. Every SCSI device, except the fixed disk drives require a software driver for DOS/Windows to recognize it.
5. ASPI and CAM drivers are incompatible, care must be taken in which order they are loaded. Use Automatic installation to load the drivers in the correct order.
6. Power-on ALL external SCSI peripherals FIRST, your PC should be powered-on LAST.
7. Not all SCSI peripherals are compatible with all SCSI Controllers, check the table in Chapter 1, Section 1.3 System Requirements.

Appendix D. CD-ROM Utilities

This section will help you use the optional CD-ROM Utilities included with PowerSCSI!. The CD-ROM Utilities include FDCDTEST, FDEJECT, FDLOCK, FDUNLOCK and FDAUDIO. The CD-ROM Utilities allow you to send low-level commands to your CD-ROM, eject media, lock and unlock the CD-ROM door or play Audio from the DOS prompt.

NOTE:The CD-ROM Utilities are included free with PowerSCSI! and have been designed to run from the DOS prompt. You can NOT run the CD-ROM Utilities from within a Windows DOS box, you must first exit Windows.

D.1 FDCDTEST

The CD-ROM test utility was designed to test the integrity of the Future Domain CD-ROM Device Driver and CD-ROM drives. Users and Developers will now be able to test all the functions supported by the CD-ROM Driver for problems related to the CD-ROM Driver or the CD-ROM drive itself.

This utility is also used in the Future Domain Quality Assurance Test Procedure for each drive supported by the Future Domain FDU-CD CD-ROM Driver. This is performed to ensure that every available function is operational for use with the CD-ROM applications on the market as well as future CD-ROM applications. For a complete description of all the functions supported by the Microsoft CD-ROM Extensions (MSCDEX), please refer to the current Microsoft CD-ROM Extensions specifications.

At the DOS prompt, type **FDCDTEST** and press **<ENTER>** to start the program. This program does not support any command line options, therefore, parameters are not needed to follow the program name.

Upon startup, the program will locate all CD-ROM drives within the system attached to the Future Domain SCSI Controller(s) and prompt for a drive selection. After selecting a CD-ROM drive, the Main menu will be displayed.

This utility will abort if the following conditions occur:

- Microsoft CD-ROM Extensions V2.20/V2.21 is not installed or an earlier version is installed,
- no CD-ROM drives found in the system are attached to the Future Domain SCSI Controller.

There are three Function Menus available, the Main Menu, the IOCTL Input Menu and the IOCTL Output Menu. To minimize the screen output, the menus are displayed only once until the "?" key is pressed to re-display a menu.

Main Menu

This menu is displayed upon startup of the program. Pressing the **<ENTER>** key from this menu will cause the program to terminate.

Following are the descriptions for the options available from the Main menu.

0 IOCTL INPUT

Choose this option to select an IOCTL Input option from the IOCTL Input Menu.

1 INPUT FLUSH

Clears all input buffers and pending requests in the Device Driver.

2 IOCTL OUTPUT

Choose this option to select an IOCTL Output option from the IOCTL Output Menu.

3 DEVICE OPEN

Used by the Device Driver to determine the number of callers (programs using the CD-ROM driver) that are currently using the CD-ROM Device Driver.

4 DEVICE CLOSE

Used by the Device Driver to determine the number of callers (programs using the CD-ROM driver) that are currently using the CD-ROM Device Driver.

5 READ LONG

A SCSI Read command is issued to the CD-ROM drive with the option of specifying the Addressing mode and the Data read mode.

Options

Addressing mode:	High Sierra mode
	Red Book mode
Date read mode:	Cooked mode - usually the default mode for EDC/ECC checking which returns a block size of 2048 bytes.
	Raw mode - for no EDC/ECC checking, this option returns all 2352 bytes which includes the EDC/ ECC data.

6 READ LONG PREFETCH

Same as READ LONG but no data is transferred.

7 SEEK

A SCSI Seek command is issued to the CD-ROM drive with the option of specifying the Addressing mode.

Options

Addressing mode:	High Sierra mode
	Red Book mode

8 PLAY AUDIO

This function is used to play a selected track on an audio disc.

Options

Track number:	Any valid track on an audio disc
Play to end of disc:	This function is used to play to the end of the disc

9 STOP AUDIO

This function is used to pause or stop a CD-ROM drive while in Play mode. Selecting this option once will force the drive in Pause mode and selecting this option twice consecutively will force the drive into the Stop mode.

A RESUME AUDIO

This function is used to restart Play mode on a CD-ROM drive currently in Pause mode. A "General Failure" error status will occur if the drive is in Stop mode.

B DISPLAY DEVICE STATUS

The Device status is a 2-bytes value which is returned by the device driver to indicate the command request has successfully been completed. This function displays Bit 8 and 9 of this status which corresponds to the Done and Busy bit.

IOCTL Input Menu

The IOCTL Input menu is displayed by selecting option 0 from the Main menu. Press the **<ENTER>** key from this menu to return to the Main menu. Following are the descriptions for the options available from the IOCTL Input menu.

0 RETURN DRIVER ADDRESS

A 4-byte address is displayed indicating where in the system memory the CD-ROM driver is located.

1 LOCATION OF HEAD

Displays the current location of the drive head in High Sierra and Red Book format.

2 AUDIO CHANNEL INFO

Use to display the current Audio Channel control settings. These settings may be changed using the Audio Channel Control IOCTL Output function.

There are a total of 4 input and output channels that may be supported by a CD-ROM drive. Valid channels are 0 to 3 which represent the following:

Channel 0:	front left
Channel 1:	front right
Channel 2:	rear left
Channel 3:	rear right
Input Channel:	this is the actual channel that is read from an Audio track on a disc.
Output Channel:	this is the channel that comes from the drive's amplifier to power the speakers.
Volume Control:	a value from 0 to 255 indicating the volume setting on the specified channel. A volume control of 0 indicates Mute mode and a volume control of 255 indicates Full volume.

3 DEVICE STATUS

The device status is maintained by the CD-ROM driver to provide a general description of the options currently set and available on the CD-ROM drive. The device status is make up of 32 bits which are defined as follows:

Bit 0:	0	door closed
	1	door open
Bit 1:	0	door locked
	1	door unlocked
Bit 2:	0	supports only cooked reading
	1	supports cooked and raw reading
Bit 3:	0	read only
	1	read/write
Bit 4:	0	data read only
	1	data read and plays audio/video tracks
Bit 5:	0	no interleaving
	1	supports ISO-9660 interleaving using interleave size and skip factor
Bit 6:	0	reserved
Bit 7:	0	no prefetching
	1	supports prefetching requests
Bit 8:	0	no audio channel manipulation
	1	supports audio channel manipulation
Bit 9:	0	supports HSG addressing mode
	1	supports HSG and red book addressing modes
Bit 10:	0	reserved
Bit 11:	0	disc is present in drive
	1	no disc is present in drive
Bit 12:	0	does not support R-W sub-channels
	1	supports R-W sub-channels
Bit 13-31:	0	reserved

4 RETURN SECTOR SIZE

The driver will return a cooked sector size of 2048 bytes and a raw sector size of 3252.

5 RETURN VOLUME SIZE

This function returns the lead-out track which corresponds to the total number of blocks on the disc. The displayed address is in High Sierra format.

6 MEDIA CHANGED

This function is used to determine the current media state of the drive. The returned values are defined as follows:

1 media not changed
0 don't know if changed
-1 Media changed

7 AUDIO DISC INFO

Displays the first and last track of an audio disc. The lead-out address is also displayed in Red Book format.

8 AUDIO TRACK INFO

Displays the starting Red Book address for each track found on the disc.

9 AUDIO Q-CHANNEL INFO

This function returns the current track number and the running time within the track and disc in Red Book format.

A UPC CODE

Use this option to get the UPC/EAN (Universal Product Code) from the disc. Most discs do not contain this code and will cause the driver to return a "Sector not Found" message. Also, if the CD-ROM drive does not support this function, an "Unknown Command" message will be returned by the driver.

B AUDIO STATUS INFO

After selecting an audio track to play, this function will display the starting and ending addresses specified by the play request. Will also display the Pause status of drive.

IOCTL Output Menu

The IOCTL Output menu is displayed by selecting Option 2 from the Main menu. Pressing the **<ENTER>** key from this menu to return to the Main menu. Following are the descriptions for the options available from the IOCTL Input menu.

0 EJECT DISC

Use this function to eject a disc from the CD-ROM drive. If the drive door is locked, the driver will unlock the door before ejecting.

1 LOCK DOOR

This function will lock the door on a CD-ROM drive.

2 UNLOCK DOOR

This function will cause the drive to unlock the door if previously locked.

3 RESET DRIVE

Use this function to reset and reinitialize the drive.

4 AUDIO CHANNEL CONTROL

This function displays the current Audio Channel control settings and prompts for an Input and Output channel and a Volume control setting for the specified channel. See IOCTL Input Audio Channel Info option for additional information.

5 CLOSE TRAY

This function will close the tray on a CD-ROM drive that employs a tray mechanism.

Error Messages

The CD-ROM driver returns a Status code for every command request that is completed. This code is used to indicate if the command request was completed successfully or if an error occurred. In

the event of an error, the driver will set the Error bit (bit-15) in the status code and will place the error code in bits 0-7.

If an error occurs when using this utility, the program will automatically convert the error code to one of the following error messages.

Error Codes	*Error Messages*
0	Write protect violation
1	Unknown unit
2	Drive not ready
3	Unknown command
4	CRC error
5	Bad drive request structure length
6	Seek error
7	Unknown media
8	Sector not found
9	Printer out of paper
10	Write fault
11	Read fault
12	General failure
13	Reserved
14	Reserved
15	Invalid disc change

Command Code Table

The following table shows the menu selection codes as corresponding to the MS-DOS CD-ROM Extensions command codes. The numbers in brackets are the IOCTL command sub-codes.

FDCDTEST Menu Selection Codes		*Microsoft CD-ROM Extensions Codes*
0-[0]	3-[0]	ADDRESS OF DEVICE DRIVER
0-[1]	3-[1]	LOCATION OF HEAD
0-[2]	3-[4]	AUDIO CHANNEL INFO
0-[3]	3-[6]	DEVICE STATUS
0-[4]	3-[7]	RETURN SECTOR SIZE
0-[5]	3-[8]	RETURN VOLUME SIZE
0-[6]	3-[9]	MEDIA CHANGED
0-[7]	3-[10]	AUDIO DISC INFO
0-[8]	3-[11]	AUDIO TRACK INFO
0-[9]	3-[12]	AUDIO Q-CHANNEL INFO
0-[A]	3-[14]	UPC CODE
0-[B]	3-[15]	AUDIO STATUS INFO
1	7	INPUT FLUSH
2-[0]	12-[0]	EJECT DISC
2-[1]	12-[1]	LOCK DOOR
2-[2]	12-[1]	UNLOCK DOOR
2-[3]	12-[2]	RESET DRIVE
2-[4]	12-[3]	AUDIO CHANNEL CONTROL
2-[5]	12-[5]	CLOSE TRAY
3	13	DEVICE OPEN
4	14	DEVICE CLOSE
5	128	READ LONG
6	130	READ LONG PREFETCH
7	131	SEEK
8	132	PLAY AUDIO
9	133	STOP AUDIO
A	136	RESUME AUDIO

D.2 FDEJECT

The FDEJECT utility is used to eject the CD-ROM disc from the CD-ROM drive. If the CD-ROM drive door is locked, this utility will first unlock the door and then eject the disc.

D.3 FDLOCK

The FDLOCK utility is used to lock the CD-ROM door on the CD-ROM drive. On most drives, this will disable the eject button on front of the CD-ROM drive unit.

D.4 FDUNLOCK

The FDUNLOCK utility is used to unlock the CD-ROM door which has been previously locked by FDLOCK or another utility.

D.5 FDAUDIO

The TSR can be used as an audio player. For further information consult the readme file called FDAUDIO.

All three utilities are executed in the same manner and use the same command line parameters. The following is an example of using the FDEJECT utility.

At the prompt, type FDEJECT [CD-ROM drive letter] and press **<ENTER>**. This will cause the disc on the specified CD-ROM drive to be ejected. If a CD-ROM drive letter is not specified, the utility will eject the disc from all the CD-ROM drives that are supported by the Future Domain CD-ROM driver.

The following conditions will cause the utilities to fail:

1. The specified drive letter is a:
   a) Non-CD-ROM drive
   b) Invalid drive letter
   c) CD-ROM drive which is not supported by our driver
2. An older version of the MS CD-ROM DOS Extensions is being used or MS CD-ROM DOS Extensions is not installed.
3. The CD-ROM drive is not ready (example: FDEJECT issued to a drive without a disc inserted).

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